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AIR QUALITY ASSESSMENT FOR THE PROPOSED EMERGE CENTRE AT RATCLIFFE-ON-SOAR (PERMITTING)
prepared for
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by
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SUMMARY

Uniper is proposing building an energy recovery facility, the East Midlands Energy Re-Generation (EMERGE) Centre, on the Ratcliffe-on-Soar power station site. An air dispersion modelling study has been undertaken to evaluate the significance of any air quality effects that may arise from the Installation. Where it was necessary to make assumptions and approximations, a worst-case approach has been adopted to ensure that the modelled concentrations are likely to be overestimates rather than underestimates.

This study concludes that no human health based ambient air quality standards or guidelines are predicted to be exceeded due to emissions from the Installation and hence there will be no significant adverse effects on human health.

This study also concludes that there will be no significant adverse effects on the sensitive features at local ecological sites due to emissions from the Installation.

Prepared by | **Approved for publication**

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ABBREVIATIONS / NOMENCLATURE

ADMS	Air Dispersion Modelling System
AEL	Associated Emission Level
AQAL	Air Quality Assessment Level
AQS	Air Quality Strategy
As	Arsenic
BAT	Best Available Techniques
BREF	Best Available Techniques Reference Document
Cd	Cadmium
CO	Carbon Monoxide
Co	Cobalt
Cr	Chromium
Cu	Copper
CLv	Critical Level
CL_{MaxN}	Acid Critical Load
CL_{NutN}	Nutrient Nitrogen Critical Load
EA	Environment Agency
EAL	Environmental Assessment Level
ELV	Emission Limit Value
EPUK	Environmental Protection UK
GT	Gas Turbine
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
Hg	Mercury
IED	Industrial Emissions Directive
IPPC	Integrated Pollution Prevention and Control
LCP BREF	Large Combustion Plant BREF
LNR	Local Nature Reserve
LWS	Local Wildlife Site
Mn	Manganese
NH_3	Ammonia
Ni	Nickel
NNR	National Nature Reserve
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
PAH	Polycyclic Aromatic Hydrocarbon
Pb	Lead
PC	Process Contribution
PCB	PolyChlorinated Biphenyl
PEC	Predicted Environmental Concentration
PM_{10}	Particulate Matter (< 10 µm diameter)
$PM_{2.5}$	Particulate Matter (< 2.5 µm diameter)
PS	Primary School
SAC	Special Area of Conservation
Sb	Antimony
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Tl	Thallium
TOC	Total Organic Carbon
V	Vanadium
VOC	Volatile Organic Carbon
WI BREF	Waste Incineration BREF

1 INTRODUCTION

This air quality dispersion modelling report quantifies the potential impact of the proposed East Midlands Energy Re-Generation (EMERGE) Centre (henceforth 'the Installation') to be located on the Ratcliffe-on-Soar power station site.

Emissions to air from the Installation have the potential to adversely affect human health and sensitive ecosystems. This report details the results of a dispersion modelling assessment of emissions from the process.

The magnitude of air quality impacts at sensitive human receptors are quantified for pollutants emitted from the main stacks of the Installation. The impact of emissions on sensitive ecological receptors is considered in the context of relevant critical loads or critical levels for designated nature sites.

The assessment considers emissions from the Installation during normal operational conditions. The potential air quality impacts associated with abnormal operation are considered in Appendix D5 of the Permit Application.

2 SCOPE

This assessment considers the impact of process emissions on local air quality, under normal operating conditions, from the main stacks serving the combustion process. This study has been designed to assess the potential effects of emissions to air on the local population and ecosystems from the Installation. This has been carried out by comparing ground level concentrations of released substances with standards and guidelines for ambient air quality, taking background levels of these substances into account. Standards and guidelines which have been specified with regard to potential human health effects have been included together with guidelines for vegetation and ecosystems for assessing the impact of emissions on designated conservation sites.

The impact of emissions for which the primary human exposure route is via ingestion are considered separately in the human health risk assessment in Appendix D3 of the Permit Application.

The pollutants considered within this assessment from the main stacks are those regulated under the Industrial Emissions Directive and the associated Waste Incineration Best Available Techniques Reference (WI BREF) document, namely:

- Oxides of Nitrogen (NO_x), as Nitrogen Dioxide (NO_2);
- Sulphur Dioxide (SO_2);
- Carbon Monoxide (CO);
- Particulate Matter (as PM_{10} and $PM_{2.5}$ size fractions);
- Hydrogen Chloride (HCl);
- Hydrogen Fluoride (HF);
- Ammonia (NH_3);
- Volatile Organic Compounds (VOCs) as Benzene and 1,3-butadiene;
- Polycyclic Aromatic Hydrocarbons (PAH) as benzo[a]pyrene;
- Polychlorinated Biphenyls (PCB);
- Twelve metals (Cadmium (Cd), Thallium (Tl), Mercury (Hg), Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V)); and

- Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans).

Where data is available, cumulative impacts from existing sources of pollution in the area have been accounted for in the adoption of site-specific background pollutant concentrations from air quality monitoring networks in the local vicinity to the Installation. Additional modelling, including the cumulative impact of the Installation with operation of the open cycle gas turbines (OCGTs) and / or the coal-fired power station at Ratcliffe-on-Soar, has been included. These modelling assessments will include some double accounting for emissions from the OCGTs and the coal-fired power station as the impact of the two existing installations on ground level concentrations will be included in the local monitoring data.

The High-Speed Rail development (HS2) has not been considered in this assessment as the long-term air quality impacts from the High-Speed Rail development are negligible.

3 ASSESSMENT CRITERIA

3.1 Air Quality Assessment Levels (AQALs)

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC) (Council of European Communities, 2008), which came into force on 11 June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values for sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter with a diameter of less than 10 µm (PM_{10}) and a new AAD Target Value and Limit Value for fine particulates (those with a diameter of less than 2.5 µm ($PM_{2.5}$)).

The fourth daughter Directive – 2004/107/EC (Council of European Communities, 2004) – was not included within the consolidation. It sets health-based Target Values for polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable. Directives 2008/50/EC (Council of European Communities, 2008) and 2004/107/EC (Council of European Communities, 2004) are transposed into UK Law into the Air Quality Standards Regulations (HMSO, The AIr Quality Standards Regulations 2010, UK Statutory Instruments 2010 No. 1001 http://www.legislation.gov.uk/uksi/2010/1001/contents/made, 2010) and subsequent amendments.

The UK Government and the devolved administrations are required under the Environment Act (HMSO, 1995) to produce a national air quality strategy. This was last reviewed and published in 2007 (DEFRA and the Devolved Administrations, 2007). The Air Quality Strategy (AQS) sets out the UK’s air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. This includes additional targets and limits for 15-minute sulphur dioxide and 1,3-butadiene and more stringent requirements for benzene and PAHs, known as AQS Objectives.

Environmental Assessment Levels (EALs) for other pollutants are presented on the gov.uk website as part of the Environment Agency’s Environmental Management Guidance (Environment Agency, 2016a), which was last updated on 2 August 2016. AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and sensitive groups. For the remainder of this assessment these are collectively referred to as Air Quality Assessment Levels (AQALs).

Local Air Quality Management Technical Guidance (DEFRA, 2016) referred to as LAQM.TG(16), outlines that the AQALs apply in the following locations:

- Annual mean – all locations where members of the public might be regularly exposed – i.e. building facades of residential properties, schools, hospitals, care homes, etc.

- 24-hour mean and 8-hour mean – all locations where the annual mean objective would apply together with hotels and gardens of residential properties.

- 1-hour mean – all locations where the annual mean, 24-hour and 8-hour mean apply together with kerbside sites and any areas where members of the public might be reasonably expected to spend one hour or more.

- 15-minute mean – all locations where members of the public might reasonably be exposed for a period of 15 minutes or more.

Table 1 shows the AQALs used in this assessment. There are no AQALs for Thallium or Cobalt; therefore, these pollutants have not been considered further in this assessment.

3.2 Industrial Pollution Regulation

Atmospheric emissions from industrial processes are controlled in the UK through the Environmental Permitting (England and Wales) Regulations (HMSO, 2010), and subsequent amendments. The Installation will be regulated by the Environment Agency and so will need an Environmental Permit to operate. The Environmental Permit will include conditions to prevent fugitive emissions of dust and odour beyond the boundary of the Installation. The Environmental Permit will also include limits on emissions to air.

The Industrial Emissions Directive (IED) (Directive 2010/75/EU) (European Commission, 2010), was adopted on 7 January 2013, and is the key European Directive which covers almost all regulation of industrial processes in the EU. Annex VI of the IED sets emission limit values (ELVs) which must be met by all waste incineration and co-incineration plants. These are set as daily and half hourly averages for emissions which require continuous monitoring and as sampling period averages for heavy metals.

Table 1: Air Quality Assessment Levels (AQALs)

Pollutant	AQAL (µg/m³)	Averaging Period	Frequency of exceedance	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AAD Limit Value
	40	Annual	-	AAD Limit Value
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AAD Limit Value
	125	24 hours	3 times per year (99.18th percentile)	AAD Limit Value
	50	Annual	-	WHO guideline
Carbon monoxide	30,000	1 hour	-	EA (2016)
	10,000	8 hour rolling	-	AAD Limit Value
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AAD Limit Value
	40	Annual	-	AAD Limit Value
Particulate matter ($PM_{2.5}$)	25	Annual	-	AAD Limit Value
Hydrogen chloride	750	1 hour	-	EA (2016)
Hydrogen fluoride	160	1 hour	-	EA (2016)
	16	Annual	-	EA (2016)
Ammonia	2,500	1 hour	-	EA (2016)
	180	Annual	-	EA (2016)
Benzene	195	1 hour	-	EA (2016)
	5	Annual	-	AQS Objective
1,3-butadiene	2.25	Annual rolling	-	AQS Objective
PAHs – benzo[a]pyrene	0.00025	Annual	-	AQS Objective
PCBs	6	1 hour	-	EA (2016)
	0.2	Annual	-	EA (2016)
Cadmium	0.005	Annual	-	EA (2016)
Thallium	-	-	-	No AQAL
Mercury	7.5	1 hour	-	EA (2016)
	0.25	Annual	-	EA (2016)
Antimony	150	1 hour	-	EA (2016)
	5	Annual	-	EA (2016)
Arsenic	0.003	Annual	-	EA (2016)
Chromium (II & III)	150	1 hour	-	EA (2016)
	5	Annual	-	EA (2016)
Chromium (VI)	0.0002	Annual	-	EA (2016)
Cobalt	-	-	-	No AQAL
Copper	200	1 hour	-	EA (2016)
	10	Annual	-	EA (2016)
Lead	0.25	Annual	-	EA (2016)
Manganese	1,500	1 hour	-	EA (2016)
	0.15	Annual	-	EA (2016)
Nickel	0.02	Annual	-	EA (2016)
Vanadium	1	1 hour	-	EA (2016)
	5	Annual	-	EA (2016)

Within the IED, the requirements of the relevant sector BREF (Best Available Techniques Reference Document) become binding as BAT (Best Available Techniques) guidance, as follows:

- Article 15, paragraph 2 of the IED requires that Emission Limit Values (ELVs) are based on best available techniques, referred to as BAT.

- Article 13 of the IED requires that ‘the Commission’ develops BAT guidance documents (referred to as BREFs).

- Article 21, paragraph 3 of the IED requires that when updated BAT conclusions are published, the Competent Authority (in England this is the Environment Agency) has up to four years to revise permits for facilities covered by that activity to comply with the requirements of the sector specific BREF.

The Waste Incineration BREF was finalised by the European IPPC (Integrated Pollution Prevention and Control) Bureau in December 2019 (European Commission, 2019). The WI BREF introduces BAT AELs (Best Available Techniques Associated Emission Levels) which are more stringent than those currently set out in the IED. These are set as daily averages for emissions which require continuous monitoring and as sampling period averages for those that do not.

The Installation will be designed to comply with the IED ELVs and BAT-AELs set out in the Waste Incineration BREF for new plant, with the most stringent limit applying where these overlap. It should be noted that the BAT AELs are, in most cases, specified as a range of concentration values. Where this applies, the modelling has been based on the higher end of the range as a worst-case approach.

3.3 Significance Criteria

3.3.1 Significance Criteria for Industrial Sources

The guidance on risk assessment on the gov.uk website sets out criteria for determining the significance of emissions from industrial sources (Environment Agency, 2016a). These criteria have been adopted in this assessment and are summarised in Table 2.

Table 2: Significance criteria from Environment Agency Guidance

Parameter	Significance Criteria	Impact
Stage 1		
Long-term Process Contribution	< 1 % of long-term environmental Standard	Insignificant
Short-term Process Contribution	< 10 % of short-term environmental Standard	Insignificant
Stage 2		
Long-term Predicted Environmental Concentration (Process Contribution plus background)	< 70 % if long-term environmental Standard	Not significant
Short-term Process Contribution	< 20 % of the short-term environmental standard plus twice the long-term background concentration	Not significant

Previous H1 guidance has noted that “if an emission is not screened out using this test, it does not necessarily follow that it will have a significant effect or that it will result in an unacceptable environmental risk. Such a judgement can only be made by consideration of the total concentration of a substance (i.e. including existing background contribution from other sources) in relation to an environmental benchmark” (Environment Agency, 2008).

Air Quality Standards are set at levels below which human health impacts or ecological impacts are not expected to occur. Consequently, if the process contribution combined with background levels does not exceed the standard, no adverse impacts should occur.

Where an impact cannot be screened out as “insignificant” based on the outputs of the initial screening and modelling, the significance of the effect has been determined based on professional scientific judgement of the likelihood of emissions causing an exceedance of an AQAL. This is a standard approach which allows the risk and likelihood of exceedance to be investigated and assessed in detail, following the initial assessment.

3.3.2 Additional Significance Criteria for Metals

In addition, the Environment Agency guidance document ‘Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016’ (Environment Agency, 2016b) for assessing the impact of emissions of metals relative to their respective AQALs, states that where the PC for any metal exceeds 1 % of the long term or 10 % of the short term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the PC exceeds these criteria, the Predicted Environmental Concentration (PEC) (i.e. the PC plus background concentrations) should be compared to the environmental standard. The PEC can be screened out where the PEC is less than the environmental standard. Where the impact is within these parameters, it can be concluded that there is no risk of exceeding the AQAL and, as such, the magnitude of change and significance of effect is considered to be not significant.

4 ASSESSMENT METHODOLOGY

An atmospheric dispersion model has been used to calculate the contribution of the Installation to ground level concentrations of the released substances. The assessment methodology for air quality impacts is described in the following sections. The assessment methodology for impacts on local ecological sites is described in Section 7.

4.1 Dispersion Model Selection

The atmospheric dispersion model ADMS (Air Dispersion Modelling System) version 5.2 has been used. ADMS is used extensively by power station operators and the Environment Agency and by many other industries and consultancies. ADMS was developed by CERC (Cambridge Environmental Research Consultants) and has been verified extensively against measurements.

4.2 Modelled Scenarios

Subject to securing the required consents, it is anticipated that the Installation would begin operation early in 2025. In line with UK Government policy, the existing coal-fired power station at Ratcliffe-on-Soar will be required to close by October 2025. There is therefore a potential operational overlap of around 9 months for the existing power station and the Installation. The wider Ratcliffe-on-Soar site also includes a pair of OCGTs which may be retained following closure of the existing power station. The wider site also includes a number of large buildings, such as the boiler house and cooling towers, which could potentially affect dispersion of the plume from the Installation. Although the intention is to demolish and remove these buildings, they could remain in place for a significant period following closure of the existing station.

In order to fully account for these iterations, this assessment considers four scenarios:

- Scenario A: The Installation operating continuously including only the buildings associated with the Installation;
- Scenario B: The Installation and the OCGTs operating continuously including only the buildings associated with the Installation;
- Scenario C: The Installation and the OCGTs operating continuously including the Installation buildings and buildings on the Ratcliffe site above 30 m in height (above 1/3 of the lowest stack height); and
- Scenario D: The Installation, the OCGTs and the coal-fired power station all operating continuously including the Installation buildings and buildings on the Ratcliffe site above 30 m in height (above 1/3 of the lowest stack height).

The Installation is anticipated to run with an annual load factor of 90 %, but has been assumed to operate with a 100 % annual load factor as a worst-case assumption.

The scenarios include worst-case assumptions in relation to operation of both the existing power station and the OCGTs. The existing power station is assumed to operate all four units at full load for the entire year (i.e. a 100 % annual load factor). In practice, the station has operated well below this level over recent years, averaging a 17 % load factor from 2015 to 2019.

The current power station environmental permit limits operation of the OCGTs to a maximum of 500 hours of operation per year (i.e. a 6 % annual load factor), but they are assumed to operate for the entire year in the modelling.

For the assessment of short-term effects (24 hours or less), it is possible, although highly unlikely, that the existing station and the OCGTs could be operating at full load simultaneously. For the assessment of long-term effects (i.e. annual impacts), the assessment will substantially overestimate the impacts of both the power station and the OCGTs.

As such, the modelling results in Scenarios B, C and D should not be interpreted as indicative of the current or expected impacts of the OCGTs and existing power station.

4.3 Emission Characteristics

4.3.1 Emissions from the Installation

The Installation stacks would be the primary source of combustion emissions. There would be two stacks, one for each combustion line, which have been modelled as one combined stack at a height of 110 m above ground level with an internal diameter of 2.75 m (the height considered to represent BAT for the Installation based on a range of stack heights assessed – see Appendix A).

The long-term modelled pollutant emission rates (in g/s) are determined by the higher end of the daily average BAT-AEL values set out within the Waste Incineration BREF (European Commission, 2019) whereas the short-term emission rates are based on the 30-minute ELVs set out within the IED (European Commission, 2010). For species which will not require continuous monitoring, such as heavy metals, PCBs and dioxins and furans, emissions are based on the WI BREF BAT AEL.

Emissions of benzo[a]pyrene from the stacks are not included in the IED. The highest recorded emission concentration of benzo[a]pyrene from the Environment Agency's public register is 0.000105 mg/Nm^3 (11 % oxygen, dry, 273.15 K). This has been multiplied by a safety factor of two (i.e. 0.00021 mg/Nm^3) which is assumed to be the emission concentration for the Installation.

This assessment assumes that the Installation would operate continuously (8,760 hours per year).

ELVs and BAT AELs are set for total dust, as opposed to the specific size fractions for which AQALs are set. For the purposes of this assessment the PM_{10} and $PM_{2.5}$ emissions have been set to those of total dust. This approach will result in the overestimation of impacts of PM_{10} and $PM_{2.5}$.

Emissions of the Group 1 metals (Cd and Tl) from the stacks have individually been taken to be emitted at the Environmental Standard for the whole group.

In April 2010 the EA published revised Environmental Standards for arsenic, nickel and chromium (VI) in its EA Permit Guidance. The new guidelines are lower than earlier Environmental Standards. In particular, the use of conservative assumptions for the assessment of Group 3 metal emissions make it possible that the assessment would identify theoretical risks that the Environmental Standard value could be exceeded in the case of arsenic, nickel and chromium (VI). The EA has, therefore, provided guidance on the assessment of Group 3 metal releases from waste combustion processes (Environment Agency, 2016b).

In the first instance, a worst-case screening step is carried out, whereby each substance is modelled as being emitted at the ELV, 0.3 mg/Nm^3 for all nine Group 3 metals. Actual emission rates at comparable facilities are normally well below the BAT-AEL, and as such the worst-case screening step is very conservative. Where the initial results from the model show the Process Contribution exceeds 1 % of the long-term AQAL or 10 % of the short-term AQAL for that substance, then the PEC which includes the background concentration is compared with the AQAL. Where the PEC is greater than 100 % of the AQAL, then the emissions of those substances have been considered further in accordance with the second step of the guidance.

The second step of the guidance requires the predictions to be revised with reference to a range of measured values recorded from testing on 18 operational municipal waste incinerators and waste wood incinerators between 2007 and 2015. As in the first step, where the PC exceeds 1 % of the long-term AQAL or 10 % of the short-term AQAL for that substance, then the PEC is compared with the AQAL. This can be screened out where the PEC is less than 100 % of the AQAL. Further justification is required to be made to the EA if data lower than the listed maximum emission concentrations are used in the assessment.

4.3.2 Emissions from the Existing Coal-fired Power Station

The existing coal-fired power station will be subject to the requirements of the IED and the Large Combustion Plant BREF document by the time the Installation begins operation. It should be noted that the existing station applied for several derogations under the LCP BREF related permit review process (Regulation 61 submission) to allow operation above the LCP BREF BAT AELs due to the limited remaining operational lifetime, whilst remaining consistent with the IED ELV requirements. Emissions have been modelled based on the Regulation 61 application emission levels as a worst-case assumption and include all species which will be regulated in the revised permit.

4.3.3 Emissions from the OCGTs

Due to the limited operating hours, the OCGTs do not currently have ELVs set within the power station permit and emission limits are not required under the IED or LCP BREF. Representative emissions for these units for SO_2, NO_x, dust and CO have been included based on a review of the emission performance of OCGTs that operate less than 500 hours per year, which included the gas-oil fired turbine models installed at Ratcliffe (Graham & Duncan, 2018).

4.3.4 Emissions Summary

The emission parameters and emission limits assumed to apply to the Installation are shown in Table 3. The emission concentrations are quoted at 11 % oxygen, dry, 273.15 K in line with the IED and WI BREF.

For Scenarios B, C and D, emission parameters for the OCGTs and the coal-fired power station are required and are shown in Table 4. The emission concentrations for the coal plant are quoted at 6 % oxygen, dry, 273.15 K and the emission concentrations for the OCGTs are quoted at 15 % oxygen, dry, 273.15 K in line with the IED and WI BREF.

Table 3: Emission parameters for the Installation (11 % oxygen, dry, 273.15 K)

Parameter	**Value**	
Stack location	450435, 330403	
Stack height (m)	110	
Internal effective diameter (m)	2.75	
Temperature (°C)	140	
Reference oxygen content (% volume)	11 %	
Water content (% volume)	17.4 %	
Oxygen content (% volume, dry)	6.41 %	
Volume flow rate (Nm^3/s)	94.8	
Volume flow rate (Am^3/s)	118.7	
Flue gas exit velocity (m/s)	20	
	Long-term	**Short-term**
Oxides of nitrogen (as NO_2) emission concentration (mg/Nm^3)	120	400
Sulphur dioxide emission concentration (mg/Nm^3)	30	200
Carbon monoxide emission concentration (mg/Nm^3)	50	100
PM_{10} emission concentration (mg/Nm^3)	5	30
$PM_{2.5}$ emission concentration (mg/Nm^3)	5	30
Hydrogen chloride emission concentration (mg/Nm^3)	6	60
Hydrogen fluoride emission concentration (mg/Nm^3)	1	4
Ammonia emission concentration (mg/Nm^3)	10	10
Volatile organic compounds (as TOC) emission concentration (mg/Nm^3)	10	20
Benzo[a]pyrene (PAHs) emission concentration (mg/Nm^3)	0.00021	0.00021
PCBs emission concentration (mg/Nm^3)	6×10^{-8}	8×10^{-8}
Cadmium and Thallium emission concentration (mg/Nm^3)	0.02	0.02
Mercury emission concentration (mg/Nm^3)	0.02	0.04
Other metals emission concentration (mg/Nm^3)	0.3	0.3
Dioxins and furans emission concentration (mg/Nm^3)	4×10^{-8}	6×10^{-8}
Oxides of nitrogen (as NO_2) emission rate (g/s)	11.4	37.9
Sulphur dioxide emission rate (g/s)	2.8	19.0
Carbon monoxide emission rate (g/s)	4.7	9.5
PM_{10} emission rate (g/s)	0.5	2.8
$PM_{2.5}$ emission rate (g/s)	0.5	2.8
Hydrogen chloride emission rate (g/s)	0.6	5.7
Hydrogen fluoride emission rate (g/s)	0.09	0.38
Ammonia emission rate (g/s)	0.95	0.95
Volatile organic compounds (as TOC) emission rate (g/s)	0.95	1.90
Benzo[a]pyrene (PAHs) emission rate (g/s)	2×10^{-5}	2×10^{-5}
PCBs emission rate (g/s)	6×10^{-9}	8×10^{-9}
Cadmium and Thallium emission rate (g/s)	0.0019	0.0019
Mercury emission rate (g/s)	0.0019	0.0033
Other metals[1] emission rate (g/s)	0.03	0.03
Dioxins and furans emission rate (g/s)	4×10^{-9}	6×10^{-9}

[1] Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

Table 4: Emission parameters for the OCGTs and the coal-fired power station

Parameter	OCGTs	Coal-fired power station	
Stack location	450279, 330183	450139, 330199	
Stack height (m)	95	199	
Internal effective diameter (m)	4.6 (assuming both OCGTs operating)	14.2 (assuming all 4 units operating)	
Temperature (°C)	460	79	
Reference oxygen content (% volume)	15 %	6 %	
Water content (% volume)	3.6 %	8.9 %	
Oxygen content (% volume, dry)	17 %	5.9 %	
Volume flow rate (Nm^3/s)	119.4	1931.2	
Volume flow rate (Am^3/s)	503.1	2715.1	
Flue gas exit velocity (m/s)	29.8	17.1	
		Long-term	**Short-term**
Oxides of nitrogen (as NO_2) emission concentration (mg/Nm^3)	225	200	400
Sulphur dioxide emission concentration (mg/Nm^3)	55	200	400
Carbon monoxide emission concentration (mg/Nm^3)	100	400	400
PM_{10} emission concentration (mg/Nm^3)	6	20	40
$PM_{2.5}$ emission concentration (mg/Nm^3)	6	20	40
Hydrogen chloride emission concentration (mg/Nm^3)	-	20	20
Hydrogen fluoride emission concentration (mg/Nm^3)	-	7	7
Ammonia emission concentration (mg/Nm^3)	-	5	5
Mercury emission concentration (mg/Nm^3)	-	4	4
Oxides of nitrogen (as NO_2) emission rate (g/s)	26.9	386.2	772.5
Sulphur dioxide emission rate (g/s)	6.6	386.2	772.5
Carbon monoxide emission rate (g/s)	11.9	772.5	772.5
PM_{10} emission rate (g/s)	0.72	38.6	77.2
$PM_{2.5}$ emission rate (g/s)	0.72	38.6	77.2
Hydrogen chloride emission rate (g/s)	-	38.6	38.6
Hydrogen fluoride emission rate (g/s)	-	13.5	13.5
Ammonia emission rate (g/s)	-	9.7	9.7
Mercury emission rate (g/s)	-	7.7	7.7

4.4 Meteorological Data

Meteorological data for the dispersion modelling study were obtained from the Meteorological Office. Five years of data from 2015 to 2019 has been used in the assessment from the meteorological site at Sutton Bonington (cloud cover data was taken from Nottingham Watnall). Sutton Bonington is located approximately 3.5 km to the south of the Installation. This meteorological site was recommended by the Meteorological Office as the most representative site for modelling an installation at the Ratcliffe power station site. The wind roses are shown in Appendix B.

4.5 Grids

For the human health and the assessment of impacts at sensitive habitats, ground level concentrations have been calculated on a regular grid of 101 × 101 points extending 5000 m north, east, south and west of the Installation. The spacing between points was 100 m.

4.6 Surface Roughness

Surface roughness length is a measure of the influence of surface features on dispersion. A value of 0.35 m has been used for the modelling assessment which is appropriate for predominantly agricultural areas. This reflects the land use within the study area.

The Meteorological Office advised that a surface roughness length of 0.20–0.22 m in winter and 0.26 m in summer is appropriate for the meteorological site at Sutton Bonington due to the change in agriculture in the different seasons. Therefore, a value of 0.25 m has been used for the Meteorological site.

4.7 Terrain

There is a small hill to the north of the proposed location of the Installation. To ensure that this does not have a detrimental impact on the dispersion of flue gases from the Installation, terrain has been included within the model. The terrain grid has a spacing of 50 m and extends beyond the output grid.

4.8 Buildings

The dispersion of substances released from an elevated point source such as the Installation can be influenced by the presence of buildings close to the source. The buildings can interrupt the wind flows and give higher ground level concentrations close to the source than would arise in the absence of the buildings.

Buildings will have a significant effect on dispersion if they are significantly taller than approximately one third of the stack height. The dimensions of the buildings from the Installation that have been considered in the model are detailed in Table 5.

There are several buildings on the Ratcliffe power station site that will remain on site after demolition of the coal-fired power station. These include the 400 kilovolt (kV) and 132 kV substations, the OCGT building and various offices and stores, including the offices for Uniper’s Technology Centre and its Engineering Academy. All these buildings are below one third of the lowest stack to be modelled (all buildings remaining on the Ratcliffe power station site after demolition of the power plant are below 30 m). Therefore, these buildings have not been included in the modelling.

The Ratcliffe coal-fired power station could still be operating when the Installation is commissioned and, even if the power station is not operating, it is very unlikely that all of the buildings on the site will have been demolished by the time the Installation is operating. Therefore, the buildings on the Ratcliffe coal-fired power station site that are above 30 m have been included in Scenarios C and D. The details of these buildings are also included in Table 5.

The main buildings used in the assessment for each source are listed below for each scenario:

- Scenario A: Main building is the boiler hall for the Installation;
- Scenario B: Main building is the boiler hall for the Installation and the OCGTs;
- Scenario C: Main building is the boiler hall for the Installation and the Ratcliffe boiler house for the OCGTs; and
- Scenario D: Main building is the boiler hall for the Installation and the Ratcliffe boiler house for the OCGTs and the coal-fired power station.

Table 5: Building dimensions

Building	Coordinates of building centre (m)	Height (m)	Length/ Diameter (m)	Width (m)	Building orientation (angle between building length and north) (°)
Installation Buildings					
Boiler hall	450431, 330461	49.5	71.5	72.8	355.7
Flue gas treatment	450435, 330406	35	38.3	72.8	355.7
Waste bunker hall	450427, 330517	35	40.4	72.8	355.7
Ratcliffe Coal-Fired Power Station Buildings					
Boiler House	450138, 330122	63	117	204.5	355.7
Turbine Hall	450146, 330012	33	104	204.5	355.7
Cooling Tower 1	449917, 330223	114	94	-	-
Cooling Tower 2	449805, 330141	114	94	-	-
Cooling Tower 3	449929, 330078	114	94	-	-
Cooling Tower 4	449816, 329995	114	94	-	-
Cooling Tower 5	449941, 329917	114	94	-	-
Cooling Tower 6	449828, 329834	114	94	-	-
Cooling Tower 7	449953, 329771	114	94	-	-
Cooling Tower 8	449839, 329688	114	94	-	-
Absorber 1	450056, 330349	44	41	20	355.7
Absorber 2	450103, 330353	44	41	20	355.7
Absorber 3	450153, 330342	44	41	20	355.7
Absorber 4	450201, 330345	44	41	20	355.7
Limestone Mill	450116, 330458	32	39	31	355.7

4.9 NO_x Chemistry

The Air Quality Strategy objectives for the protection of human health relate to the concentrations of the nitrogen dioxide (NO_2) component of nitrogen oxides (NO_x). The Installation will release both nitrogen dioxide and nitric oxide (NO). Once released, nitric oxide can be converted to nitrogen dioxide by reaction with low level ozone in the atmosphere. The process is reversible in sunlight and the new rate of conversion of NO to NO_2 in the plume is, therefore, a function of the rate of dilution of the plume by ambient air, trace gas concentrations in the air and meteorology.

Ground level NO_x concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70 % conversion from NO_x to nitrogen dioxide for annual means and a 35 % conversion for short-term (hourly) concentrations, based upon the worst-case scenario in the Environment Agency methodology. Given the short plume travel time to the areas of maximum concentrations, this approach is considered conservative.

4.10 Human Receptor Points

As shown in Figure 1, there are a number of residential receptors within 3 km of the location of the Installation. Given the locality, assessment of air quality impacts at the location of the highest impact will provide the most precautionary approach to the assessment of human exposure. Additionally, sixteen receptor points representing local properties, farms and schools have been modelled. Additionally, assessment of air quality impacts at the location of the highest impact has been included as the most precautionary approach to the assessment of human exposure. The receptor locations are shown in Table 6 and Figure 1.

Table 6: Modelled Human Receptors

Reference	Description	OS Grid Reference	Distance from the Installation (km)
R1	Church Lane, Thrumpton	451059, 331118	0.9
R2	Wood Farm, Thrumpton	451487, 330914	1.2
R3	Hillside Cottage	451869, 330662	1.4
R4	Stonepit Farm	452143, 329669	1.8
R5	Winking Hill Farm	450969, 329726	0.8
R6	Gotham Primary School	453241, 330149	2.8
R7	Main Street, Ratcliffe-on-Soar Village	449619, 329082	1.6
R8	Lock Lane, Sawley	449231, 330563	1.2
R9	Redhill Marina and Redhill Farm, Sawley	449353, 330111	1.1
R10	Kingston Hall, Gotham Road	450696, 327912	2.5
R11	Middlegate Farm	449420, 329814	1.2
R12	Little Lunnon, Barton-in-Fabis	452175, 332499	2.7
R13	Kegworth Road, Kingston -on-Soar	449943, 327760	2.7
R14	Cranfleet Farm	449485, 331365	1.4
R15	Trent Lock	448961, 331206	1.7
R16	Ludford Close, Long Eaton	449413, 331970	1.9

Additionally, there have been four Air Quality Management Areas (AQMAs) declared within 5 km of the Installation (North West Leicestershire District Council, 2019), (Erewash Borough Council, 2019), (Nottingham City Council, 2018). These have been considered as receptors within the assessment and are listed in Table 7 and shown in Figure 1.

Table 7: AQMAs within 5 km of the Installation

AQMA	Authority	Air Quality Standard	Approximate Distance from Installation	Receptor points used in the model
Kegworth AQMA	North West Leicestershire District Council	Annual mean NO_2	4 km	448170, 327119 448604, 326826 448773, 326407
M1 AQMA	North West Leicestershire District Council	1-hour and annual mean NO_2	5 km	447367, 326372 447081, 325420
AQMA No.2	Erewash Borough Council	Annual mean NO_2	4.4 km	447155, 334561 447264, 333443
AQMA No.2	Nottingham City Council	Annual mean NO_2	4.3 km	454332, 333626

5 BASELINE CONDITIONS

5.1 Estimated Background Concentrations: Human Health Assessment

Consideration has been given to existing background concentrations arising from sources to take account of the potential adverse effects arising from total exposure to pollutant concentrations. Measurements of existing air quality in the vicinity of the proposed location of the Installation are summarised in Appendix C. Based on measurements presented, values to represent background annual mean concentrations for the study area have been estimated and are presented in Table 8.

Table 8: Estimated Background Annual Mean Concentrations

Pollutant	Estimated background annual Mean Concentration ($\mu g/m^3$)	Justification
Nitrogen dioxide	24.6	Maximum mapped background concentration from across the modelling domain – DEFRA 2017 dataset
Sulphur dioxide	2.4	Maximum monitored concentration locally to the Installation 2015–2019
Carbon monoxide	458	Maximum mapped background concentration from across the modelling domain – DEFRA 2001 dataset
Particulate matter (PM_{10})	18.7	Maximum mapped background concentration from across the modelling domain – DEFRA 2017 dataset
Particulate matter ($PM_{2.5}$)	11.9	Maximum mapped background concentration from across the modelling domain – DEFRA 2017 dataset
Hydrogen chloride	0.42	Maximum monitored concentration at Sutton Bonington 2011–2015
Hydrogen fluoride	2.35	Maximum measured concentration from EPAQS report
Benzene	0.81	Maximum mapped background concentration from across the modelling domain – DEFRA 2001 dataset
1,3-butadiene	0.35	Maximum mapped background concentration from across the modelling domain – DEFRA 2001 dataset
Ammonia	5.3	Maximum monitored concentration at Sutton Bonington 2015–2019
Cadmium	0.0025	Maximum monitored concentration at all urban industrial sites across the UK 2014–2018
Mercury	0.019	
Arsenic	0.0012	
Antimony	0.0015	Maximum monitored concentration at Beacon Hill 2010–2013
Chromium	0.015	Maximum monitored concentration at all urban industrial sites across the UK 2014–2018
Chromium (VI)	0.003[1]	
Copper	0.08	
Lead	0.063	
Manganese	0.11	
Nickel	0.0041	Maximum monitored concentration at all urban industrial sites across the UK 2014–2018 (excluding Portardawe Tawe Terrace – see Appendix C)
Vanadium	0.012	Maximum monitored concentration at all urban industrial sites across the UK 2014–2018
Benzo[a]pyrene	0.0036	Maximum monitored concentration at all urban industrial sites across the UK 2014–2018
PCBs	0.000129	Maximum monitored concentrations across the UK 2014–2018

[1] 20 % of total chromium is assumed to be in the form of Chromium VI (see Appendix C).

6 AIR QUALITY IMPACT ASSESSMENT

This section presents the results of the air quality impact assessment.

For each substance and concentration statistic, the tables show:

- The AQS objective or Environmental Assessment Level (EAL) that concentrations are compared against;
- Typical background annual mean concentrations in the study area;
- The contribution of the station to ground level concentrations, the Process Contribution (PC);
- The PC expressed as a percentage of the AQS objective or EAL;
- The Predicted Environmental Concentration (PEC), the combination of the process contribution and background concentrations;
- The PEC expressed as a percentage of the AQS objective or EAL; and
- A significance descriptor based on the PC/AQAL to determine if the PC can be classed as insignificant for annual mean impacts (PC/AQAL < 1 %, see Section 3.3.1) or insignificant for short-term impacts (PC/AQAL < 10 %, see Section 3.3.1).

Table 9 to Table 12 present the results of the dispersion modelling of process emissions for each scenario modelled at the point of maximum impact.

For short-term impacts, background concentrations are based on twice the annual mean background concentrations (from Table 8) in line with Environment Agency guidance.

Note that the results for Scenario B are only presented for species where emissions were modelled for both the Installation and the OCGTs, as the results for other species would be identical to Scenario A.

Similarly, the results for Scenario D are only presented for species where emissions were modelled for both the Installation and the existing power station (which includes species also emitted by the OCGTs), as the results for other species would be identical to Scenario C.

Table 9: Scenario A – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL ($\mu g/m^3$)	Back-ground conc ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/ AQAL (%)	PEC ($\mu g/m^3$)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Nitrogen dioxide	Annual mean	40	24.6	0.23	0.58 %	24.83	62 %	Insignificant
	99.79th %ile of hourly means	200	49.2	11.5	5.7 %	60.7	30 %	Insignificant
Sulphur dioxide	Annual mean	50	2.4	0.08	0.16 %	2.48	5 %	Insignificant
	99.9th %ile of 15-minute means	266	4.8	21.7	8.2 %	26.5	10 %	Insignificant
	99.73rd %ile of hourly means	350	4.8	15.0	4.3 %	19.8	6 %	Insignificant
	99.18th %ile of daily means	125	4.8	6.3	5.0 %	11.1	9 %	Insignificant
Carbon monoxide	8 hour running mean	10,000	916	8.4	< 0.1 %	924.4	9 %	Insignificant
	Hourly mean	30,000	916	14.2	< 0.1 %	930.2	3 %	Insignificant
PM_{10}	Annual mean	40	18.7	0.015	< 0.1 %	18.72	47 %	Insignificant
	90.41st %ile of daily mean	50	37.4	0.29	0.6 %	37.7	75 %	Insignificant
$PM_{2.5}$	Annual mean	25	11.9	0.015	< 0.1 %	11.92	48 %	Insignificant
Hydrogen chloride	Hourly mean	750	0.84	8.52	1.1 %	9.4	1 %	Insignificant
Hydrogen fluoride	Annual mean	16	2.35	0.0026	< 0.1 %	2.35	15 %	Insignificant
	Hourly mean	160	4.7	0.57	0.36 %	527	3 %	Insignificant
Ammonia	Annual mean	180	5.3	0.028	< 0.1 %	5.33	3 %	Insignificant
	Hourly mean	2,500	10.6	1.42	< 0.1 %	12.0	0.5 %	Insignificant
VOCs (as Benzene)	Annual mean	5	0.81	0.029	0.58 %	0.84	17 %	Insignificant
	Hourly mean	195	1.62	2.84	1.5 %	4.5	2 %	Insignificant
VOCs (as 1,3-butadiene)	Annual mean	2.25	0.35	0.029	1.3 %	0.38	17 %	-
PAHs (as Benzo[a]pyrene	Annual mean	0.00025	0.0036	5.8×10^{-7}	0.23 %	0.0036	1,440 %	Insignificant
PCBs	Annual mean	0.2	0.00013	1.7×10^{-10}	< 0.1 %	0.00013	< 0.1 %	Insignificant
	Hourly mean	6	0.00026	1.2×10^{-8}	< 0.1 %	0.00026	< 0.1 %	Insignificant

Table 9 (cont): Scenario A – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL (µg/m³)	Back-ground conc (µg/m³)	PC (µg/m³)	PC/ AQAL (%)	PEC (µg/m³)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Cadmium	Annual mean	0.005	0.0025	5.6×10^{-5}	1.11 %	0.0026	51 %	-
Mercury	Annual mean	0.25	0.019	5.6×10^{-5}	< 0.1 %	0.019	8 %	Insignificant
	Hourly mean	7.5	0.038	0.005	< 0.1 %	0.043	0.6 %	Insignificant
Antimony	Annual mean	5	0.0015	0.00088	< 0.1 %	0.0024	< 0.1 %	Insignificant
	Hourly mean	150	0.003	0.045	< 0.1 %	0.048	< 0.1 %	Insignificant
Arsenic	Annual mean	0.003	0.0012	0.00088	29 %	0.0021	69 %	-
Chromium	Annual mean	5	0.015	0.00088	< 0.1 %	0.0016	0.3 %	Insignificant
	Hourly mean	150	0.03	0.045	< 0.1 %	0.075	< 0.1 %	Insignificant
Chromium (VI)	Annual mean	0.0002	0.003	0.00088	438 %	0.0039	1,938 %	-
Copper	Annual mean	10	0.08	0.00088	< 0.1 %	0.081	0.8 %	Insignificant
	Hourly mean	200	0.016	0.045	< 0.1 %	0.061	< 0.1 %	Insignificant
Lead	Annual mean	0.25	0.063	0.00088	0.35 %	0.064	26 %	Insignificant
Manganese	Annual mean	0.15	0.11	0.00088	0.58 %	0.11	74 %	Insignificant
	Hourly mean	1,500	0.22	0.045	< 0.1 %	0.27	< 0.1 %	Insignificant
Nickel	Annual mean	0.02	0.0041	0.00088	4.38 %	0.005	25 %	-
Vanadium	Annual mean	5	0.012	0.00088	< 0.1 %	0.013	0.3 %	Insignificant
	Hourly mean	1	0.024	0.045	4.5 %	0.069	7 %	Insignificant

Table 10: Scenario B – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL ($\mu g/m^3$)	Back-ground conc ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/ AQAL (%)	PEC ($\mu g/m^3$)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Nitrogen dioxide	Annual mean	40	24.6	0.35	0.87 %	24.95	62 %	Insignificant
	99.79th %ile of hourly means	200	49.2	12.0	6.0 %	61.2	31 %	Insignificant
Sulphur dioxide	Annual mean	50	2.4	0.12	0.24 %	2.52	5 %	Insignificant
	99.9th %ile of 15-minute means	266	4.8	22.0	8.3 %	26.8	10 %	Insignificant
	99.73rd %ile of hourly means	350	4.8	15.3	4.4 %	20.1	6 %	Insignificant
	99.18th %ile of daily means	125	4.8	6.7	5.4 %	11.5	9 %	Insignificant
Carbon monoxide	8 hour running mean	10,000	916	9.6	0.1 %	925.6	9 %	Insignificant
	Hourly mean	30,000	916	15.4	< 0.1 %	931.4	3 %	Insignificant
PM_{10}	Annual mean	40	18.7	0.019	< 0.1 %	18.72	47 %	Insignificant
	90.41st %ile of daily mean	50	37.4	0.30	0.6 %	37.7	75 %	Insignificant
$PM_{2.5}$	Annual mean	25	11.9	0.019	< 0.1 %	11.92	48 %	Insignificant

Table 11: Scenario C – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL ($\mu g/m^3$)	Back-ground conc ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/ AQAL (%)	PEC ($\mu g/m^3$)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Nitrogen dioxide	Annual mean	40	24.6	0.54	1.35 %	25.14	63 %	-
	99.79th %ile of hourly means	200	49.2	15.6	7.8 %	64.8	32 %	Insignificant
Sulphur dioxide	Annual mean	50	2.4	0.19	0.38 %	2.59	5 %	Insignificant
	99.9th %ile of 15-minute means	266	4.8	22.0	8.3 %	26.8	10 %	Insignificant
	99.73rd %ile of hourly means	350	4.8	15.9	4.5 %	20.7	6 %	Insignificant
	99.18th %ile of daily means	125	4.8	7.9	6.3 %	12.7	10 %	Insignificant
Carbon monoxide	8 hour running mean	10,000	916	15.3	0.15 %	931.3	9 %	Insignificant
	Hourly mean	30,000	916	17.7	< 0.1 %	933.7	3 %	Insignificant
PM_{10}	Annual mean	40	18.7	0.025	< 0.1 %	18.73	47 %	Insignificant
	90.41st %ile of daily mean	50	37.4	2.88	6 %	40.3	81 %	Insignificant
$PM_{2.5}$	Annual mean	25	11.9	0.025	0.1 %	11.93	48 %	Insignificant
Hydrogen chloride	Hourly mean	750	0.84	8.52	1.1 %	9.36	1 %	Insignificant
Hydrogen fluoride	Annual mean	16	2.35	0.0026	< 0.1 %	2.35	15 %	Insignificant
	Hourly mean	160	4.7	0.57	0.36 %	5.27	3 %	Insignificant
Ammonia	Annual mean	180	5.3	0.028	< 0.1 %	5.33	3 %	Insignificant
	Hourly mean	2,500	10.6	1.42	< 0.1 %	12.0	0.5 %	Insignificant
VOCs (as Benzene)	Annual mean	5	0.81	0.029	0.58 %	0.84	17 %	Insignificant
	Hourly mean	195	1.62	2.84	1.5 %	4.5	2 %	Insignificant
VOCs (as 1,3-butadiene)	Annual mean	2.25	0.35	0.029	1.3 %	0.38	17 %	-
PAHs (as Benzo[a]pyrene	Annual mean	0.00025	0.0036	5.8×10^{-7}	0.23 %	0.0036	1,440 %	Insignificant
PCBs	Annual mean	0.2	0.00013	1.7×10^{-10}	< 0.1 %	0.00013	< 0.1 %	Insignificant
	Hourly mean	6	0.00026	1.2×10^{-8}	< 0.1 %	0.00026	< 0.1 %	Insignificant

Table 11 (cont): Scenario C – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL (µg/m³)	Back-ground conc (µg/m³)	PC (µg/m³)	PC/ AQAL (%)	PEC (µg/m³)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Cadmium	Annual mean	0.005	0.0025	5.6×10^{-5}	1.11 %	0.0026	51 %	-
Mercury	Annual mean	0.25	0.019	5.6×10^{-5}	< 0.1 %	0.019	8 %	Insignificant
	Hourly mean	7.5	0.038	0.005	< 0.1 %	0.043	0.6 %	Insignificant
Antimony	Annual mean	5	0.0015	0.00088	< 0.1 %	0.0024	< 0.1 %	Insignificant
	Hourly mean	150	0.003	0.045	< 0.1 %	0.048	< 0.1 %	Insignificant
Arsenic	Annual mean	0.003	0.0012	0.00088	29 %	0.0021	69 %	-
Chromium	Annual mean	5	0.015	0.00088	< 0.1 %	0.0016	0.3 %	Insignificant
	Hourly mean	150	0.03	0.045	< 0.1 %	0.075	< 0.1 %	Insignificant
Chromium (VI)	Annual mean	0.0002	0.003	0.00088	438 %	0.0039	1,938 %	-
Copper	Annual mean	10	0.08	0.00088	< 0.1 %	0.081	0.8 %	Insignificant
	Hourly mean	200	0.016	0.045	< 0.1 %	0.061	< 0.1 %	Insignificant
Lead	Annual mean	0.25	0.063	0.00088	0.35 %	0.064	26 %	Insignificant
Manganese	Annual mean	0.15	0.11	0.00088	0.58 %	0.11	74 %	Insignificant
	Hourly mean	1,500	0.22	0.045	< 0.1 %	0.27	< 0.1 %	Insignificant
Nickel	Annual mean	0.02	0.0041	0.00088	4.38 %	0.005	25 %	-
Vanadium	Annual mean	5	0.012	0.00088	< 0.1 %	0.013	0.3 %	Insignificant
	Hourly mean	1	0.024	0.045	4.5 %	0.069	7 %	Insignificant

Table 12: Scenario D – Dispersion Modelling Results – point of maximum impact

Pollutant	Statistic	AQAL ($\mu g/m^3$)	Back-ground conc ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/ AQAL (%)	PEC ($\mu g/m^3$)	PEC/ AQAL (%)	PC/AQAL descriptor Annual mean < 1 % – insignificant Short-term < 10 % – insignificant
Nitrogen dioxide	Annual mean	40	24.6	0.67	1.68 %	25.27	63 %	-
	99.79th %ile of hourly means	200	49.2	32.0	16 %	81.2	41 %	-
Sulphur dioxide	Annual mean	50	2.4	0.57	1.14 %	2.97	6 %	-
	99.9th %ile of 15-minute means	266	4.8	105.6	40 %	110.4	42 %	-
	99.73rd %ile of hourly means	350	4.8	70.7	20 %	75.5	22 %	-
	99.18th %ile of daily means	125	4.8	23.4	19 %	28.2	23 %	-
Carbon monoxide	8 hour running mean	10,000	916	77.2	0.77 %	993.2	10 %	Insignificant
	Hourly mean	30,000	916	126.8	0.42 %	1,042.8	3 %	Insignificant
PM_{10}	Annual mean	40	18.7	0.063	0.16 %	18.76	47 %	Insignificant
	90.41st %ile of daily mean	50	37.4	3.15	6 %	40.55	81 %	Insignificant
$PM_{2.5}$	Annual mean	25	11.9	0.063	0.25 %	11.96	48 %	Insignificant
Hydrogen chloride	Hourly mean	750	0.84	8.61	1.15 %	9.45	1 %	Insignificant
Hydrogen fluoride	Annual mean	16	2.35	0.018	0.11 %	2.37	15 %	Insignificant
	Hourly mean	160	4.7	2.21	1.39 %	6.92	4 %	Insignificant
Ammonia	Annual mean	180	5.3	0.035	< 0.1 %	5.34	3 %	Insignificant
	Hourly mean	2,500	10.6	1.76	< 0.1 %	12.36	0.5 %	Insignificant
Mercury	Annual mean	0.25	0.019	0.0098	3.92 %	0.029	12 %	-
	Hourly mean	7.5	0.038	1.21	16 %	1.25	17 %	-

Tables 9 to 12 show that the process contribution is greater than 1 % of the long-term AQAL and greater than 10 % of the short-term AQAL at the point of maximum impact for the following pollutants for each scenario and, therefore, the magnitude of change cannot be screened out as insignificant:

- **Scenario A:**
  - Annual mean VOCs as 1,3-butadiene;
  - Annual mean cadmium;
  - Annual mean arsenic;
  - Annual mean chromium (VI); and
  - Annual mean nickel.

- **Scenario B:**
  - None additional to Scenario A.

- **Scenario C:**
  - Annual mean nitrogen dioxide;
  - Annual mean VOCs as 1,3-butadiene;
  - Annual mean cadmium;
  - Annual mean arsenic;
  - Annual mean chromium (VI); and
  - Annual mean nickel.

- **Scenario D:**
  - Annual mean nitrogen dioxide;
  - Hourly mean nitrogen dioxide;
  - Annual mean sulphur dioxide;
  - 15-minute mean, hourly mean and daily mean sulphur dioxide;
  - Annual mean mercury; and
  - Hourly mean mercury.

For all other pollutants and averaging periods, the magnitude of change at the maximum impact point can be screened out as insignificant for annual mean AQALs and for short-term AQALs irrespective of baseline concentrations. The predicted ground level concentrations at the local receptors will be below the levels stated in Tables 9 to 12 and, therefore, will also be insignificant at these receptors. The pollutants and averaging periods that can be classed as insignificant at the maximum impact point have not been considered further in this assessment.

It is worth noting that the predicted environmental concentration for PAHs as benzo[a]pyrene is above the AQAL for all scenarios modelled. This is due to the background concentration used in the assessment being significantly above the AQAL. The process contribution from all four scenarios modelled is less than 1 % and can, therefore, be classed as insignificant regardless of background concentration. Therefore, PAHs have not been considered further.

The next stage of assessment is to use the Stage 2 assessment criteria set out in Table 2. This shows that for pollutants where the long-term average concentration at the receptor is less than 70 % of the AQAL, impact can be regarded as not significant. Therefore, the impact of annual mean nitrogen dioxide, sulphur dioxide, VOCs as 1,3-butadiene, arsenic, cadmium, manganese, mercury and nickel can be classed as not significant under the four scenarios as the long-term average concentration at the maximum impact point is less than 70 % of the AQAL. Therefore, the annual mean concentrations of these pollutants have not been considered further.

Short term averages can be regarded as not significant where the PEC is less than 20 % of the AQAL using twice the annual mean background concentration. Therefore, the impact of hourly mean mercury concentrations under Scenario D can be classified as not significant.

The following sections discuss the pollutants that cannot be screened as insignificant or not significant within the first two stages of assessment, which are:

- **Scenario A:**
  - Annual mean chromium (VI).
- **Scenario C:**
  - Annual mean chromium (VI).
- **Scenario D:**
  - Hourly mean nitrogen dioxide; and
  - 15-minute mean, hourly mean and daily mean sulphur dioxide.

Annual mean nitrogen dioxide concentrations have also been considered further at the local air quality management area locations for completeness.

6.1 Nitrogen Dioxide Concentrations

6.1.1 99.79th Percentile Hourly Mean Nitrogen Dioxide Concentrations

Tables 9 to 12 show that the predicted 99.79th percentile hourly mean nitrogen dioxide concentrations at the maximum impact location can be classed as insignificant for Scenarios A, B and C. The predicted 99.79th percentile hourly mean concentration for Scenario D is predicted to be 16 % of the AQAL of 200 µg/m^3. This is above the insignificance threshold of 10 %.

The PEC is predicted to be a maximum of 41 % of the AQAL. This shows that there is still a significant margin between the PEC and the 99.79th percentile hourly mean NO_2 AQS objective. Additionally, the modelling assessment assumes that the Installation, the OCGTs and the coal-fired power station are all operating at full load during the hours of the year that cause the highest ground level concentrations. This is extremely unlikely to occur. The modelling shows that even if this does occur, the AQAL for hourly mean NO_2 concentrations will still be easily met at the point of maximum impact.

There is also some double accounting for impacts from the OCGTs and the coal-fired power station as baseline concentrations will include a contribution from these two sources as they are already operating. Even with all these worst-case assumptions, the hourly mean NO_2 AQAL is easily met.

Table 13 shows the predicted 99.79th percentile concentrations at the local receptor points for Scenario D which shows that the predicted short-term NO_2 concentrations are all below 10 % of the AQAL and can be classed as insignificant except for Gotham Primary School. The predicted 99.79th percentile of hourly mean NO_2 concentrations at Gotham Primary School is 10.42 % of the AQAL which is only just above the threshold for insignificance of 10 %. The PEC at Gotham Primary School is only 35 % of the AQAL which shows that the AQAL is met by a significant margin.

Table 13: Predicted 99.79th percentile hourly mean NO_2 process contribution (PC) and predicted environmental concentrations (PEC) for Scenario D at the local human receptors

Receptor	AQS objective (µg/m³)	Back-ground (µg/m³)	PC (µg/m³)	PC/ EAL (%)	PEC (µg/m³)	PEC/ EAL (%)	Descriptor
Church Lane	200	49.2	16.1	8.05 %	65.3	33 %	Insignificant
Wood Farm	200	49.2	14.9	7.44 %	64.1	32 %	Insignificant
Hillside Cottage	200	49.2	17.3	8.66 %	66.5	33 %	Insignificant
Stonepit Farm	200	49.2	19.3	9.66 %	68.5	34 %	Insignificant
Winking Hill Farm	200	49.2	10.5	5.27 %	59.7	30 %	Insignificant
Gotham PS	200	49.2	20.8	10.42 %	70.0	35 %	-
Main St	200	49.2	9.5	4.77 %	58.7	29 %	Insignificant
Lock Lane	200	49.2	9.3	4.67 %	58.5	29 %	Insignificant
Redhill Marina	200	49.2	9.4	4.72 %	58.6	29 %	Insignificant
Kingston Hall	200	49.2	7.8	3.92 %	57.0	29 %	Insignificant
Middlegate Farm	200	49.2	11.0	5.51 %	60.2	30 %	Insignificant
Little Lunnon	200	49.2	14.1	7.05 %	63.3	32 %	Insignificant
Kegworth Rd	200	49.2	8.8	4.39 %	58.0	29 %	Insignificant
Cranfleet Farm	200	49.2	8.5	4.24 %	57.7	29 %	Insignificant
Trent Lock	200	49.2	8.1	4.05 %	57.3	29 %	Insignificant
Ludford Close	200	49.2	8.2	4.09 %	57.4	29 %	Insignificant

The M1 AQMA which has been declared by North West Leicestershire District Council (North West Leicestershire District Council, 2019) is the only AQMA in the local area which has been declared for both annual mean and hourly mean concentrations of nitrogen dioxide. Therefore, Table 14 shows the 99.79th percentile hourly mean concentrations of nitrogen dioxide predicted at the M1 AQMA. Table 14 shows that hourly mean process contributions from the assessment can be classed as insignificant at the M1 AQMA for all scenarios.

Figure 2 to Figure 5 show the 99.79th percentile of hourly mean nitrogen concentrations across the modelling domain for Scenarios A to D respectively.

Table 14: 99.79th percentile nitrogen dioxide concentrations at the M1 AQMA

Receptor	AQS objective ($\mu g/m^3$)	Back-ground ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/ EAL (%)	PEC ($\mu g/m^3$)	PEC/ EAL (%)	Descriptor
SCENARIO A							
M1 AQMA1	200	49.2	3.47	1.74 %	52.67	26 %	Insignificant
M1 AQMA2	200	49.2	3.07	1.53 %	52.27	26 %	Insignificant
SCENARIO B							
M1 AQMA1	200	49.2	3.95	1.97 %	53.15	27 %	Insignificant
M1 AQMA2	200	49.2	3.68	1.84 %	52.88	26 %	Insignificant
SCENARIO C							
M1 AQMA1	200	49.2	3.89	1.94 %	53.09	27 %	Insignificant
M1 AQMA2	200	49.2	3.84	1.92 %	53.04	27 %	Insignificant
SCENARIO D							
M1 AQMA1	200	49.2	14.7	7.35 %	63.9	32 %	Insignificant
M1 AQMA2	200	49.2	14.0	6.98 %	63.2	32 %	Insignificant

6.2 Sulphur Dioxide Concentrations

6.2.1 Short-term Sulphur Dioxide Concentrations

Tables 9 to 12 show that the predicted short-term sulphur dioxide concentrations at the maximum impact location can be classed as insignificant for Scenarios A, B and C. The predicted 99.9th percentile of 15-minute mean SO_2 concentrations for Scenario D is predicted to be 40 % of the AQAL of 266 $\mu g/m^3$. The predicted environmental concentration to the 99.9th percentile of 15-minute mean SO_2 concentrations is predicted to be a maximum of 42 % of the AQAL. The predicted 99.73rd percentile of hourly mean SO_2 concentrations for Scenario D is predicted to be 20 % of the AQAL of 350 $\mu g/m^3$. The predicted environmental concentration to the 99.73rd percentile of hourly mean SO_2 concentrations is predicted to be a maximum of 22 % of the AQAL. The predicted 99.18th percentile of daily mean SO_2 concentrations for Scenario D is predicted to be 19 % of the AQAL of 125 $\mu g/m^3$. The predicted environmental concentration to the 99.18th percentile of daily mean SO_2 concentrations is predicted to be a maximum of 23 % of the AQAL. The process contributions for all three short-term statistics at the maximum impact point are predicted to be above the insignificance threshold of 10 %.

The PECs for each short-term statistic show that there is still a significant margin between the PEC and the AQAL for each statistic and, therefore, it is very unlikely that the Installation will cause any of the SO_2 short-term AQALs to be breached.

Additionally, the modelling assessment assumes that the Installation, the OCGTs and the coal-fired power station are all operating at full load during the hours of the year that cause the highest ground level concentrations. This is extremely unlikely to occur in practice. The modelling shows that even if this does occur, the short-term SO_2 AQALs will still be easily met. The modelling also shows that most of the sulphur dioxide concentrations at the maximum impact point are due to the coal-fired power station. Therefore, once the coal-fired power station stops operating, the sulphur dioxide concentrations will significantly decrease to the levels shown in the other three scenarios (< 10 % of the AQALs). Even with all these worst-case assumptions, the SO_2 short term AQALs are easily met.

Tables 15 to 17 show the predicted short-term SO_2 concentrations at the local human health receptors for each statistic. Table 15 shows that the impact on the 99.9th percentile of 15-minute mean SO_2 concentrations at 9 of the 16 local human receptors can be classed as insignificant.

The maximum PEC at any of the human health receptors is 28 % of the AQAL which shows that the 99.9th percentile of 15-minute mean SO_2 concentrations will be easily met at all the local human receptor points.

Table 16 shows that the impact on the 99.73rd percentile of hourly mean SO_2 concentrations at 14 of the 16 local human receptors can be classed as insignificant. The maximum PEC at any of the human health receptors is 16 % of the AQAL which shows that the 99.73rd percentile of hourly mean SO_2 concentrations will be easily met at all the local human receptor points.

Table 17 shows that the impact on the 99.18th percentile of daily mean SO_2 concentrations at all but one of the local human receptors can be classed as insignificant. The maximum PEC at any of the human health receptors is 14 % of the AQAL which shows that the 99.18th percentile of daily mean SO_2 concentrations will be easily met at all the local human receptor points.

Figure 6 to Figure 8 show the short-term SO_2 concentrations for Scenario D for 99.9th percentile of 15-minute mean, 99.73rd percentile of hourly mean and 99.18th percentile of daily mean SO_2 concentrations respectively.

Table 15: Predicted 99.9th percentile 15-minute mean SO_2 process contribution (PC) and predicted environmental concentrations (PEC) for Scenario D at the local human receptors

Receptor	AQS objective (µg/m³)	Back-ground (µg/m³)	PC (µg/m³)	PC/ EAL (%)	PEC (µg/m³)	PEC/ EAL (%)	Descriptor
Church Lane	266	4.8	27.5	10 %	32.3	12 %	-
Wood Farm	266	4.8	32.1	12 %	36.9	14 %	-
Hillside Cottage	266	4.8	44.3	17 %	49.1	18 %	-
Stonepit Farm	266	4.8	56.5	21 %	61.3	23 %	-
Winking Hill Farm	266	4.8	20.1	8 %	24.9	9 %	Insignificant
Gotham PS	266	4.8	69.3	26 %	74.1	28 %	-
Main St	266	4.8	17.4	7 %	22.2	8 %	Insignificant
Lock Lane	266	4.8	20.8	8 %	25.6	10 %	Insignificant
Redhill Marina	266	4.8	16.9	6 %	21.7	8 %	Insignificant
Kingston Hall	266	4.8	20.9	8 %	25.7	10 %	Insignificant
Middlegate Farm	266	4.8	19.3	7 %	24.1	9 %	Insignificant
Little Lunnon	266	4.8	40.3	15 %	45.1	17 %	-
Kegworth Rd	266	4.8	31.4	12 %	36.2	14 %	-
Cranfleet Farm	266	4.8	14.7	6 %	19.5	7 %	Insignificant
Trent Lock	266	4.8	19.1	7 %	23.9	9 %	Insignificant
Ludford Close	266	4.8	21.6	8 %	26.4	10 %	Insignificant

Table 16: Predicted 99.73rd percentile hourly mean SO_2 process contribution (PC) and predicted environmental concentrations (PEC) for Scenario D at the local human receptors

Receptor	AQS objective (µg/m³)	Back-ground (µg/m³)	PC (µg/m³)	PC/ EAL (%)	PEC (µg/m³)	PEC/ EAL (%)	Descriptor
Church Lane	350	4.8	20.2	6 %	25.0	7 %	Insignificant
Wood Farm	350	4.8	24.3	7 %	29.1	8 %	Insignificant
Hillside Cottage	350	4.8	34.5	10 %	39.3	11 %	Insignificant
Stonepit Farm	350	4.8	44.5	13 %	49.3	14 %	-
Winking Hill Farm	350	4.8	14.5	4 %	19.3	6 %	Insignificant
Gotham PS	350	4.8	51.9	15 %	56.7	16 %	-
Main St	350	4.8	13.3	4 %	18.1	5 %	Insignificant
Lock Lane	350	4.8	13.2	4 %	18.0	5 %	Insignificant
Redhill Marina	350	4.8	13.0	4 %	17.8	5 %	Insignificant
Kingston Hall	350	4.8	11.8	3 %	16.6	5 %	Insignificant
Middlegate Farm	350	4.8	15.4	4 %	20.2	6 %	Insignificant
Little Lunnon	350	4.8	27.7	8 %	32.5	9 %	Insignificant
Kegworth Rd	350	4.8	17.7	5 %	22.5	6 %	Insignificant
Cranfleet Farm	350	4.8	11.9	3 %	16.7	5 %	Insignificant
Trent Lock	350	4.8	12.5	4 %	17.3	5 %	Insignificant
Ludford Close	350	4.8	13.4	4 %	18.2	5 %	Insignificant

Table 17: Predicted 99.18th percentile daily mean SO_2 process contribution (PC) and predicted environmental concentrations (PEC) for Scenario D at the local human receptors

Receptor	AQS objective (µg/m³)	Back-ground (µg/m³)	PC (µg/m³)	PC/ EAL (%)	PEC (µg/m³)	PEC/ EAL (%)	Descriptor
Church Lane	125	4.8	6.2	5 %	11.0	9 %	Insignificant
Wood Farm	125	4.8	6.9	5 %	11.7	9 %	Insignificant
Hillside Cottage	125	4.8	9.4	8 %	14.2	11 %	Insignificant
Stonepit Farm	125	4.8	12.0	10 %	16.8	13 %	Insignificant
Winking Hill Farm	125	4.8	5.2	4 %	10.0	8 %	Insignificant
Gotham PS	125	4.8	13.0	10 %	17.8	14 %	-
Main St	125	4.8	4.7	4 %	9.5	8 %	Insignificant
Lock Lane	125	4.8	6.3	5 %	11.1	9 %	Insignificant
Redhill Marina	125	4.8	4.6	4 %	9.4	8 %	Insignificant
Kingston Hall	125	4.8	4.0	3 %	8.8	7 %	Insignificant
Middlegate Farm	125	4.8	5.8	5 %	10.6	9 %	Insignificant
Little Lunnon	125	4.8	7.1	6 %	11.9	10 %	Insignificant
Kegworth Rd	125	4.8	4.9	4 %	9.7	8 %	Insignificant
Cranfleet Farm	125	4.8	4.8	4 %	9.6	8 %	Insignificant
Trent Lock	125	4.8	5.3	4 %	10.1	8 %	Insignificant
Ludford Close	125	4.8	5.2	4 %	10.0	8 %	Insignificant

6.3 Annual Mean Chromium (VI) Concentrations

The predicted annual mean chromium (VI) process contributions from the Installation under Scenarios A and C are 438 % of the AQAL of 0.0002 µg/m³. The predicted environmental concentration is 1,938 % of the AQAL for chromium (VI). As the PEC is above the Environmental Standard when modelled on a worst-case basis (i.e. assuming that chromium (VI) is released at the ELV for all nine Group 3 metals), the second step of the EA guidance has been followed (Environment Agency, 2016b). This step revises the predicted impacts using emissions data which has been measured by the EA at municipal waste incinerators. Table 18 shows the revised annual mean process contributions and predicted environmental concentrations for chromium (VI) using the maximum, mean and minimum emission concentrations from the EA guidance (Environment Agency, 2016b).The results show that the process contribution when using the maximum, mean and minimum emission concentrations from the EA guidance are all below 1 % of the AQAL and, therefore, can be classed as insignificant. The PEC for chromium VI is above the AQAL due to the background concentration being 15 times the annual mean AQAL.

Table 18: Revised annual mean process contributions and predicted environmental concentrations for chromium (VI)

Pollutant		AQAL (µg/m³)	Back-ground conc (µg/m³)	PC (µg/m³)	PC/ AQAL (%)	PEC (µg/m³)	PEC/ AQAL (%)
Cr (VI)	Max emissions	0.0002	0.003	3.5×10^{-7}	0.18 %	0.003	1500 %
	Mean emissions	0.0002	0.003	9.6×10^{-8}	< 0.1 %	0.003	1500 %
	Min emissions	0.0002	0.003	6.4×10^{-9}	< 0.1 %	0.003	1500 %

7 HABITATS IMPACT ASSESSMENT

The impacts of emissions to air on all relevant designated and non-designated ecological sites in the locality of the Installation have been assessed in line with the distance criterion specified in the Environment Agency guidance (Environment Agency, 2016a), namely 10 km for Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or RAMSAR sites and 2 km for Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Ancient Woodlands and Local Wildlife Sites (LWSs).

Potential impacts on sensitive receptors at the local sites include direct effects resulting from concentrations of NO_x, SO_2, NH_3 and HF together with effects related to the deposition of acidity and nutrient nitrogen.

7.1 Local Ecologically Sensitive Sites

There are no SACs, SPAs or RAMSAR sites within 10 km of the Installation. There are no ancient woodlands or NNRs within 2 km of the Installation.

There is one Site of Special Scientific Interest (SSSI), namely Lockington Marshes SSSI, within 2 km of the Installation.

There is one Local Nature Reserve (LNR), namely Forbes Hole LNR, within 2 km of the Installation.

Figure 9 shows the location of the SSSI and LNR.

The area within 2 km of the power station site straddles three counties, namely Nottinghamshire, Derbyshire and Leicestershire. Information obtained from the biological records centres for the three areas, together with pre-application advice from the Environment Agency in relation to the Environmental Permit, suggested the presence of 40 LWSs (or candidate LWSs) within 2 km of the Installation. These were:

- Attenborough West Gravel Pits
- Copse Kingston-on-Soar
- Cranfleet Farm Floodbanks
- Cranfleet Ponds (West Pond)
- Erewash Canal
- Gotham Hill Woods
- Gotham Wood
- Lockington Ash
- Lockington Ash 2
- Lockington Confluence Backwater
- Lockington Confluence Hedges
- Lockington Fen
- Lockington Grounds, pond and marsh near Trent
- Lockington Trentside Pools
- Lockington swamp by SSSI
- Lower Soar Floodplain Wetland
- Meadow Lane Carr
- Narrow Bridge Fish Pond
- Pond in hedgeline between two improved grasslands
- Poplars Fish Pond
- Rare Plant Register Mousetail Pasture
- Ratcliffe Lane Pasture and Stream
- Ratcliffe-on-Soar Flyash Grassland
- Ratcliffe-on-Soar Flyash Track Grassland
- Ratcliffe-on-Soar Pond
- Red Hill Ratcliffe on Soar
- Redhill Marina Backwater
- River Soar Loughborough Meadows to Trent
- River Soar West Bank south of A453
- River Trent North Bank
- Shooting Ground Marsh Grassland, Lockington
- Sheetstores Junction Pond
- Soar Meadow near Ratcliffe Lock
- South Junction Pond
- Thrumpton Bank
- Thrumpton Park
- Trent Floodplain Wetland - Lock M07
- Trent Floodplain Wetland Lock M13
- Trent Lock Marsh
- River Trent

The approximate locations are shown in Figure 10.

7.2 Assessment Criteria – Critical Levels and Critical Loads

Potential impacts on sensitive receptors at the local sites include direct effects resulting from concentrations of NO_x, SO_2, NH_3 and HF together with effects related to the deposition of acidity (associated with NO_x, NH_3, SO_2, HCl and HF) and nutrient nitrogen (associated with NO_x and NH_3).

Table 19 shows the critical levels against which air concentrations should be assessed at local ecological sites as set out in the Environment Agency guidance (Environment Agency, 2016a). As a precautionary approach, the more stringent critical levels for ammonia and SO_2 have been used in this assessment.

Table 19: Critical levels for the assessment of air quality impacts on local ecological sites

Emission	Critical Level (µg/m^3)	Averaging Period
NH_3	1 where lichens or bryophytes are present 3 where they are not present	Annual
SO_2	10 where lichens or bryophytes are present 20 where they are not present	Annual
NO_x	30	Annual
NO_x	75	Daily
HF	0.5	Weekly
HF	5	Daily

Acid and nutrient nitrogen deposition at local ecological sites has been assessed against appropriate critical loads extracted from the Air Pollution Information System (APIS) database (www.apis.co.uk). APIS is a support tool for staff in the UK conservation and regulatory agencies, industry and local authorities, for assessing the potential effects of substances released to air on habitats and species.

Site relevant acid and nutrient nitrogen critical loads were available from APIS for the Lockington marshes SSSI for the sensitive habitat features present. The fen, marsh and swap features were identified as not sensitive to acid or nitrogen deposition. The broad-leaved, mixed and yew woodland features were identified as sensitive to nitrogen deposition (critical load 10–20 kg N/ha/yr) and acid deposition (critical load 1.764 to 11.013 keq/ha/yr). The invertebrates assemblage feature was identified as sensitive to nitrogen and acid deposition; however, no critical loads were available for this feature in APIS. As a precautionary measure, the lower (i.e. most stringent) end of the nitrogen and acid critical load range for the broad-leaved, mixed and yew woodland feature was used for the assessment. It was also assumed that these applied at the point of maximum impact, although critical loads may vary geographically across each site in practice. This approach should be sufficiently conservative to provide assurance that the woodland feature assessment would also encompass any potential impacts on the invertebrates assemblage feature, in the absence of any specific assessment criteria for the latter.

Site-specific critical loads are not available from APIS for LNRs or LWSs; however, location-specific critical loads are available for a selection of habitat types.

The following approach was taken for assigning habitats to each LWS and the LNR.

For woodland features:

- A nitrogen critical load of 10 kg N/ha/yr was assigned representative of the lower (more stringent) end of the broad-leaved, mixed and yew woodland nitrogen critical load range. The exception was Thrumpton Park where the project ecologists recommended a critical load of 15 kg N/ha/yr based on the presence of Meso and eutrophic Quercus woodland (critical load range 15–20 kg N/ha/yr).

- A location specific acidity critical load for broad-leaved, mixed and yew woodland was extracted from APIS and the lower end of the critical load range applied.

For non-woodland features:

- Location-specific acid and nitrogen critical loads for calcareous grassland were assigned to Red Hill Ratcliffe-on Soar LWS (on ecologists advice) and to the Ratcliffe on Soar flyash grassland and Ratcliffe on Soar flyash track grassland (on the basis of the stored ash calcium content)

- Ratcliffe Lane Pasture and Stream, River Trent North Bank, Shooting Ground Marsh Grassland Lockington, Soar Meadow near Ratcliffe Lock and Thrumpton were assigned nitrogen critical loads of either 15 or 20 keq/ha/yr for low and medium altitude hay meadows based on advice from the project ecologists.

- The project ecologists assigned the rich fens habitats to a number of the local LWSs. The majority of other LWSs appeared to have surface water or marsh related habitats present. Therefore, the remaining LWSs were assigned a nitrogen critical load of 15 keq/ha/yr based on the rich fens habitat (critical load range 15–30 kg N/ha/yr).

- As the fen, marsh and swamp habitats and low and medium altitude hay meadows habitats are deemed non-sensitive to acid deposition by APIS, all LWS with the exception of those assigned for calcareous grassland were assigned acid critical loads associated with the bogs habitats, as a precautionary approach. These were extracted from APIS using the ‘Search by location’ tool at the point of maximum impact for each site.

The above assignments represent a highly precautionary approach for acidity critical loads as it is likely that, in practice, a number of sites will not exhibit sensitivity to acid deposition.

It should be noted that the high priority coastal and floodplain grazing marshes habitat identified in the Thrumpton Park area in the Environment Agency pre-application advice is encompassed within the critical loads assigned to this site (for low and medium altitude hay meadows).

The Environment Agency has set out an approach for assessing deposition against acid critical loads [Environment Agency, 2012]. This states that

- If $PEC_{\text{nitrogen deposition}}$ < CLminN, sulphur deposition is compared against CLmaxS.

- If $PEC_{\text{nitrogen deposition}}$ > CLminN, the sum of the nitrogen and sulphur deposition is compared against CLmaxN.

As CLminN was exceeded by background deposition at all local sensitive sites for both woodland and non-woodland critical loads, the latter approach comparing total acid deposition against CLmaxN has been applied in all cases.

7.3 Significance Criteria for Ecological Impacts

Environment Agency guidance (Environment Agency, 2016) has been used to assess the significance of potential impacts. This states the following significance criteria, applicable to both critical loads and critical levels:

For SACs, SPAs, Ramsar sites and SSSIs, impacts may be considered insignificant where:

- the short-term PC is less than 10 % of the short-term environmental standard

- the long-term PC is less than 1 % of the long-term environmental standard.

For local nature sites (ancient woods, local wildlife sites and national and local nature reserves) impacts may be considered insignificant where:

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

Where impacts are not classed as insignificant, the combined PC and estimated background deposition (available from APIS) should be compared to the environmental standard.

An evaluation of the assessment results by an ecologist which was prepared to support the planning application for the Installation is also included in Appendix D2 of the Permit Application.

7.4 Modelling Methodology

Concentrations and deposition have been predicted on a 10 km by 10 km grid centred on the Installation with a grid spacing of 100 m for NO_x, SO_2, NH_3 and HF. Five years of meteorology were used, as described in Section 4.4, to ensure that worst-case meteorological conditions were captured.

Both concentrations and deposition have been assessed based on the long-term emission rates set out in Table 3 and Table 4. In the case of the Installation, the long-term emission rates are based on the maximum daily average BAT AEL in the WI BREF. As acid and nitrogen critical loads are based on annual deposition and critical levels are based on averaging periods ranging from daily to annual, the use of these maximum daily emission rates remains suitably precautionary. In terms of the coal plant emissions, the long-term emission rates are based on annual average BAT AELs. The permitted daily mean emission rates for SO_2 and NO_x will be based on a 10 % uplift of the annual emission in practice (i.e. 220 mg/Nm^3 in both cases); however, the assumption in the modelling that the station will operate for the entire year at full load is sufficiently precautionary to encompass this increase, being equivalent to a 91 % annual load factor at 220 mg/Nm^3.

Results presented are the maximum predicted for any year of meteorological data at any modelled point over each local ecological site. As a precautionary approach, these runs assumed no plume depletion due to deposition.

Dry deposition to both non-woodland and woodland features has been assessed by multiplying the modelled concentrations by the deposition velocities shown in Table 20 based on the AQTAG06 Environment Agency Guidance (Environment Agency, 2014) followed by appropriate unit conversion for comparison to acid and nutrient nitrogen critical loads. These runs did not incorporate NO_x chemistry and effectively assign the same deposition velocity to NO and NO_2. This represents a precautionary approach for nitrogen deposition as this is primarily associated with NO_2 with the NO deposition velocity being negligible in comparison. AQTAG06 does not include deposition velocities for HF; therefore, the deposition velocity for HCl has been used for this species given their shared chemical properties as hydrogen halides.

Wet deposition of SO_2, NO_x and NH_3 is negligible in comparison with dry deposition over near-field distances (Environment Agency, 2014) and has therefore been omitted. Given the high solubility of HCl and to an extent HF, there is potential for wet deposition to be significant over short distances. As a precautionary approach, the modelled dry deposition total has been doubled to account for wet deposition. This is consistent with the approach applied in other energy from waste plant deposition assessments for these species.

Table 20: Deposition parameter values used in ADMS modelling

Species	Dry deposition velocity (m/s) Non-woodland habitats	Dry deposition velocity (m/s) Woodland habitats	Wet deposition
NO_x	0.0015	0.003	-
SO_2	0.012	0.024	-
NH_3	0.02	0.03	-
HCl	0.025	0.060	Assumed equal to dry deposition
HF	0.025	0.060	Assumed equal to dry deposition

7.5 Results

7.5.1 Assessment Against NH_3 Annual Mean Critical Level

Table 21 compares the modelled annual mean NH_3 concentrations to the annual mean NH_3 critical level for Scenarios A, C and D. As it is assumed there are negligible emissions of NH_3 from the OCGTs, the results for Scenario B will be the same as Scenario A and are not considered separately.

It can be seen that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all three scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for long-term impacts. It should be noted that the project ecologist recommended that the less stringent ammonia critical level of 3 µg/m^3 should be applied at the LNR and LWSs (see Appendix D2 of the Permit Application) which would reduce the impact to less than 1 % of the critical level at all sites except the Gotham Hill Woods LWS.

The PC at Lockington Marshes SSSI is fractionally above the 1 % long-term significance threshold for SSSIs for the three scenarios. Table 22 shows the PECs using the background NH_3 concentration extracted from APIS for the location of the maximum impact point. It can be seen that the background ammonia concentration already exceeds the annual mean NH_3 critical level by more than a factor of two. The PC comprises 0.6 %, 0.6 % and 0.8 % of the background ammonia concentration for Scenarios A, C and D respectively.

The area around the Ratcliffe-on-Soar power station site is predominantly rural and as such the background ammonia concentrations will derive primarily from farming activities as opposed to industrial or commercial sources; hence, it is evident that sources other than the Installation and the existing coal-fired power station dominate ammonia concentrations at the Lockington Marshes SSSI.

The assessment has been based on the highest impact at any point on the site over the five meteorological years modelled. The average ammonia concentration over the five years is below the 1 % threshold over the entire SSSI (the highest average value being 0.009 µg/m^3 at any point in the site) for Scenarios A and C and is below the 1 % threshold over 90 % of the entire SSSI area for Scenario D.

The site-specific critical level information on APIS for the Lockington Marshes SSSI suggests that site-specific advice should be sought in relation to the habitat sensitivity of the fen, marsh and swamp features and the broad-leaved mixed and yew woodland features in relation to ammonia. A critical level of 3 µg/m^3 is recommended for the invertebrate assemblage feature. A review by the project ecologist (see Appendix D2 of the Permit Application) concluded that the higher ammonia critical load of 3 µg/m^3 should be applied at the SSSI. Applying the higher critical load would result in PCs comprising 0.5 % and 0.6 % of the critical level for Scenario A and Scenario D respectively, which would be below the 1 % significance threshold.

The assessment has a number of conservative assumptions built in, notably:

- The Installation and existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year;
- The assessment is based on the highest impact point over the entire site; and
- The more precautionary 1 µg/m^3 critical level has been used.

Table 21: Predicted process contributions (PC) assessed against the annual mean NH_3 critical level (Clv) – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Lockington Marshes SSSI	1	0.014	1.4 %	0.014	1.4 %	0.018	1.8 %
Forbes Hole LNR	1	0.007	0.7 %	0.007	0.7 %	0.009	0.9 %
Attenborough West Gravel Pits	1	0.012	1.2 %	0.012	1.2 %	0.014	1.4 %
Copse Kingston-on-Soar	1	0.006	0.6 %	0.006	0.6 %	0.008	0.8 %
Cranfleet Farm Floodbanks	1	0.009	0.9 %	0.009	0.9 %	0.009	0.9 %
Cranfleet Ponds (West Pond)	1	0.007	0.7 %	0.007	0.7 %	0.008	0.8 %
Erewash Canal	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Gotham Hill Woods	1	0.027	2.7 %	0.027	2.7 %	0.035	3.5 %
Gotham Wood	1	0.013	1.3 %	0.008	0.8 %	0.021	2.1 %
Lockington Ash	1	0.006	0.6 %	0.006	0.6 %	0.006	0.6 %
Lockington Ash 2	1	0.006	0.6 %	0.006	0.6 %	0.006	0.6 %
Lockington Confluence Backwater	1	0.007	0.7 %	0.007	0.7 %	0.007	0.7 %
Lockington Confluence Hedges	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Lockington Fen	1	0.010	1.0 %	0.012	1.2 %	0.017	1.7 %
Lockington Grounds, pond and marsh near Trent	1	0.005	0.5 %	0.005	0.5 %	0.006	0.6 %
Lockington Trentside Pools	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Lockington swamp by SSSI	1	0.005	0.5 %	0.005	0.5 %	0.006	0.6 %
Lower Soar Floodplain Wetland	1	0.016	1.6 %	0.016	1.6 %	0.019	1.9 %
Meadow Lane Carr	1	0.008	0.8 %	0.008	0.8 %	0.009	0.9 %
Narrow Bridge Fish Pond	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Pond in hedgeline between two improved grasslands	1	0.014	1.4 %	0.014	1.4 %	0.016	1.6 %
Poplars Fish Pond	1	0.007	0.7 %	0.007	0.7 %	0.007	0.7 %
Rare Plant Register Mousetail Pasture	1	0.017	1.7 %	0.017	1.7 %	0.019	1.9 %
Ratcliffe Lane Pasture and Stream	1	0.016	1.6 %	0.016	1.6 %	0.018	1.8 %
Ratcliffe-on-Soar Flyash Grassland	1	0.007	0.7 %	0.007	0.7 %	0.008	0.8 %
Ratcliffe-on-Soar Flyash Track Grassland	1	0.007	0.7 %	0.007	0.7 %	0.007	0.7 %
Ratcliffe-on-Soar Pond	1	0.004	0.4 %	0.004	0.4 %	0.004	0.4 %
Red Hill Ratcliffe on Soar	1	0.007	0.7 %	0.007	0.7 %	0.007	0.7 %
Redhill Marina Backwater	1	0.008	0.8 %	0.008	0.8 %	0.008	0.8 %

Table 21 (cont): Predicted process contributions (PC) assessed against the annual mean NH_3 critical level (Clv) – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
River Soar Loughborough Meadows to Trent	1	0.017	1.7 %	0.014	1.4 %	0.019	1.9 %
River Soar West Bank south of A453	1	0.010	1.0 %	0.012	1.2 %	0.013	1.3 %
River Trent North Bank	1	0.027	2.7 %	0.027	2.7 %	0.029	2.9 %
Shooting Ground Marsh Grassland, Lockington	1	0.014	1.4 %	0.017	1.7 %	0.017	1.7 %
Sheetstores Junction Pond	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Soar Meadow near Ratcliffe Lock	1	0.016	1.6 %	0.016	1.6 %	0.018	1.8 %
South Junction Pond	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Thrumpton Bank	1	0.026	2.6 %	0.026	2.6 %	0.028	2.8 %
Thrumpton Park	1	0.026	2.6 %	0.026	2.6 %	0.027	2.7 %
Trent Floodplain Wetland - Lock M07	1	0.006	0.6 %	0.006	0.6 %	0.007	0.7 %
Trent Floodplain Wetland Lock M13	1	0.005	0.5 %	0.005	0.5 %	0.006	0.6 %
Trent Lock Marsh	1	0.006	0.6 %	0.006	0.6 %	0.006	0.6 %
River Trent (Erewash)	1	0.007	0.7 %	0.007	0.7 %	0.007	0.7 %

Table 22: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the annual mean NH_3 critical level – Scenarios A and D

	Critical Level ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/CLv (%)	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/ CLv (%)
Scenario A	1	0.014	1.4 %	2.17	2.19	219 %
Scenario C	1	0.014	1.4 %	2.17	2.19	219 %
Scenario D	1	0.018	1.8 %	2.17	2.18	218 %

Given the precautionary approach adopted, the low levels of impact relative to both the critical level and the background, and the domination of ammonia levels at the SSSI by sources other than the Installation, it can reasonably be concluded that annual emissions of ammonia from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As ammonia impacts are below are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that annual emissions of ammonia from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.2 Assessment Against SO_2 Annual Mean Critical Level

Table 23 compares the modelled annual mean SO_2 concentrations to the annual mean SO_2 critical level for Scenarios A to D.

Table 23 shows that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all four scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for long-term impacts.

The PC at Lockington Marshes SSSI is only above the 1 % long-term significance threshold for SSSIs for Scenario D. Table 24 shows the PEC for Scenario D using the background SO_2 concentration extracted from APIS for the location of the maximum impact point. It can be seen that the PEC is well below the critical level.

The site-specific critical level information on APIS for the Lockington Marshes SSSI suggests that site-specific advice should be sought in relation to the habitat sensitivity of the fen, marsh and swamp features and the broad-leaved mixed and yew woodland features in relation to sulphur dioxide. A critical level of 20 $\mu g/m^3$ is recommended for the invertebrate assemblage feature. Applying the higher critical load would result in a PC of 1.2 % of the critical level for Scenario D.

Table 23: Predicted process contributions (PC) assessed against the annual mean SO_2 critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Lockington Marshes SSSI	10	0.040	0.4 %	0.065	0.6 %	0.074	0.7 %	0.236	2.4 %
Forbes Hole LNR	10	0.022	0.2 %	0.032	0.3 %	0.032	0.3 %	0.089	0.9 %
Attenborough West Gravel Pits	10	0.035	0.4 %	0.049	0.5 %	0.057	0.6 %	0.143	1.4 %
Copse Kingston-on-Soar	10	0.019	0.2 %	0.030	0.3 %	0.031	0.3 %	0.082	0.8 %
Cranfleet Farm Floodbanks	10	0.026	0.3 %	0.035	0.4 %	0.035	0.4 %	0.050	0.5 %
Cranfleet Ponds (West Pond)	10	0.022	0.2 %	0.030	0.3 %	0.030	0.3 %	0.040	0.4 %
Erewash Canal	10	0.018	0.2 %	0.023	0.2 %	0.023	0.2 %	0.046	0.5 %
Gotham Hill Woods	10	0.078	0.8 %	0.120	1.2 %	0.139	1.4 %	0.543	5.4 %
Gotham Wood	10	0.037	0.4 %	0.069	0.7 %	0.042	0.4 %	0.406	4.1 %
Lockington Ash	10	0.016	0.2 %	0.022	0.2 %	0.022	0.2 %	0.044	0.4 %
Lockington Ash 2	10	0.016	0.2 %	0.022	0.2 %	0.022	0.2 %	0.044	0.4 %
Lockington Confluence Backwater	10	0.019	0.2 %	0.024	0.2 %	0.024	0.2 %	0.054	0.5 %
Lockington Confluence Hedges	10	0.019	0.2 %	0.024	0.2 %	0.024	0.2 %	0.047	0.5 %
Lockington Fen	10	0.031	0.3 %	0.057	0.6 %	0.064	0.6 %	0.245	2.4 %
Lockington Grounds, pond and marsh near Trent	10	0.014	0.1 %	0.019	0.2 %	0.020	0.2 %	0.055	0.6 %
Lockington Trentside Pools	10	0.019	0.2 %	0.024	0.2 %	0.024	0.2 %	0.041	0.4 %
Lockington swamp by SSSI	10	0.016	0.2 %	0.022	0.2 %	0.022	0.2 %	0.048	0.5 %
Lower Soar Floodplain Wetland	10	0.048	0.5 %	0.076	0.8 %	0.090	0.9 %	0.176	1.8 %
Meadow Lane Carr	10	0.023	0.2 %	0.033	0.3 %	0.033	0.3 %	0.092	0.9 %
Narrow Bridge Fish Pond	10	0.018	0.2 %	0.023	0.2 %	0.023	0.2 %	0.039	0.4 %
Pond in hedgeline between two improved grasslands	10	0.042	0.4 %	0.063	0.6 %	0.068	0.7 %	0.123	1.2 %
Poplars Fish Pond	10	0.020	0.2 %	0.026	0.3 %	0.025	0.3 %	0.051	0.5 %
Rare Plant Register Mousetail Pasture	10	0.051	0.5 %	0.079	0.8 %	0.094	0.9 %	0.162	1.6 %
Ratcliffe Lane Pasture and Stream	10	0.047	0.5 %	0.076	0.8 %	0.089	0.9 %	0.245	2.4 %
Ratcliffe-on-Soar Flyash Grassland	10	0.020	0.2 %	0.031	0.3 %	0.032	0.3 %	0.078	0.8 %
Ratcliffe-on-Soar Flyash Track Grassland	10	0.020	0.2 %	0.025	0.3 %	0.025	0.3 %	0.047	0.5 %
Ratcliffe-on-Soar Pond	10	0.011	0.1 %	0.013	0.1 %	0.014	0.1 %	0.020	0.2 %
Red Hill Ratcliffe on Soar	10	0.020	0.2 %	0.025	0.3 %	0.025	0.3 %	0.041	0.4 %

Table 23 (cont): Predicted process contributions (PC) assessed against the annual mean SO_2 critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Redhill Marina Backwater	10	0.023	0.2 %	0.026	0.3 %	0.027	0.3 %	0.042	0.4 %
River Soar Loughborough Meadows to Trent	10	0.051	0.5 %	0.079	0.8 %	0.072	0.7 %	0.188	1.9 %
River Soar West Bank south of A453	10	0.028	0.3 %	0.052	0.5 %	0.054	0.5 %	0.096	1.0 %
River Trent North Bank	10	0.081	0.8 %	0.106	1.1 %	0.164	1.6 %	0.224	2.2 %
Shooting Ground Marsh Grassland, Lockington	10	0.040	0.4 %	0.063	0.6 %	0.094	0.9 %	0.201	2.0 %
Sheetstores Junction Pond	10	0.018	0.2 %	0.023	0.2 %	0.023	0.2 %	0.044	0.4 %
Soar Meadow near Ratcliffe Lock	10	0.048	0.5 %	0.075	0.7 %	0.086	0.9 %	0.161	1.6 %
South Junction Pond	10	0.019	0.2 %	0.024	0.2 %	0.024	0.2 %	0.053	0.5 %
Thrumpton Bank	10	0.076	0.8 %	0.101	1.0 %	0.147	1.5 %	0.225	2.3 %
Thrumpton Park	10	0.077	0.8 %	0.100	1.0 %	0.186	1.9 %	0.212	2.1 %
Trent Floodplain Wetland - Lock M07	10	0.019	0.2 %	0.024	0.2 %	0.024	0.2 %	0.038	0.4 %
Trent Floodplain Wetland Lock M13	10	0.014	0.1 %	0.019	0.2 %	0.020	0.2 %	0.052	0.5 %
Trent Lock Marsh	10	0.017	0.2 %	0.022	0.2 %	0.022	0.2 %	0.045	0.4 %
River Trent (Erewash)	10	0.020	0.2 %	0.025	0.2 %	0.025	0.2 %	0.057	0.6 %

Table 24: Predicted process contribution (PC) and predicted environmental concentration (PEC) at Lockington Marshes SSSI assessed against the annual mean SO_2 critical level – Scenario D

	Critical Level ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/CLv (%)	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/CLv (%)
Scenario D	10	0.236	2.4 %	1.56	1.80	18.0 %

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year;
- The assessment is based on the highest impact point over the entire site; and
- The more precautionary 10 $\mu g/m^3$ critical level has been used.

Given that the PEC is well below the annual mean SO_2 critical level, it can confidently be concluded that annual emissions of SO_2 from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As SO_2 impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that annual emissions of SO_2 from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.3 Assessment Against NO_x Annual Mean Critical Level

Table 25 compares the modelled annual mean NO_x concentrations to the annual mean NO_x critical level for Scenarios A to D. It can be seen that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all four scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for long-term impacts.

The PC at Lockington Marshes SSSI is fractionally above the 1 % long-term significance threshold for SSSIs for Scenario C and Scenario D.

Table 26 shows the PECs for Scenario C and Scenario D using the background NO_x concentration extracted from APIS for the location of the maximum impact point. It can be seen that the PEC is more than 20 % below the critical level for both scenarios.

Table 25: Predicted process contributions (PC) assessed against the annual mean NO_x critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Lockington Marshes SSSI	30	0.164	0.5 %	0.264	0.9 %	0.302	1.0 %	0.464	1.5 %
Forbes Hole LNR	30	0.090	0.3 %	0.129	0.4 %	0.129	0.4 %	0.186	0.6 %
Attenborough West Gravel Pits	30	0.144	0.5 %	0.201	0.7 %	0.234	0.8 %	0.319	1.1 %
Copse Kingston-on-Soar	30	0.077	0.3 %	0.122	0.4 %	0.127	0.4 %	0.177	0.6 %
Cranfleet Farm Floodbanks	30	0.105	0.4 %	0.143	0.5 %	0.143	0.5 %	0.158	0.5 %
Cranfleet Ponds (West Pond)	30	0.088	0.3 %	0.121	0.4 %	0.121	0.4 %	0.131	0.4 %
Erewash Canal	30	0.073	0.2 %	0.095	0.3 %	0.095	0.3 %	0.113	0.4 %
Gotham Hill Woods	30	0.319	1.1 %	0.496	1.7 %	0.572	1.9 %	0.943	3.1 %
Gotham Wood	30	0.150	0.5 %	0.281	0.9 %	0.173	0.6 %	0.638	2.1 %
Lockington Ash	30	0.066	0.2 %	0.088	0.3 %	0.089	0.3 %	0.111	0.4 %
Lockington Ash 2	30	0.066	0.2 %	0.088	0.3 %	0.089	0.3 %	0.111	0.4 %
Lockington Confluence Backwater	30	0.079	0.3 %	0.099	0.3 %	0.099	0.3 %	0.118	0.4 %
Lockington Confluence Hedges	30	0.078	0.3 %	0.100	0.3 %	0.100	0.3 %	0.117	0.4 %
Lockington Fen	30	0.125	0.4 %	0.233	0.8 %	0.261	0.9 %	0.442	1.5 %
Lockington Grounds, pond and marsh near Trent	30	0.057	0.2 %	0.079	0.3 %	0.080	0.3 %	0.115	0.4 %
Lockington Trentside Pools	30	0.078	0.3 %	0.098	0.3 %	0.098	0.3 %	0.115	0.4 %
Lockington swamp by SSSI	30	0.066	0.2 %	0.088	0.3 %	0.089	0.3 %	0.115	0.4 %
Lower Soar Floodplain Wetland	30	0.197	0.7 %	0.309	1.0 %	0.367	1.2 %	0.453	1.5 %
Meadow Lane Carr	30	0.095	0.3 %	0.135	0.5 %	0.135	0.5 %	0.194	0.6 %
Narrow Bridge Fish Pond	30	0.075	0.2 %	0.092	0.3 %	0.092	0.3 %	0.105	0.4 %
Pond in hedgeline between two improved grasslands	30	0.171	0.6 %	0.256	0.9 %	0.279	0.9 %	0.334	1.1 %
Poplars Fish Pond	30	0.080	0.3 %	0.104	0.3 %	0.104	0.3 %	0.129	0.4 %
Rare Plant Register Mousetail Pasture	30	0.206	0.7 %	0.321	1.1 %	0.384	1.3 %	0.452	1.5 %
Ratcliffe Lane Pasture and Stream	30	0.193	0.6 %	0.309	1.0 %	0.364	1.2 %	0.502	1.7 %
Ratcliffe-on-Soar Flyash Grassland	30	0.081	0.3 %	0.126	0.4 %	0.132	0.4 %	0.178	0.6 %
Ratcliffe-on-Soar Flyash Track Grassland	30	0.081	0.3 %	0.102	0.3 %	0.102	0.3 %	0.122	0.4 %
Ratcliffe-on-Soar Pond	30	0.047	0.2 %	0.054	0.2 %	0.055	0.2 %	0.062	0.2 %
Red Hill Ratcliffe on Soar	30	0.080	0.3 %	0.103	0.3 %	0.103	0.3 %	0.116	0.4 %

Table 25 (cont): Predicted process contributions (PC) assessed against the annual mean NO_x critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Redhill Marina Backwater	30	0.095	0.3 %	0.108	0.4 %	0.110	0.4 %	0.121	0.4 %
River Soar Loughborough Meadows to Trent	30	0.210	0.7 %	0.321	1.1 %	0.295	1.0 %	0.473	1.6 %
River Soar West Bank south of A453	30	0.115	0.4 %	0.210	0.7 %	0.220	0.7 %	0.262	0.9 %
River Trent North Bank	30	0.329	1.1 %	0.433	1.4 %	0.669	2.2 %	0.716	2.4 %
Shooting Ground Marsh Grassland, Lockington	30	0.164	0.5 %	0.257	0.9 %	0.384	1.3 %	0.423	1.4 %
Sheetstores Junction Pond	30	0.075	0.2 %	0.092	0.3 %	0.092	0.3 %	0.111	0.4 %
Soar Meadow near Ratcliffe Lock	30	0.195	0.6 %	0.304	1.0 %	0.350	1.2 %	0.426	1.4 %
South Junction Pond	30	0.077	0.3 %	0.100	0.3 %	0.100	0.3 %	0.129	0.4 %
Thrumpton Bank	30	0.308	1.0 %	0.412	1.4 %	0.598	2.0 %	0.677	2.3 %
Thrumpton Park	30	0.315	1.1 %	0.408	1.4 %	0.774	2.6 %	0.799	2.7 %
Trent Floodplain Wetland - Lock M07	30	0.078	0.3 %	0.100	0.3 %	0.100	0.3 %	0.113	0.4 %
Trent Floodplain Wetland Lock M13	30	0.057	0.2 %	0.079	0.3 %	0.080	0.3 %	0.112	0.4 %
Trent Lock Marsh	30	0.068	0.2 %	0.090	0.3 %	0.090	0.3 %	0.112	0.4 %
River Trent (Erewash)	30	0.081	0.3 %	0.100	0.3 %	0.100	0.3 %	0.119	0.4 %

Table 26: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the annual mean NO_x critical level – Scenarios C and D

	Critical Level ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/CLv (%)	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/CLv (%)
Scenario C	30	0.302	1.0 %	23.41	23.71	79.0 %
Scenario D	30	0.464	1.5 %	23.41	23.87	79.6 %

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year; and
- The assessment is based on the highest impact point over the entire site.

Given that the PEC is significantly below the annual mean NO_x critical level, it can confidently be concluded that annual emissions of NO_x from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As NO_x impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that annual emissions of NO_x from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.4 Assessment Against NO_x Maximum Daily Mean Critical Level

Table 27 compares the modelled maximum daily mean NO_x concentrations to the maximum daily mean NO_x critical level for Scenarios A to D. It can be seen that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all four scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for short-term impacts.

The PC at Lockington Marshes SSSI is below the 10 % short-term significance threshold for Scenario A, fractionally above the threshold for Scenario B and 14.3 % and 27.9 % of the critical level for Scenario C and Scenario D, respectively.

Table 28 shows the PECs for Scenario B, Scenario C and Scenario D using the background NO_x concentration extracted from APIS for the location of the maximum impact point. The Environment Agency guidance suggests using twice the annual mean background concentration when determining the PEC for short-term effects.

It can be seen that the PEC is more than 20 % below the critical level for Scenario B and Scenario C, and around 90 % of the critical level for Scenario D. It should be noted that Scenario D considers operation of the existing power station and, hence, this scenario would occur for no more than nine months in total based on the assumed dates for commencing operation of the Installation and for closure of the existing power station.

Table 27: Predicted process contributions (PC) assessed against the daily mean NO_x critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Lockington Marshes SSSI	75	3.44	4.6 %	7.68	10.2 %	10.76	14.3 %	20.92	27.9 %
Forbes Hole LNR	75	2.87	3.8 %	4.52	6.0 %	4.52	6.0 %	7.59	10.1 %
Attenborough West Gravel Pits	75	3.19	4.3 %	4.39	5.9 %	4.47	6.0 %	8.58	11.4 %
Copse Kingston-on-Soar	75	2.08	2.8 %	3.96	5.3 %	4.10	5.5 %	7.11	9.5 %
Cranfleet Farm Floodbanks	75	3.52	4.7 %	4.58	6.1 %	4.58	6.1 %	4.85	6.5 %
Cranfleet Ponds (West Pond)	75	2.92	3.9 %	3.83	5.1 %	3.82	5.1 %	4.44	5.9 %
Erewash Canal	75	2.66	3.5 %	3.18	4.2 %	3.18	4.2 %	5.07	6.8 %
Gotham Hill Woods	75	3.25	4.3 %	7.00	9.3 %	8.24	11.0 %	23.21	30.9 %
Gotham Wood	75	2.89	3.8 %	4.69	6.3 %	4.77	6.4 %	14.45	19.3 %
Lockington Ash	75	3.04	4.1 %	3.52	4.7 %	3.56	4.7 %	5.48	7.3 %
Lockington Ash 2	75	3.04	4.1 %	3.52	4.7 %	3.56	4.7 %	5.48	7.3 %
Lockington Confluence Backwater	75	3.14	4.2 %	3.90	5.2 %	3.90	5.2 %	5.63	7.5 %
Lockington Confluence Hedges	75	3.40	4.5 %	4.36	5.8 %	4.36	5.8 %	5.54	7.4 %
Lockington Fen	75	2.46	3.3 %	6.84	9.1 %	8.59	11.4 %	23.03	30.7 %
Lockington Grounds, pond and marsh near Trent	75	2.34	3.1 %	3.08	4.1 %	3.08	4.1 %	5.52	7.4 %
Lockington Trentside Pools	75	2.96	4.0 %	3.52	4.7 %	3.52	4.7 %	4.56	6.1 %
Lockington swamp by SSSI	75	2.71	3.6 %	3.56	4.7 %	3.55	4.7 %	5.63	7.5 %
Lower Soar Floodplain Wetland	75	3.54	4.7 %	7.11	9.5 %	11.50	15.3 %	16.23	21.6 %
Meadow Lane Carr	75	3.04	4.1 %	4.50	6.0 %	4.50	6.0 %	7.52	10.0 %
Narrow Bridge Fish Pond	75	2.68	3.6 %	3.43	4.6 %	3.45	4.6 %	4.81	6.4 %
Pond in hedgeline between two improved grasslands	75	3.37	4.5 %	6.28	8.4 %	8.34	11.1 %	10.18	13.6 %
Poplars Fish Pond	75	2.36	3.2 %	3.22	4.3 %	3.21	4.3 %	4.94	6.6 %
Rare Plant Register Mousetail Pasture	75	3.64	4.9 %	7.42	9.9 %	13.19	17.6 %	16.81	22.4 %
Ratcliffe Lane Pasture and Stream	75	3.37	4.5 %	7.22	9.6 %	10.87	14.5 %	19.06	25.4 %
Ratcliffe-on-Soar Flyash Grassland	75	3.06	4.1 %	3.31	4.4 %	3.31	4.4 %	6.23	8.3 %
Ratcliffe-on-Soar Flyash Track Grassland	75	3.83	5.1 %	5.14	6.9 %	5.13	6.8 %	7.91	10.5 %
Ratcliffe-on-Soar Pond	75	2.25	3.0 %	2.31	3.1 %	2.32	3.1 %	2.69	3.6 %
Red Hill Ratcliffe on Soar	75	3.69	4.9 %	4.87	6.5 %	4.86	6.5 %	5.51	7.3 %

Table 27 (cont): Predicted process contributions (PC) assessed against the daily mean NO_x critical level – Scenarios A to D

Site		Scenario A		Scenario B		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Redhill Marina Backwater	75	3.17	4.2 %	3.62	4.8 %	3.61	4.8 %	5.50	7.3 %
River Soar Loughborough Meadows to Trent	75	4.16	5.6 %	7.91	10.6 %	10.98	14.6 %	16.11	21.5 %
River Soar West Bank south of A453	75	2.72	3.6 %	5.28	7.0 %	5.54	7.4 %	7.18	9.6 %
River Trent North Bank	75	5.81	7.8 %	9.55	12.7 %	15.56	20.7 %	17.20	22.9 %
Shooting Ground Marsh Grassland, Lockington	75	3.12	4.2 %	7.68	10.2 %	13.88	18.5 %	20.58	27.4 %
Sheetstores Junction Pond	75	2.58	3.4 %	3.27	4.4 %	3.29	4.4 %	5.27	7.0 %
Soar Meadow near Ratcliffe Lock	75	3.20	4.3 %	6.05	8.1 %	9.85	13.1 %	11.92	15.9 %
South Junction Pond	75	2.22	3.0 %	3.06	4.1 %	3.05	4.1 %	5.07	6.8 %
Thrumpton Bank	75	4.42	5.9 %	8.06	10.8 %	11.31	15.1 %	14.74	19.7 %
Thrumpton Park	75	6.13	8.2 %	9.34	12.5 %	25.28	33.7 %	25.36	33.8 %
Trent Floodplain Wetland - Lock M07	75	3.40	4.5 %	4.36	5.8 %	4.36	5.8 %	4.96	6.6 %
Trent Floodplain Wetland Lock M13	75	2.37	3.2 %	2.99	4.0 %	3.05	4.1 %	5.21	6.9 %
Trent Lock Marsh	75	2.36	3.2 %	2.92	3.9 %	2.92	3.9 %	4.89	6.5 %
River Trent (Erewash)	75	3.32	4.4 %	3.86	5.1 %	3.86	5.1 %	6.35	8.5 %

Table 28: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the maximum daily mean NO_x critical level – Scenarios B, C and D

	Critical Level (µg/m³)	PC (µg/m³)	PC/CLv (%)	Background (µg/m³)*	PEC (µg/m³)	PEC/CLv (%)
Scenario B	75	7.7	10.2 %	46.82	54.5	72.7 %
Scenario C	75	10.8	14.3 %	46.82	57.6	76.8 %
Scenario D	75	20.9	27.9 %	46.82	67.7	90.3 %

***Based on twice the annual mean background of 23.41 µg/m³**

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year; and
- The assessment is based on the highest impact point over the entire site.

Given that the PEC is significantly below the maximum daily mean NO_x critical level, it can confidently be concluded that daily emissions of NO_x from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As NO_x impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that daily emissions of NO_x from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.5 Assessment Against HF Maximum Daily Mean Critical Level

Table 29 compares the modelled maximum daily mean HF concentrations to the maximum daily mean HF critical level for Scenarios A, C and D. As it is assumed there are negligible emissions of HF from the OCGTs, the results for Scenario B will be the same as Scenario A and are not considered separately. It can be seen that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all three scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for short-term impacts. The PC is also below the 10 % short-term significance threshold at the Lockington Marshes SSSI and hence the impacts can be considered as insignificant at this site.

As HF impacts are below significance at the SSSI, LNR and all local LWSs, it can confidently be concluded that daily emissions of HF from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.6 Assessment Against HF Maximum Weekly Mean Critical Level

Table 30 compares the modelled maximum weekly mean HF concentrations to the maximum weekly mean HF critical level for Scenarios A, C and D. As it is assumed there are negligible emissions of HF from the OCGTs, the results for Scenario B will be the same as Scenario A and are not considered separately. It can be seen that the PC is below 100 % of the critical level at the LNR and at all of the LWSs for all three scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for short-term impacts.

The PC is also below the 10 % short-term significance threshold at the Lockington Marshes SSSI for Scenarios A and C and hence the impacts can be considered as insignificant at this site for the Installation operating after the existing power station has closed.

The air quality assessment section of this report used a highly precautionary background HF concentration of 2.35 µg/m^3 (see Table 8). As this is well above the HF maximum weekly mean critical level, it is important to use a more appropriate background concentration for determining the PEC. The 2.4 µg/m^3 figure was taken from an EPAQS report published in 2006 (EPAQS, 2006) based on measurements in the vicinity of three industrial plants. HF is primarily associated with coal burning and hence UK emissions have decreased dramatically reducing from 3.8 kt in 2006 to 0.43 kt in 2017 (based on the UK National Emissions Inventory (NEAI), https://naei.beis.gov.uk/).

Given the predominantly rural location of the Installation site, and the low load factors associated with UK coal-fired power stations over recent years, there are unlikely to be any significant local sources of HF other that the Ratcliffe-on-Soar coal-fired power station. The maximum modelled annual mean HF concentration over the entire modelling grid for the existing power station (based on a 100 % annual load factor) was 0.017 µg/m^3.

Given the association with coal burning the concentration of HF could be approximated by multiplying measured SO_2 concentrations by the ratio of HF to SO_2 emissions from coal-fired power stations. This ratio was around 0.01 in 2017 based on the NAEI. Applying this to the local SO_2 background concentration of 2.4 µg/m^3 (see Table 8) would give a HF background concentration of 0.024 µg/m^3, similar in magnitude to the maximum modelled annual mean HF. This value has therefore been applied as the local background for evaluation of the PEC.

Table 31 shows the PEC for Scenario D using twice the annual mean background concentration when determining the PEC for short-term effects. It can be seen that the PEC is well below the critical level.

Given that the PEC is well below the maximum weekly mean HF critical level, it can confidently be concluded that weekly emissions of HF from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As HF impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that weekly emissions of HF from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

Table 29: Predicted process contributions (PC) assessed against the daily HF critical level – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv µg/m³	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %	PC µg/m³	PC/Clv %
Lockington Marshes SSSI	5	0.027	0.5 %	0.027	0.5 %	0.419	8.4 %
Forbes Hole LNR	5	0.023	0.5 %	0.027	0.5 %	0.168	3.4 %
Attenborough West Gravel Pits	5	0.025	0.5 %	0.024	0.5 %	0.185	3.7 %
Copse Kingston-on-Soar	5	0.016	0.3 %	0.016	0.3 %	0.136	2.7 %
Cranfleet Farm Floodbanks	5	0.028	0.6 %	0.028	0.6 %	0.059	1.2 %
Cranfleet Ponds (West Pond)	5	0.023	0.5 %	0.023	0.5 %	0.055	1.1 %
Erewash Canal	5	0.021	0.4 %	0.021	0.4 %	0.116	2.3 %
Gotham Hill Woods	5	0.026	0.5 %	0.026	0.5 %	0.545	10.9 %
Gotham Wood	5	0.023	0.5 %	0.023	0.5 %	0.390	7.8 %
Lockington Ash	5	0.024	0.5 %	0.024	0.5 %	0.094	1.9 %
Lockington Ash 2	5	0.024	0.5 %	0.024	0.5 %	0.094	1.9 %
Lockington Confluence Backwater	5	0.025	0.5 %	0.025	0.5 %	0.109	2.2 %
Lockington Confluence Hedges	5	0.027	0.5 %	0.027	0.5 %	0.078	1.6 %
Lockington Fen	5	0.019	0.4 %	0.019	0.4 %	0.524	10.5 %
Lockington Grounds, pond and marsh near Trent	5	0.018	0.4 %	0.018	0.4 %	0.116	2.3 %
Lockington Trentside Pools	5	0.023	0.5 %	0.023	0.5 %	0.071	1.4 %
Lockington swamp by SSSI	5	0.021	0.4 %	0.021	0.4 %	0.106	2.1 %
Lower Soar Floodplain Wetland	5	0.028	0.6 %	0.028	0.6 %	0.182	3.6 %
Meadow Lane Carr	5	0.024	0.5 %	0.024	0.5 %	0.163	3.3 %
Narrow Bridge Fish Pond	5	0.021	0.4 %	0.021	0.4 %	0.084	1.7 %
Pond in hedgeline between two improved grasslands	5	0.027	0.5 %	0.027	0.5 %	0.091	1.8 %
Poplars Fish Pond	5	0.019	0.4 %	0.019	0.4 %	0.098	2.0 %
Rare Plant Register Mousetail Pasture	5	0.029	0.6 %	0.029	0.6 %	0.147	2.9 %
Ratcliffe Lane Pasture and Stream	5	0.027	0.5 %	0.027	0.5 %	0.346	6.9 %
Ratcliffe-on-Soar Flyash Grassland	5	0.024	0.5 %	0.024	0.5 %	0.112	2.2 %
Ratcliffe-on-Soar Flyash Track Grassland	5	0.030	0.6 %	0.030	0.6 %	0.125	2.5 %
Ratcliffe-on-Soar Pond	5	0.018	0.4 %	0.018	0.4 %	0.049	1.0 %
Red Hill Ratcliffe on Soar	5	0.029	0.6 %	0.029	0.6 %	0.083	1.7 %
Redhill Marina Backwater	5	0.025	0.5 %	0.025	0.5 %	0.095	1.9 %

Table 29 (cont) . Predicted process contributions (PC) assessed against the daily HF critical level – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv $\mu g/m^3$	PC $\mu g/m^3$	PC/Clv %	PC $\mu g/m^3$	PC/Clv %	PC $\mu g/m^3$	PC/Clv %
River Soar Loughborough Meadows to Trent	5	0.033	0.7 %	0.025	0.5 %	0.169	3.4 %
River Soar West Bank south of A453	5	0.021	0.4 %	0.021	0.4 %	0.140	2.8 %
River Trent North Bank	5	0.046	0.9 %	0.046	0.9 %	0.144	2.9 %
Shooting Ground Marsh Grassland, Lockington	5	0.025	0.5 %	0.033	0.7 %	0.377	7.5 %
Sheetstores Junction Pond	5	0.020	0.4 %	0.020	0.4 %	0.095	1.9 %
Soar Meadow near Ratcliffe Lock	5	0.025	0.5 %	0.025	0.5 %	0.116	2.3 %
South Junction Pond	5	0.018	0.4 %	0.018	0.4 %	0.104	2.1 %
Thrumpton Bank	5	0.035	0.7 %	0.035	0.7 %	0.164	3.3 %
Thrumpton Park	5	0.048	1.0 %	0.048	1.0 %	0.096	1.9 %
Trent Floodplain Wetland - Lock M07	5	0.027	0.5 %	0.027	0.5 %	0.068	1.4 %
Trent Floodplain Wetland Lock M13	5	0.019	0.4 %	0.019	0.4 %	0.100	2.0 %
Trent Lock Marsh	5	0.019	0.4 %	0.019	0.4 %	0.088	1.8 %
River Trent (Erewash)	5	0.026	0.5 %	0.026	0.5 %	0.136	2.7 %

Table 30: Predicted process contributions (PC) assessed against the weekly HF critical level (Clv) – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv µg/m^3	PC µg/m^3	PC/Clv %	PC µg/m^3	PC/Clv %	PC µg/m^3	PC/Clv %
Lockington Marshes SSSI	0.5	0.013	2.5 %	0.013	2.5 %	0.098	19.5 %
Forbes Hole LNR	0.5	0.006	1.3 %	0.006	1.3 %	0.029	5.7 %
Attenborough West Gravel Pits	0.5	0.008	1.7 %	0.008	1.7 %	0.038	7.7 %
Copse Kingston-on-Soar	0.5	0.005	1.1 %	0.005	1.1 %	0.033	6.7 %
Cranfleet Farm Floodbanks	0.5	0.007	1.4 %	0.007	1.4 %	0.010	2.0 %
Cranfleet Ponds (West Pond)	0.5	0.007	1.3 %	0.007	1.3 %	0.008	1.6 %
Erewash Canal	0.5	0.005	1.0 %	0.005	1.0 %	0.019	3.8 %
Gotham Hill Woods	0.5	0.012	2.4 %	0.012	2.3 %	0.147	29.3 %
Gotham Wood	0.5	0.006	1.3 %	0.005	1.0 %	0.119	23.8 %
Lockington Ash	0.5	0.006	1.1 %	0.006	1.1 %	0.023	4.6 %
Lockington Ash 2	0.5	0.006	1.1 %	0.006	1.1 %	0.023	4.6 %
Lockington Confluence Backwater	0.5	0.005	1.1 %	0.005	1.1 %	0.026	5.1 %
Lockington Confluence Hedges	0.5	0.006	1.2 %	0.006	1.2 %	0.017	3.4 %
Lockington Fen	0.5	0.010	2.1 %	0.010	2.1 %	0.122	24.4 %
Lockington Grounds, pond and marsh near Trent	0.5	0.005	0.9 %	0.005	0.9 %	0.027	5.5 %
Lockington Trentside Pools	0.5	0.005	1.0 %	0.005	1.0 %	0.014	2.8 %
Lockington swamp by SSSI	0.5	0.006	1.2 %	0.006	1.2 %	0.025	5.1 %
Lower Soar Floodplain Wetland	0.5	0.014	2.8 %	0.014	2.8 %	0.045	9.0 %
Meadow Lane Carr	0.5	0.006	1.3 %	0.006	1.3 %	0.028	5.7 %
Narrow Bridge Fish Pond	0.5	0.004	0.9 %	0.004	0.9 %	0.015	2.9 %
Pond in hedgeline between two improved grasslands	0.5	0.011	2.3 %	0.011	2.3 %	0.041	8.1 %
Poplars Fish Pond	0.5	0.006	1.2 %	0.006	1.2 %	0.013	2.7 %
Rare Plant Register Mousetail Pasture	0.5	0.015	3.0 %	0.015	3.0 %	0.040	8.1 %
Ratcliffe Lane Pasture and Stream	0.5	0.013	2.6 %	0.013	2.6 %	0.081	16.2 %
Ratcliffe-on-Soar Flyash Grassland	0.5	0.007	1.4 %	0.007	1.4 %	0.030	6.1 %
Ratcliffe-on-Soar Flyash Track Grassland	0.5	0.012	2.5 %	0.012	2.4 %	0.019	3.8 %
Ratcliffe-on-Soar Pond	0.5	0.005	1.0 %	0.005	1.0 %	0.009	1.9 %
Red Hill Ratcliffe on Soar	0.5	0.007	1.5 %	0.007	1.5 %	0.020	4.0 %
Redhill Marina Backwater	0.5	0.008	1.5 %	0.008	1.5 %	0.020	4.1 %

Table 30 (cont): Predicted process contributions (PC) assessed against the weekly HF critical level (Clv) – Scenarios A, C and D

Site		Scenario A		Scenario C		Scenario D	
	Clv µg/m^3	PC µg/m^3	PC/Clv %	PC µg/m^3	PC/Clv %	PC µg/m^3	PC/Clv %
River Soar Loughborough Meadows to Trent	0.5	0.015	3.1 %	0.012	2.4 %	0.054	10.8 %
River Soar West Bank south of A453	0.5	0.009	1.9 %	0.009	1.9 %	0.033	6.7 %
River Trent North Bank	0.5	0.015	2.9 %	0.015	2.9 %	0.030	6.0 %
Shooting Ground Marsh Grassland, Lockington	0.5	0.012	2.4 %	0.015	3.1 %	0.087	17.5 %
Sheetstores Junction Pond	0.5	0.004	0.8 %	0.004	0.8 %	0.017	3.3 %
Soar Meadow near Ratcliffe Lock	0.5	0.013	2.6 %	0.013	2.6 %	0.044	8.8 %
South Junction Pond	0.5	0.006	1.1 %	0.006	1.1 %	0.016	3.2 %
Thrumpton Bank	0.5	0.012	2.4 %	0.012	2.4 %	0.033	6.7 %
Thrumpton Park	0.5	0.015	2.9 %	0.015	2.9 %	0.026	5.2 %
Trent Floodplain Wetland - Lock M07	0.5	0.005	1.1 %	0.005	1.1 %	0.014	2.9 %
Trent Floodplain Wetland Lock M13	0.5	0.005	0.9 %	0.005	0.9 %	0.027	5.4 %
Trent Lock Marsh	0.5	0.004	0.9 %	0.004	0.9 %	0.020	4.0 %
River Trent (Erewash)	0.5	0.005	1.1 %	0.005	1.1 %	0.030	5.9 %

Table 31: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the maximum weekly mean HF critical level – Scenario D

	Critical Level ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/LCv (%)	Background ($\mu g/m^3$)*	PEC ($\mu g/m^3$)	PEC/CLv (%)
Scenario D	0.5	0.098	19.5 %	0.048	0.15	29.1 %

*****Based on twice the annual mean background of 0.024 $\mu g/m^3$

7.5.7 Assessment Against Nitrogen Critical Loads

Table 32 compares the modelled nitrogen deposition to the nutrient nitrogen critical loads (CL_{NutN}) for Scenarios A to D. It can be seen that the PC is below 100 % of the critical load at the LNR and at all of the LWSs for all four scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for long-term impacts.

The PC at Lockington Marshes SSSI ranges from 1.5 % of the critical load in Scenario A to 2.7 % of the critical load in Scenario D.

Table 33 shows the PECs for Scenarios A to D using the background nitrogen deposition extracted from APIS for the location of the maximum impact point. It can be seen that the background nitrogen deposition already exceeds the nitrogen critical load level by more than a factor of two. The PC comprises less than 1 % of the background nitrogen deposition across all four scenarios.

The area around the Ratcliffe-on-Soar power station site is predominantly rural and as such the background ammonia concentrations deriving from farming activities will make a significant contribution to local nitrogen deposition. There will also be significant NO_x emissions associated with traffic on the M1 and A453 contributing to local concentrations and deposition. Source attribution data on APIS suggests that around 27 % of the nitrogen deposition at the SSSI arises from livestock and fertiliser, around 28 % from transport and around 18 % is imported from Europe. Industrial combustion contributes less than 2 %. Given the maximum contribution under Scenario D comprises only 2.7 % of the critical load, it is evident that sources other than the Installation and the existing coal-fired power station dominate nitrogen deposition at the Lockington Marshes SSSI.

Importantly, the project ecologist advised that the W6 - Alnus glutinosa - Urtica dioica woodland habitat present at the Lockington Marshes SSSI is not sensitive to nitrogen deposition and that the critical load assignment is due to an anomaly in the interpretation of plant communities by APIS (see Appendix D2 of the Permit Application).

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year;
- The assessment is based on the highest impact point over the entire site;
- The lowest end of the critical load range has been used; and
- The habitat is unlikely to be sensitive in reality.

Table 32: Predicted process contributions (PC) assessed against the Nitrogen Critical Load (CL_{NutN}) – Scenarios A to D

Site			Scenario A		Scenario B		Scenario C		Scenario D	
	Woodland or Non-woodland	CL_{NutN} kgN/ha/yr	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %
Lockington Marshes SSSI	NW	Covered by woodland feature assessment – see Subsection 7.2								
	W	10	0.154	1.5 %	0.182	1.8 %	0.193	1.9 %	0.271	2.7 %
Forbes Hole LNR	NW	15	0.052	0.3 %	0.058	0.4 %	0.058	0.4 %	0.073	0.5 %
	W	10	0.084	0.8 %	0.096	1.0 %	0.096	1.0 %	0.123	1.2 %
Attenborough West Gravel Pits	NW	15	0.083	0.6 %	0.091	0.6 %	0.096	0.6 %	0.120	0.8 %
Copse Kingston-on-Soar	W	10	0.073	0.7 %	0.084	0.8 %	0.086	0.9 %	0.110	1.1 %
Cranfleet Farm Floodbanks	NW	15	0.061	0.4 %	0.066	0.4 %	0.066	0.4 %	0.070	0.5 %
Cranfleet Ponds (West Pond)	NW	15	0.051	0.3 %	0.056	0.4 %	0.056	0.4 %	0.058	0.4 %
Erewash Canal	NW	15	0.042	0.3 %	0.045	0.3 %	0.045	0.3 %	0.050	0.3 %
Gotham Hill Woods	W	10	0.299	3.0 %	0.349	3.5 %	0.370	3.7 %	0.535	5.4 %
Gotham Wood	W	10	0.141	1.4 %	0.178	1.8 %	0.186	1.9 %	0.346	3.5 %
Lockington Ash	W	10	0.062	0.6 %	0.068	0.7 %	0.069	0.7 %	0.079	0.8 %
Lockington Ash 2	W	10	0.062	0.6 %	0.068	0.7 %	0.069	0.7 %	0.079	0.8 %
Lockington Confluence Backwater	NW	15	0.045	0.3 %	0.048	0.3 %	0.048	0.3 %	0.052	0.3 %
Lockington Confluence Hedges	NW	15	0.045	0.3 %	0.046	0.3 %	0.048	0.3 %	0.052	0.3 %
Lockington Fen	NW	15	0.083	0.6 %	0.096	0.6 %	0.100	0.7 %	0.150	1.0 %
Lockington Grounds, pond and marsh near Trent	NW	15	0.033	0.2 %	0.036	0.2 %	0.036	0.2 %	0.046	0.3 %
Lockington Trentside Pools	NW	15	0.045	0.3 %	0.048	0.3 %	0.048	0.3 %	0.052	0.3 %
Lockington swamp by SSSI	NW	15	0.038	0.3 %	0.041	0.3 %	0.041	0.3 %	0.048	0.3 %
Lower Soar Floodplain Wetland	NW	15	0.114	0.8 %	0.130	0.9 %	0.138	0.9 %	0.162	1.1 %
Meadow Lane Carr	NW	15	0.055	0.4 %	0.060	0.4 %	0.060	0.4 %	0.076	0.5 %
	W	10	0.089	0.9 %	0.100	1.0 %	0.100	1.0 %	0.129	1.3 %
Narrow Bridge Fish Pond	NW	15	0.043	0.3 %	0.046	0.3 %	0.046	0.3 %	0.049	0.3 %
Pond in hedgeline between two improved grasslands	NW	15	0.099	0.7 %	0.111	0.7 %	0.114	0.8 %	0.129	0.9 %
Poplars Fish Pond	NW	15	0.046	0.3 %	0.049	0.3 %	0.049	0.3 %	0.053	0.4 %

Table 32 (cont): Predicted process contributions (PC) assessed against the Nitrogen Critical Load (CL_{NutN}) – Scenarios A to D

Site			Scenario A		Scenario B		Scenario C		Scenario D	
	Woodland or Non-woodland	CL_{NutN} kgN/ha/yr	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %	PC kgN/ha/yr	PC/ CL_{NutN} %
Rare Plant Register Mousetail Pasture	NW	20	0.119	0.6 %	0.136	0.7 %	0.123	0.6 %	0.163	0.8 %
Ratcliffe Lane Pasture and Stream	NW	20	0.111	0.6 %	0.128	0.6 %	0.136	0.7 %	0.171	0.9 %
Ratcliffe-on-Soar Flyash Grassland	NW	15	0.047	0.3 %	0.052	0.3 %	0.053	0.4 %	0.066	0.4 %
Ratcliffe-on-Soar Flyash Track Grassland	NW	15	0.046	0.3 %	0.050	0.3 %	0.049	0.3 %	0.054	0.4 %
Ratcliffe-on-Soar Pond	NW	15	0.027	0.2 %	0.028	0.2 %	0.028	0.2 %	0.030	0.2 %
Red Hill Ratcliffe on Soar	NW	15	0.046	0.3 %	0.049	0.3 %	0.049	0.3 %	0.052	0.3 %
Redhill Marina Backwater	NW	15	0.055	0.4 %	0.057	0.4 %	0.057	0.4 %	0.059	0.4 %
River Soar Loughborough Meadows to Trent	NW	15	0.121	0.8 %	0.136	0.9 %	0.113	0.8 %	0.167	1.1 %
River Soar West Bank south of A453	NW	15	0.083	0.6 %	0.092	0.6 %	0.094	0.6 %	0.105	0.7 %
River Trent North Bank	NW	20	0.190	0.9 %	0.205	1.0 %	0.238	1.2 %	0.253	1.3 %
Shooting Ground Marsh Grassland, Lockington	NW	15	0.095	0.6 %	0.108	0.7 %	0.145	1.0 %	0.149	1.0 %
Sheetstores Junction Pond	NW	15	0.043	0.3 %	0.046	0.3 %	0.046	0.3 %	0.049	0.3 %
Soar Meadow near Ratcliffe Lock	NW	20	0.112	0.6 %	0.128	0.6 %	0.135	0.7 %	0.155	0.8 %
South Junction Pond	NW	15	0.045	0.3 %	0.047	0.3 %	0.047	0.3 %	0.052	0.3 %
Thrumpton Bank	NW	15	0.178	1.2 %	0.193	1.3 %	0.219	1.5 %	0.241	1.6 %
Thrumpton Park	NW	20	0.182	0.9 %	0.195	1.0 %	0.233	1.2 %	0.244	1.2 %
	W	15	0.296	2.0 %	0.322	2.1 %	0.398	2.7 %	0.416	2.8 %
Trent Floodplain Wetland - Lock M07	NW	15	0.045	0.3 %	0.048	0.3 %	0.048	0.3 %	0.052	0.3 %
Trent Floodplain Wetland Lock M13	NW	15	0.033	0.2 %	0.036	0.2 %	0.036	0.2 %	0.045	0.3 %
Trent Lock Marsh	NW	15	0.039	0.3 %	0.043	0.3 %	0.043	0.3 %	0.049	0.3 %
	W	10	0.064	0.6 %	0.070	0.7 %	0.070	0.7 %	0.081	0.8 %
River Trent (Erewash)	NW	15	0.047	0.3 %	0.050	0.3 %	0.050	0.3 %	0.053	0.4 %

Table 33: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the nutrient nitrogen critical load – Scenarios A to D

	CL_{NutN} kgN/ha/yr	PC kgN/ha/yr	PC/ CL_{NutN} %	Background kgN/ha/yr	PEC kgN/ha/yr	PEC/ CL_{NutN} %
Scenario A	10	0.154	1.5 %	33.88	34.03	340 %
Scenario B	10	0.182	1.8 %	33.88	34.06	341 %
Scenario C	10	0.193	1.9 %	33.88	34.07	341 %
Scenario D	10	0.271	2.7 %	33.88	34.15	342 %

Given the precautionary approach adopted, the low levels of impact relative to both the critical level and the background, and the domination of nitrogen deposition at the SSSI by sources other than the Installation, it can reasonably be concluded that annual emissions of NO_x and NH_3 from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As nitrogen impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that annual emissions of NO_x and NH_3 from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

7.5.8 Assessment Against Acid Critical Loads

Table 34 compares the modelled acid deposition to the acid critical loads (CL_{MaxtN}) for Scenarios A to D. It can be seen that the PC is below 100 % of the critical load at the LNR and at all of the LWSs for all four scenarios and hence the impacts can be considered as insignificant at these sites in relation to the EA significance criterion for long-term impacts.

The PC at Lockington Marshes SSSI ranges from 1.8 % of the critical load in Scenario A to 6.5 % of the critical load in Scenario D.

Table 35 shows the PECs for Scenarios A to D using the background acid deposition extracted from APIS for the location of the maximum impact point. It can be seen that the background acid deposition already exceeds the acid critical load. The PC comprises less than 2.0 % of the background acid deposition for Scenarios A to C and 5.2 % of the background for Scenario D.

Source attribution data on APIS suggests that around 20 % of the acid deposition at the SSSI arises from livestock and fertiliser, around 22 % from transport and around 16 % is imported from Europe. Around 4 % is directly attributed to the existing coal-fired power station; hence, the PEC in Table 35 is double counting the existing power station contribution. Given that the maximum contribution under Scenarios A to C comprises only 2.4 % of the critical load, it is evident that sources other than the Installation dominate nitrogen deposition at the Lockington Marshes SSSI.

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year;
- The assessment is based on the highest impact point over the entire site; and

- The lowest end of the critical load range has been used.

Scenario B and Scenario C assume that the OCGTs are operating for 8760 hours per year, whereas in reality they are restricted to a maximum of 500 hours of operation. If the OCGT impacts are scaled to reflect this, the PCs would be reduced to less than 2 % of the acid critical loads.

Although the in-combination contribution with the existing power station could be close to 7 %, it is highly unlikely that the existing power station would run anywhere close to a 100 % annual load factor, given that generation has averaged 17 % over the past five years. In any case, operation of the Installation and the power station is not anticipated to overlap for more than nine months given the requirement to close the existing station by October 2025.

Given the precautionary approach adopted, the low levels of impact relative to both the critical level and the background, and the domination of acid deposition at the SSSI by sources other than the Installation, it can reasonably be concluded that annual emissions of NO_x, SO_2, NH_3, HF and HCl from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

As acid deposition impacts are below the EA significance threshold at the LNR and all local LWSs, it can confidently be concluded that that annual emissions of NO_x, SO_2, NH_3, HF and HCl from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

Table 34: Predicted process contributions (PC) assessed against the Acid Critical Load (CL_{MaxN}) – Scenarios A to D

Site			Scenario A		Scenario B		Scenario C		Scenario D	
	Woodland or Non-woodland	CL_{MaxN} keq/ha/yr	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}
Lockington Marshes SSSI	NW	Covered by woodland feature assessment – see Subsection 7.2								
	W	1.764	0.032	1.8 %	0.040	2.2 %	0.043	2.4 %	0.114	6.5 %
Forbes Hole LNR	NW	0.53	0.009	1.7 %	0.010	2.0 %	0.010	2.0 %	0.022	4.2 %
	W	1.762	0.017	1.0 %	0.021	1.2 %	0.021	1.2 %	0.046	2.6 %
Attenborough West Gravel Pits	NW	0.511	0.014	2.8 %	0.018	0.2 %	0.019	0.2 %	0.041	0.4 %
Copse Kingston-on-Soar	W	11.001	0.015	0.1 %	0.012	2.2 %	0.012	2.2 %	0.015	2.8 %
Cranfleet Farm Floodbanks	NW	0.53	0.010	2.0 %	0.010	1.9 %	0.010	1.9 %	0.012	2.3 %
Cranfleet Ponds (West Pond)	NW	0.53	0.009	1.7 %	0.008	1.5 %	0.008	1.5 %	0.012	2.3 %
Erewash Canal	NW	0.53	0.007	1.4 %	0.076	0.7 %	0.082	0.7 %	0.254	2.3 %
Gotham Hill Woods	W	10.973	0.062	0.6 %	0.039	0.4 %	0.041	0.4 %	0.187	1.7 %
Gotham Wood	W	11	0.029	0.3 %	0.015	0.1 %	0.015	0.1 %	0.024	0.2 %
Lockington Ash	W	11.013	0.013	0.1 %	0.015	0.1 %	0.015	0.1 %	0.024	0.2 %
Lockington Ash 2	W	11.013	0.013	0.1 %	0.009	1.6 %	0.009	1.6 %	0.014	2.6 %
Lockington Confluence Backwater	NW	0.531	0.008	1.5 %	0.008	1.6 %	0.009	1.6 %	0.013	2.4 %
Lockington Confluence Hedges	NW	0.531	0.008	1.5 %	0.018	3.3 %	0.019	3.5 %	0.057	10.6 %
Lockington Fen	NW	0.533	0.014	2.7 %	0.007	1.2 %	0.007	1.2 %	0.014	2.6 %
Lockington Grounds, pond and marsh near Trent	NW	0.532	0.006	1.1 %	0.009	1.6 %	0.009	1.6 %	0.012	2.2 %
Lockington Trentside Pools	NW	0.53	0.008	1.5 %	0.007	1.4 %	0.007	1.4 %	0.013	2.4 %
Lockington swamp by SSSI	NW	0.532	0.007	1.2 %	0.024	4.5 %	0.026	4.9 %	0.044	8.3 %
Lower Soar Floodplain Wetland	NW	0.533	0.020	3.7 %	0.011	2.1 %	0.011	2.1 %	0.023	4.4 %
Meadow Lane Carr	NW	0.53	0.009	1.8 %	0.022	1.2 %	0.022	1.2 %	0.047	2.7 %
	W	1.762	0.018	1.0 %	0.008	1.5 %	0.008	1.5 %	0.011	2.1 %
Narrow Bridge Fish Pond	NW	0.53	0.007	1.4 %	0.020	3.8 %	0.021	4.0 %	0.033	6.1 %
Pond in hedgeline between two improved grasslands	NW	0.533	0.017	3.2 %	0.009	1.6 %	0.009	1.6 %	0.014	2.6 %
Poplars Fish Pond	NW	0.53	0.008	1.5 %	0.040	2.2 %	0.043	2.4 %	0.114	6.5 %

Table 34 (cont): Predicted process contributions (PC) assessed against the Acid Critical Load (CL_{MaxN}) – Scenarios A to D

Site			Scenario A		Scenario B		Scenario C		Scenario D	
	Woodland or Non-woodland	CL_{MaxN} keq/ha/yr	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}	PC keq/ha/yr	PC/ CL_{MaxN}
Rare Plant Register Mousetail Pasture	NW	0.533	0.020	3.8 %	0.025	4.7 %	0.027	5.2 %	0.042	7.8 %
Ratcliffe Lane Pasture and Stream	NW	0.533	0.019	3.6 %	0.024	4.4 %	0.026	4.8 %	0.058	10.8 %
Ratcliffe-on-Soar Flyash Grassland	NW	4.928	0.008	0.2 %	0.010	0.2 %	0.010	0.2 %	0.019	0.4 %
Ratcliffe-on-Soar Flyash Track Grassland	NW	5.071	0.008	0.2 %	0.009	0.2 %	0.009	0.2 %	0.013	0.3 %
Ratcliffe-on-Soar Pond	NW	0.521	0.005	0.9 %	0.005	0.9 %	0.005	1.0 %	0.006	1.2 %
Red Hill Ratcliffe on Soar	NW	4.928	0.008	0.2 %	0.009	0.2 %	0.009	0.2 %	0.012	0.2 %
Redhill Marina Backwater	NW	0.533	0.009	1.8 %	0.010	1.9 %	0.010	1.9 %	0.012	2.3 %
River Soar Loughborough Meadows to Trent	NW	0.533	0.021	3.9 %	0.025	4.7 %	0.021	4.0 %	0.047	8.8 %
River Soar West Bank south of A453	NW	0.535	0.014	2.7 %	0.017	3.2 %	0.017	3.2 %	0.026	4.8 %
River Trent North Bank	NW	0.51	0.033	6.4 %	0.037	7.2 %	0.046	9.0 %	0.058	11.4 %
Shooting Ground Marsh Grassland, Lockington	NW	0.533	0.016	3.1 %	0.020	3.7 %	0.027	5.2 %	0.048	9.0 %
Sheetstores Junction Pond	NW	0.53	0.007	1.4 %	0.008	1.5 %	0.008	1.5 %	0.012	2.2 %
Soar Meadow near Ratcliffe Lock	NW	0.533	0.019	3.6 %	0.024	4.4 %	0.025	4.8 %	0.041	7.7 %
South Junction Pond	NW	0.53	0.008	1.4 %	0.008	1.6 %	0.008	1.6 %	0.014	2.7 %
Thrumpton Bank	NW	0.51	0.031	6.0 %	0.035	6.8 %	0.042	8.2 %	0.058	11.4 %
Thrumpton Park	NW	0.51	0.031	6.1 %	0.035	6.9 %	0.041	8.0 %	0.053	10.4 %
	W	1.726	0.061	3.6 %	0.069	4.0 %	0.081	4.7 %	0.106	6.1 %
Trent Floodplain Wetland - Lock M07	NW	0.531	0.008	1.5 %	0.009	1.6 %	0.009	1.6 %	0.011	2.1 %
Trent Floodplain Wetland Lock M13	NW	0.532	0.006	1.1 %	0.007	1.2 %	0.007	1.2 %	0.013	2.5 %
Trent Lock Marsh	NW	0.531	0.007	1.3 %	0.008	1.4 %	0.008	1.4 %	0.012	2.3 %
	W	1.763	0.013	0.8 %	0.015	0.9 %	0.015	0.9 %	0.025	1.4 %
River Trent (Erewash)	NW	0.531	0.008	1.5 %	0.009	1.7 %	0.009	1.7 %	0.014	2.7 %

Table 35: Predicted process contributions (PC) and predicted environmental concentrations (PEC) at Lockington Marshes SSSI assessed against the acid critical load – Scenarios A to D

	CL_{NutN} keqN/ha/yr	PC keq/ha/yr	PC/ CL_{NutN} %	Background keq/ha/yr	PEC keq/ha/yr	PEC/ CL_{MaxN} %
Scenario A	1.764	0.032	1.8 %	2.18	2.21	125 %
Scenario B	1.764	0.040	2.2 %	2.18	2.22	126 %
Scenario C	1.764	0.043	2.4 %	2.18	2.22	126 %
Scenario D	1.764	0.114	6.5 %	2.18	2.29	130 %

8 CONCLUSIONS

Uniper is proposing building an energy recovery facility on the Ratcliffe-on-Soar power station site. An air dispersion modelling study has been undertaken to evaluate the significance of any air quality effects that may arise from the Installation. Where it was necessary to make assumptions and approximations, a worst-case approach has been adopted to ensure that the modelled concentrations are likely to be overestimates rather than underestimates.

8.1 Impacts on Human Health

The Installation will release emissions to air of nitrogen oxides, sulphur dioxide, carbon monoxide, particulates, hydrogen chloride, hydrogen fluoride, ammonia, heavy metals, PAHs and PCBs. This assessment has modelled all these pollutants and compared the predicted ground level concentrations at the maximum impact point with the relevant air quality assessment levels. This study concludes that no human health based ambient air quality standards or guidelines are predicted to be exceeded due to emissions from the Installation and hence there will be no significant adverse effects on human health. This assessment also concludes that cumulative impacts from the Installation, the OCGTs and the coal-fired power station will not have a significant adverse effect on human health.

8.2 Impacts on Local Ecological Sites

The process contributions under all scenarios for all species were below the EA significance criteria in relation to the corresponding critical levels and acid and nitrogen critical loads at the Forbes Hole LNR and all local LWSs. It can therefore confidently be concluded that emissions from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at these sites under all of the scenarios considered.

The maximum scenario process contributions to ground level concentrations of NH_3 at the Lockington Marshes SSSI were 1.5 % or less of the annual ammonia critical level and less than 1 % of current ammonia background concentrations under the four scenarios considered.

The maximum contributions to ground level concentrations of SO_2 at the Lockington Marshes SSSI were 0.4 % to 2.4 % of the annual SO_2 critical level and were less than the critical level in combination with background concentrations.

The maximum scenario process contributions to ground level concentrations of NO_x at the Lockington Marshes SSSI were 0.5 % to 1.5 % of the annual NO_x critical level and were less than the critical level in combination with background concentrations.

The maximum scenario process contributions to ground level concentrations of NO_x at the Lockington Marshes SSSI were 4.6 % to 27.9 % of the maximum daily mean NO_x critical level and were less than the critical level in combination with background concentrations.

The maximum scenario process contributions to ground level concentrations of HF at the Lockington Marshes SSSI were below significance in relation to the maximum daily mean critical level.

The maximum scenario process contributions to ground level concentrations of HF at the Lockington Marshes SSSI were 2.5 % to 19.5 % of the maximum weekly mean HF critical level and were less than the critical level in combination with background concentrations.

The maximum scenario process contributions to nitrogen deposition at the Lockington Marshes SSSI were 1.5 % to 2.7 % of the most stringent applicable critical load.

The maximum process contributions to acid deposition at the Lockington Marshes SSSI were 1.8 % to 2.4 % of the most stringent applicable critical load for Scenarios A to C and 6.5 % for Scenario D, although the latter scenario will occur for no more than 9 months.

The assessment has a number of conservative assumptions built in, notably:

- The Installation, OCGTs (which are restricted to 500 hours of operation per year) and the existing coal-fired power station are assumed to operate with a 100 % annual load factor;
- The assessment is based on the worst-case meteorological year;
- The assessment is based on the highest impact point over the entire site; and
- The lowest end of the critical load range has been used for nitrogen and acid deposition.

Given the precautionary approach adopted, the low levels of impact relative to the applicable critical levels and critical loads, and taking into account the level of background concentrations at the Lockington Marshes SSSI and the associated sources, it can reasonably be concluded that emissions from the Installation would not be at levels which could lead to significant adverse effects on the ecological features at the Lockington Marshes SSSI under all of the scenarios considered.

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FIGURES

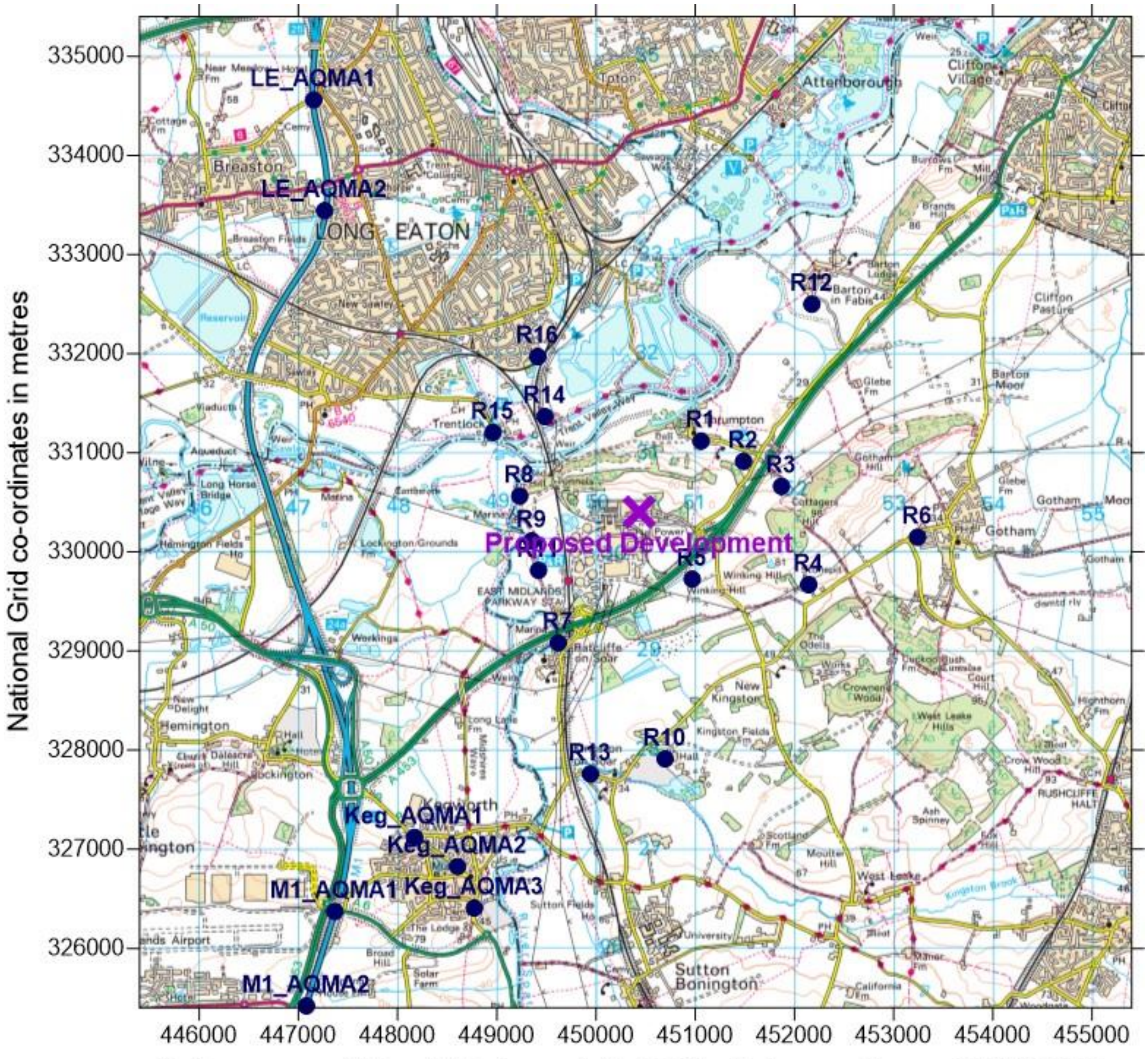

Figure 1: Installation and human receptor locations

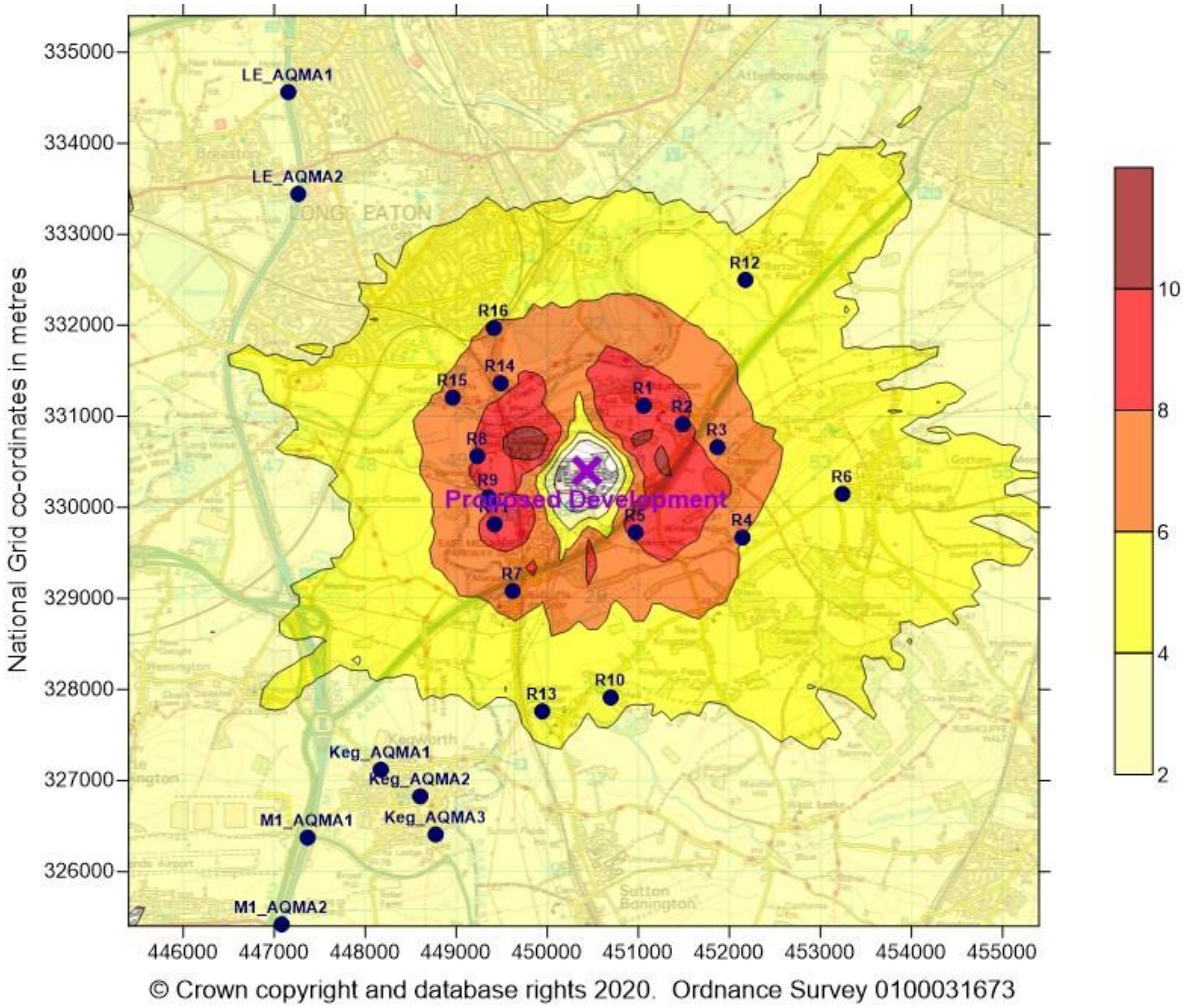

Figure 2: Predicted 99.79th percentile of hourly mean NO_2 concentrations resulting from the Installation operating continuously (Scenario A) for 2019 meteorology

Contours plotted: 2 µg/m^3 to 10 µg/m^3 in steps of 2 µg/m^3

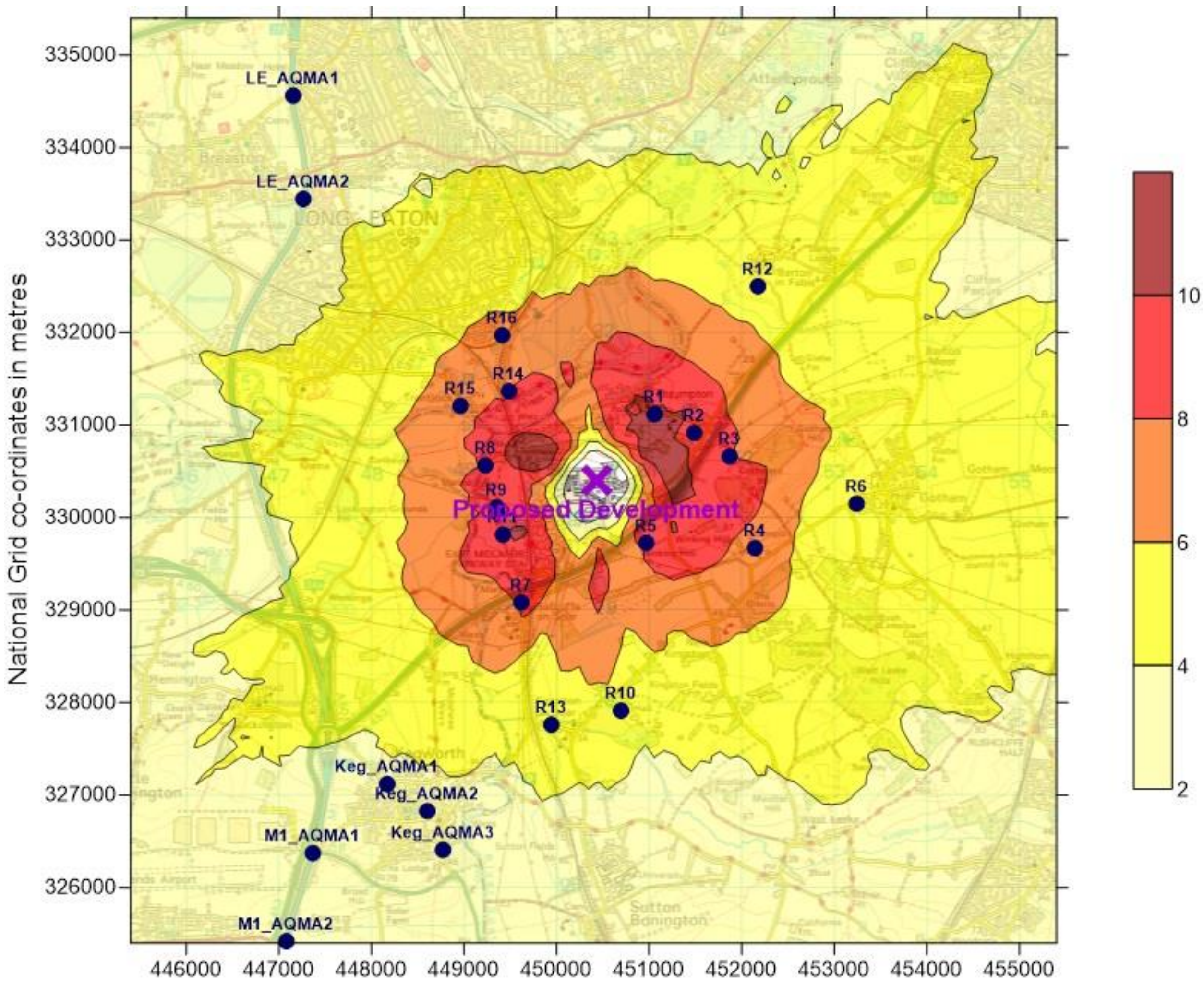

Figure 3: Predicted 99.79th percentile of hourly mean NO_2 concentrations resulting from the Installation and the OCGTs operating continuously (Scenario B) for 2019 meteorology

Contours plotted: 2 µg/m³ to 10 µg/m³ in steps of 2 µg/m³

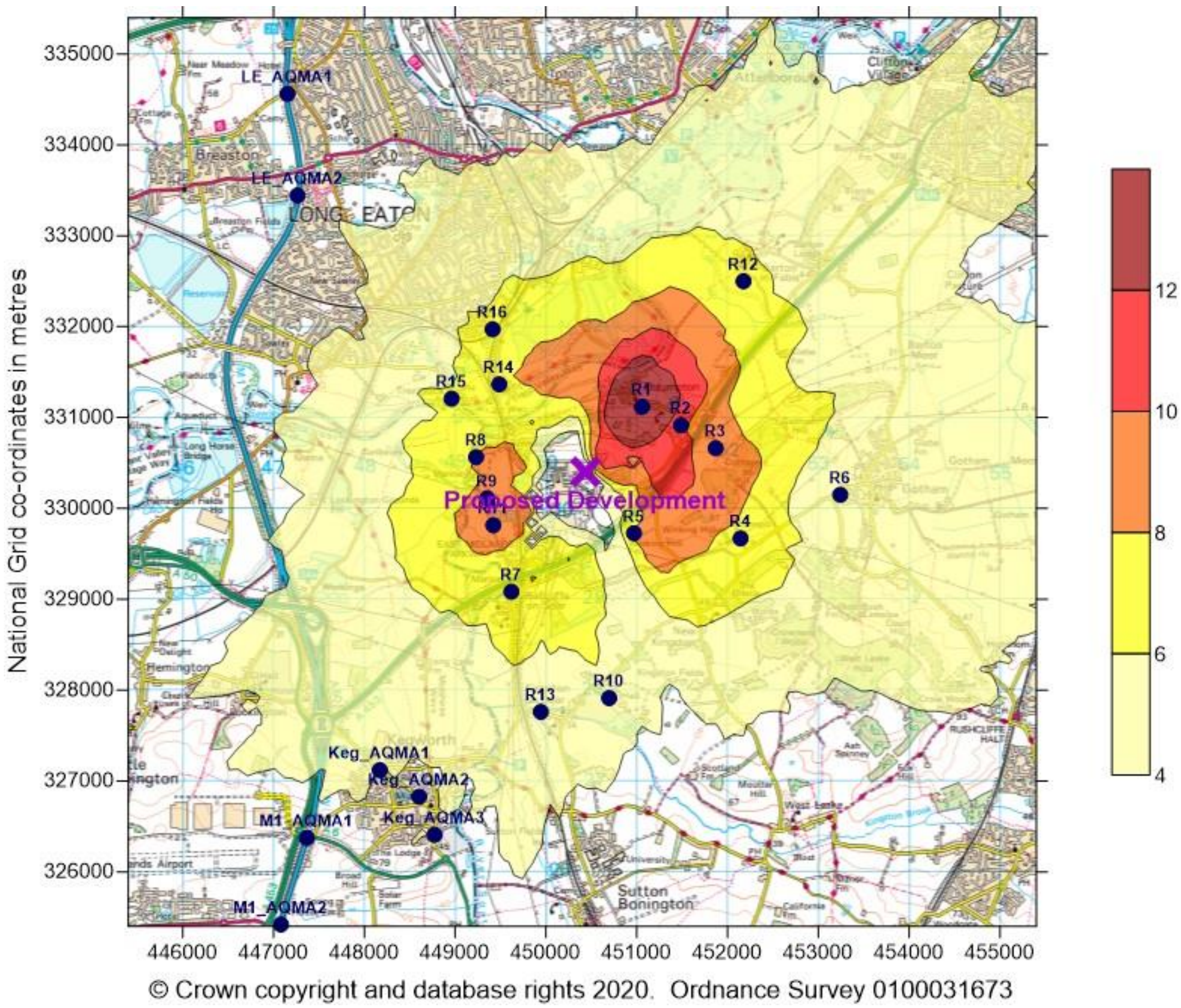

Figure 4: Predicted 99.79th percentile of hourly mean NO_2 concentrations (µg/m^3) resulting from the Installation and the OCGTs operating continuously including the buildings on the Ratcliffe site above 30 m in height (Scenario C) for 2015 meteorology

Contours plotted: 4 µg/m^3 to 12 µg/m^3 in steps of 2 µg/m^3

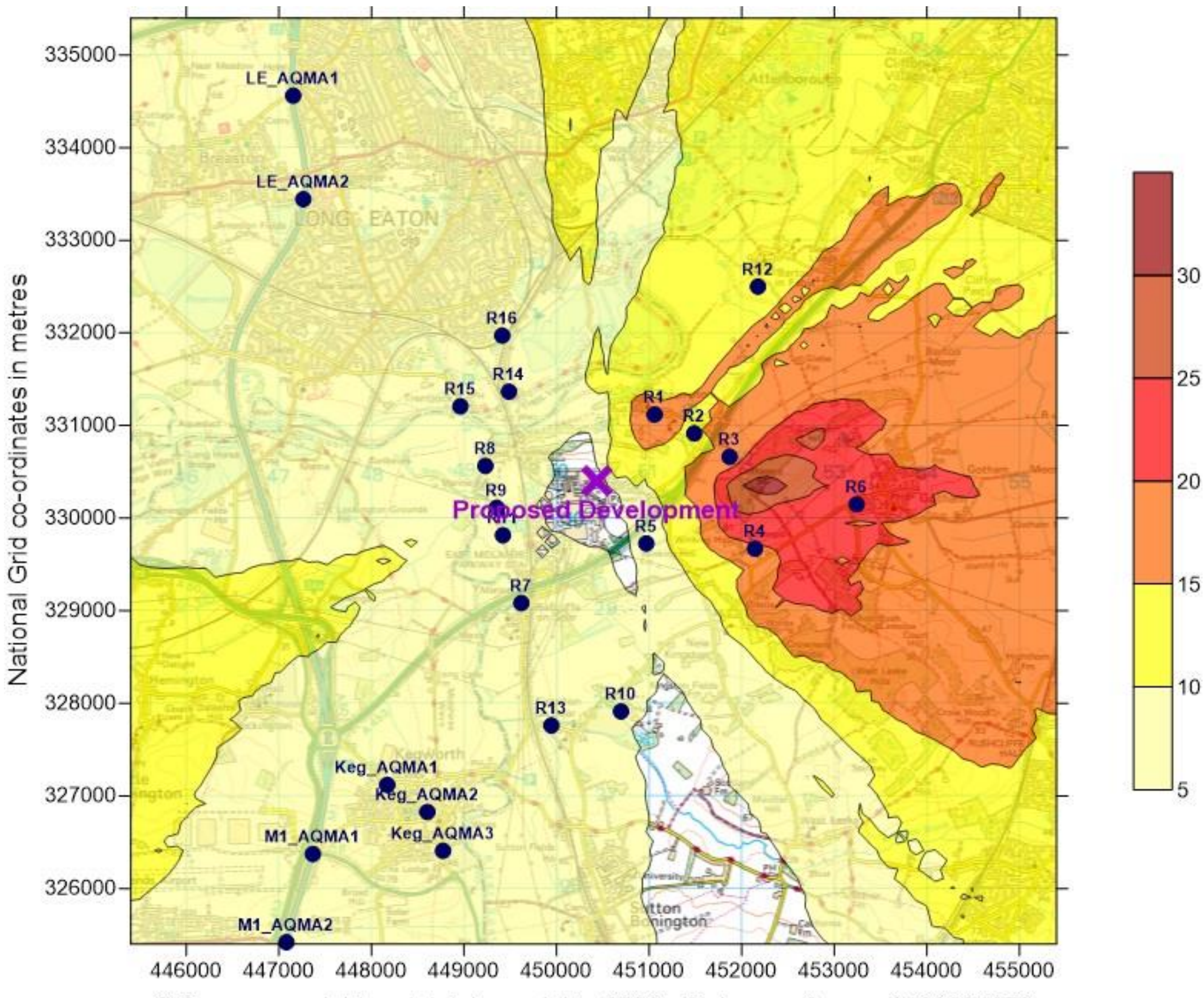

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Figure 5: Predicted 99.79th percentile of hourly mean NO_2 concentrations (µg/m^3) resulting from the Installation, the OCGTs and the coal-fired power station operating continuously including the buildings on the Ratcliffe site above 30 m in height (Scenario D) for 2015 meteorology

Contours plotted: 5 µg/m^3 to 30 µg/m^3 in steps of 5 µg/m^3

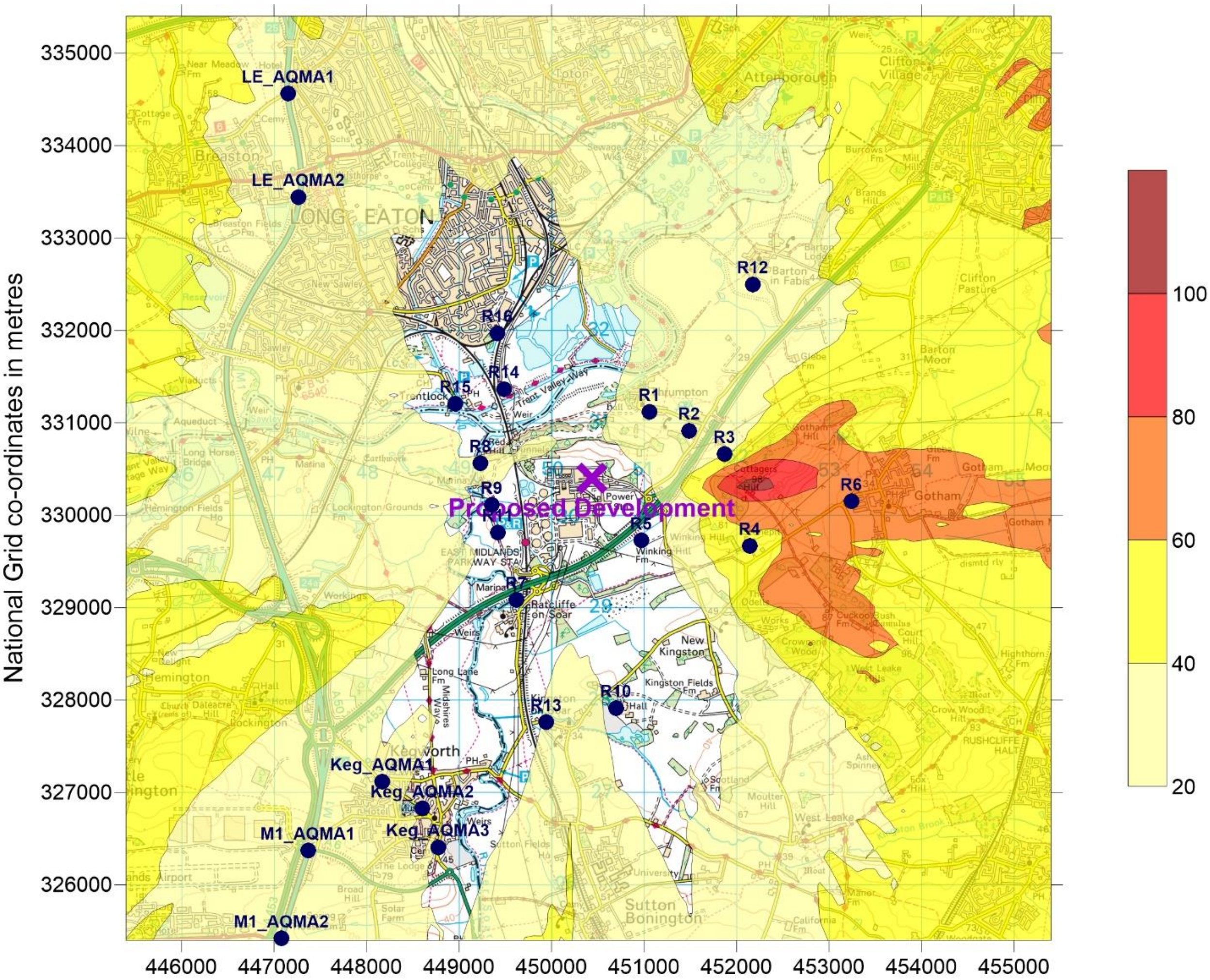

Figure 6: Predicted 99.9th percentile of 15-minute mean SO_2 concentrations (µg/m^3) resulting from the Installation, the OCGTs and the coal-fired power station operating continuously including the buildings on the Ratcliffe site above 30 m in height (Scenario D) for 2019 meteorology

Contours plotted: 20 µg/m^3 to 100 µg/m^3 in steps of 20 µg/m^3

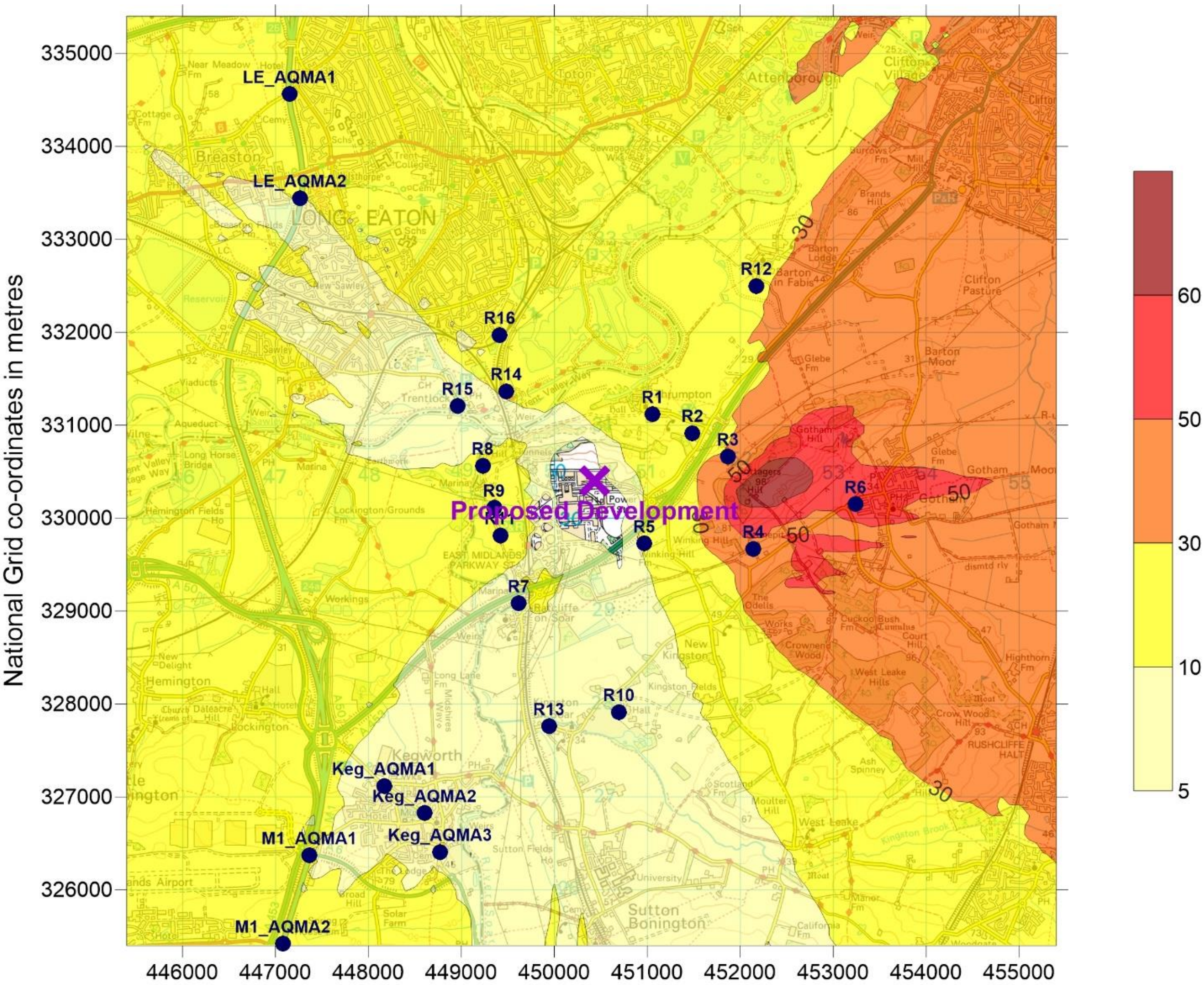

Figure 7: Predicted 99.73rd percentile of hourly mean SO_2 concentrations (µg/m^3) resulting from the Installation, the OCGTs and the coal-fired power station operating continuously including the buildings on the Ratcliffe site above 30 m in height (Scenario D) for 2015 meteorology

Contours plotted: 5 µg/m^3, 10 µg/m^3 to 50 µg/m^3 in steps of 20 µg/m^3, 60 µg/m^3

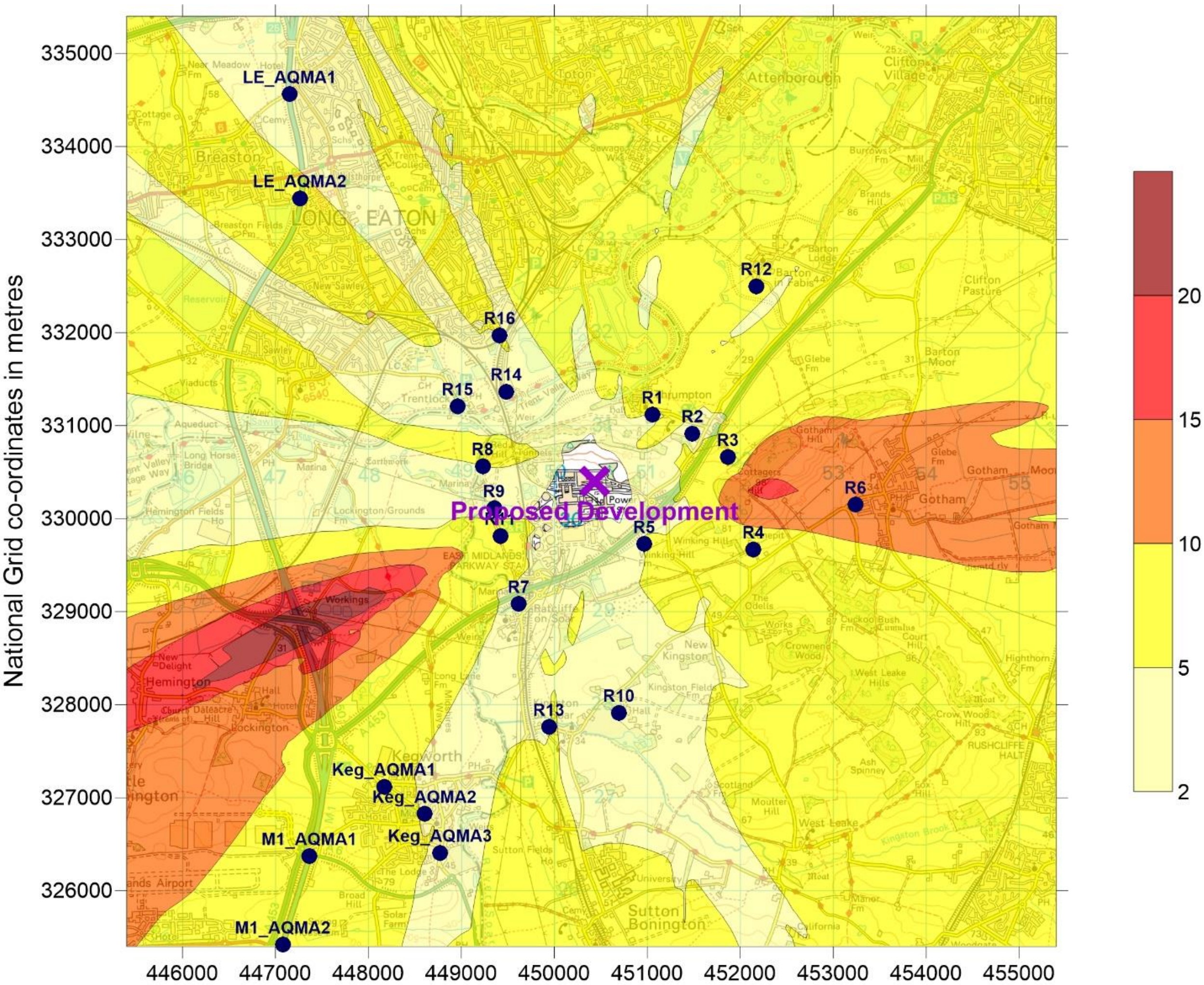

Figure 8: Predicted 99.18th percentile of daily mean SO_2 concentrations (µg/m^3) resulting from the Installation, the OCGTs and the coal-fired power station operating continuously including the buildings on the Ratcliffe site above 30 m in height (Scenario D) for 2018 meteorology

Contours plotted: 2 µg/m^3, 5 µg/m^3 to 20 µg/m^3 in steps of 5 µg/m^3

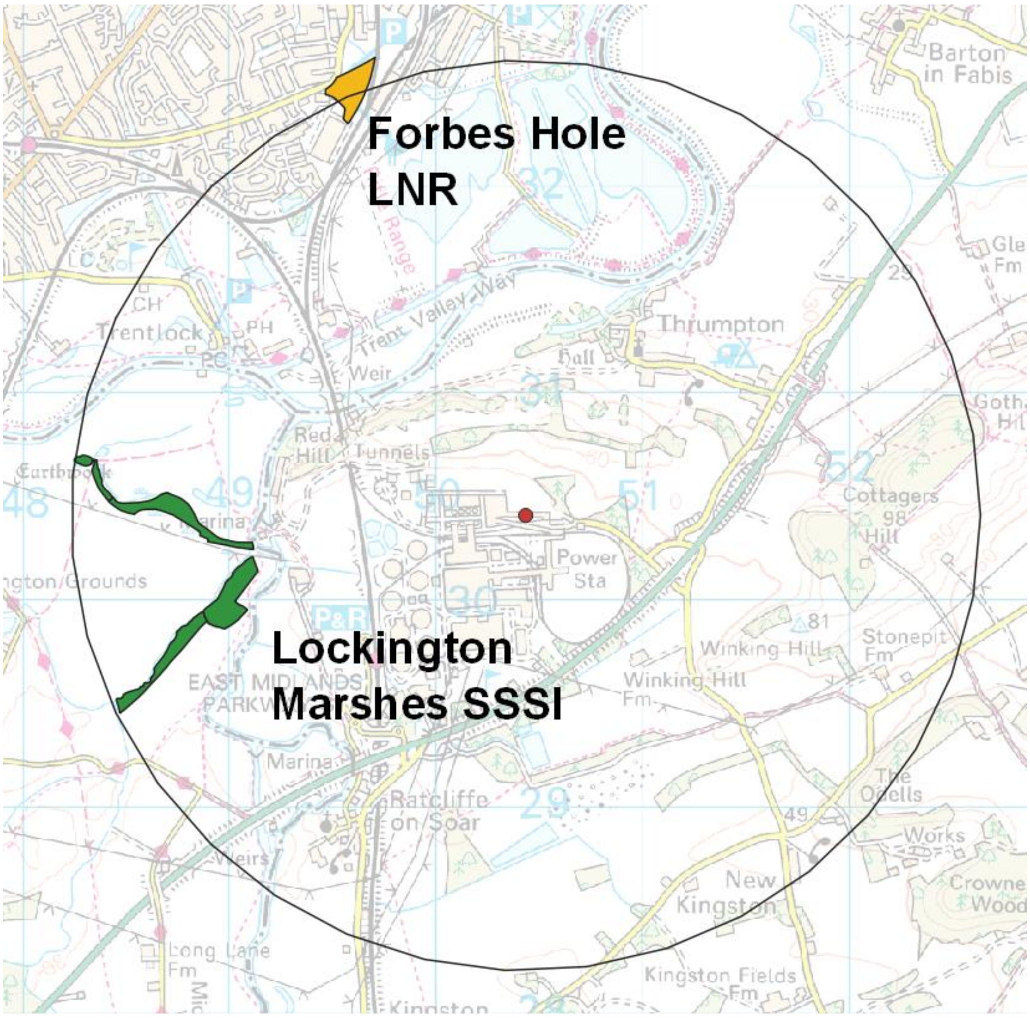

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Figure 9: Map showing Sites of Special Scientific interest (SSSI) and Local Nature Reserves (LNRs) within 2 km of the Installation.
Note that the screened area is based on a 2.2 km radius to account for the site boundary

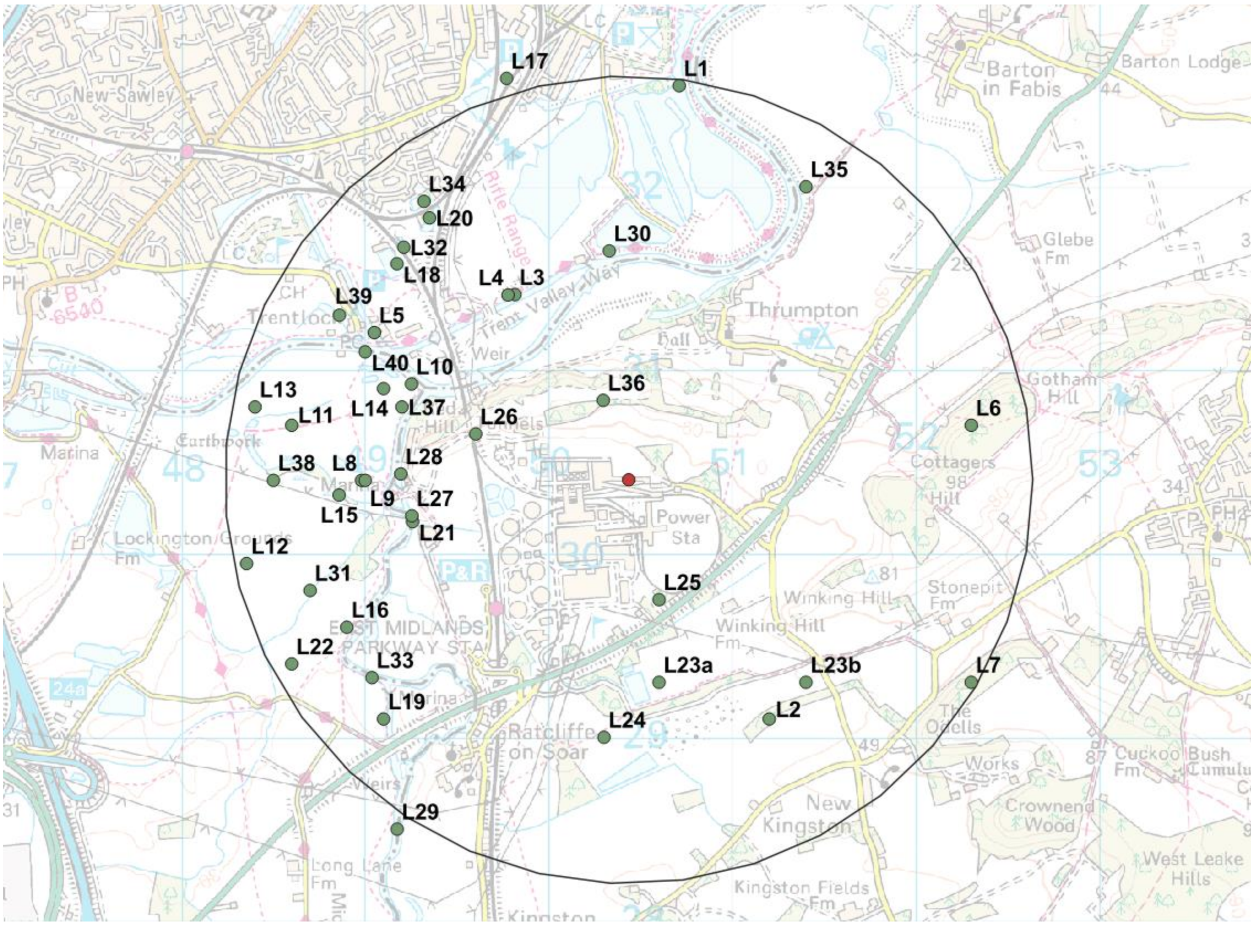


Figure 10: Map showing Local Wildlife Sites within 2 km of the Installation. Note that the screened area is based on a 2.2 km radius to account for the site boundary

L1	Attenborough West Gravel Pits	L22	Ratcliffe Lane Pasture and Stream
L2	Copse Kingston-on-Soar	L23a	Ratcliffe-on-Soar Flyash Grassland1
L3	Cranfleet Farm Floodbanks	L23b	Ratcliffe-on-Soar Flyash Grassland2
L4	Cranfleet Ponds (West Pond)	L24	Ratcliffe-on-Soar Flyash Track Grassland
L5	Erewash Canal	L25	Ratcliffe-on-Soar Pond
L6	Gotham Hill Woods	L26	Red Hill Ratcliffe on Soar
L7	Gotham Wood	L27	Redhill Marina Backwater
L8	Lockington Ash	L28	River Soar Loughborough Meadows to Trent
L9	Lockington Ash 2	L29	River Soar West Bank south of A453
L10	Lockington Confluence Backwater	L30	River Trent North Bank
L11	Lockington Confluence Hedges	L31	Shooting Ground Marsh Grassland, Lockington
L12	Lockington Fen	L32	Sheetstores Junction Pond
L13	Lockington Grounds, pond and marsh near Trent	L33	Soar Meadow near Ratcliffe Lock
L14	Lockington Trentside Pools	L34	South Junction Pond
L15	Lockington swamp by SSSI	L35	Thrumpton Bank
L16	Lower Soar Floodplain Wetland	L36	Thrumpton Park
L17	Meadow Lane Carr	L37	Trent Floodplain Wetland - Lock M07
L18	Narrow Bridge Fish Pond	L38	Trent Floodplain Wetland Lock M13
L19	Pond in hedgeline between two improved grasslands	L39	Trent Lock Marsh
L20	Poplars Fish Pond	L40	River Trent
L21	Rare Plant Register Mousetail Pasture		

APPENDIX A:

STACK HEIGHT EVALUATION

An evaluation of the stack height for the Installation has been undertaken using ADMS v5.2. The selection of an appropriate stack release height requires a number of factors to be taken into account, the most important of which is the need to balance a release height sufficient to achieve adequate dispersion of pollutants against other constraints such as visual impact.

Stack heights between 60 m and 150 m in increments of 10 m have been investigated. A graph showing the highest process contribution (PC) to annual mean and maximum 1-hour mean pollutant concentrations for a modelled unit emission rate (1 g/s) is presented in Figure A1. The purpose of the graph is to evaluate the optimum release height in terms of the dispersion of pollutants which would occur, against the visual constraints of further increases in release height.

Analysis of the annual mean curve shows that the benefit of incremental increases in release height up to 90 m is relatively pronounced. At heights above 100 m, the air quality benefit of increasing release height further is reduced. From 110 m height onwards the decrease in annual mean concentrations from the 10 m stack height increase is minimal.

The relative benefit of increasing the release height on maximum 1-hour mean concentrations follows a similar pattern to the annual mean curve with a flattening of the curve seen at heights greater than 100 m, above which a reduced improvement in ground level concentrations is predicted with increasing release height.

The graph shows that the use of a stack of height 110 m above ground level would be capable of mitigating both the short-term and long-term impacts of the modelled emissions of emitted pollutants. Therefore, a stack height of 110 m is considered to be appropriate when balancing the visual impacts versus air quality benefits.

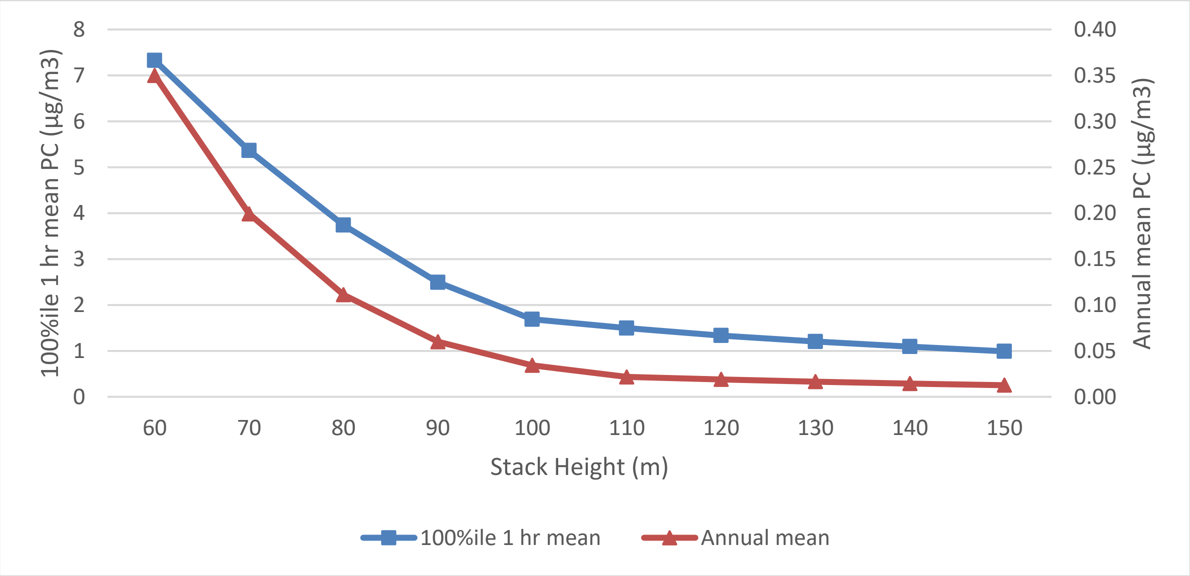
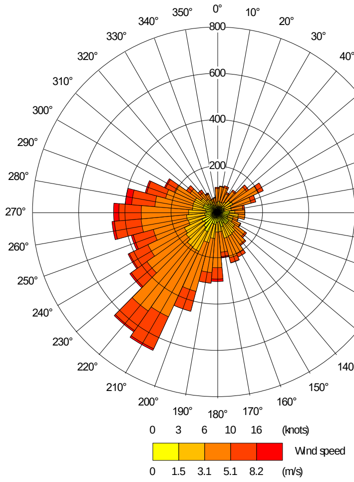


Figure A1: Predicted process contribution to annual mean ground level pollutant concentrations at stack release heights between 60 m and 150 m based on 1 g/s release rate.

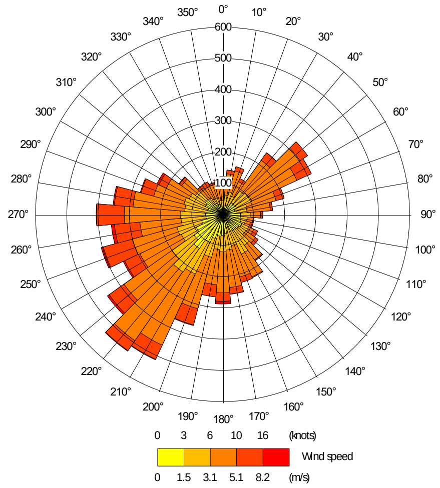
APPENDIX B:

WIND ROSES FOR SUTTON BONINGTON 2015–2019

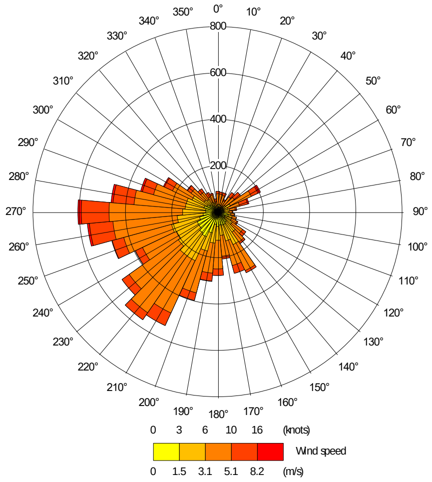
2015



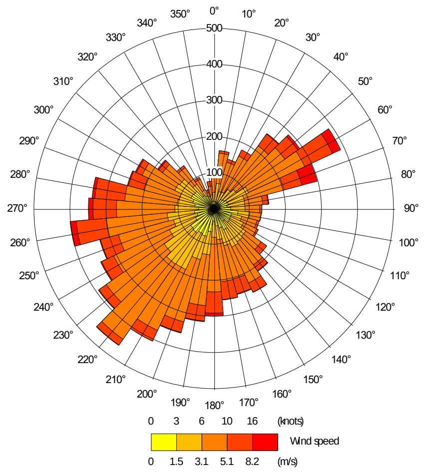
2016



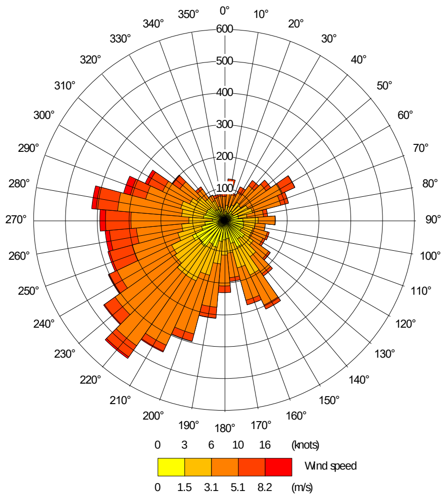
2017



2018



2019



APPENDIX C:

EXISTING (BASELINE) AIR QUALITY

Measurements of air quality in the vicinity of the Installation have been collated. Based on the measurements, estimates of annual mean concentrations of all pollutants assessed have been derived. The background concentrations are added to modelled plant contributions to determine that overall concentrations are compliant with air quality standards.

C1 Nitrogen Dioxide

The proposed location of the Installation is located within the Rushcliffe local authority with Broxtowe, Erewash, North West Leicestershire and Nottingham County Council all being in close proximity. Annual air quality reports for all five local authorities have been reviewed to identify any monitoring sites located within 5 km of the proposed location of the energy facility. Table C1 presents the automatic and diffusion tube monitoring sites identified together with the annual mean concentrations measured since 2013. It should be noted that the diffusion tube concentrations are all reported by local authorities after bias correction has been applied. As there were 20 diffusion tubes within 5 km of the Installation, only the closest five diffusion tube sites have been selected.

Table C1 shows that the annual mean AQS objective for NO_2 is met at all monitoring locations even when the diffusion tubes are next to the road. The Ruddington and Weston-on-Trent monitoring sites are specifically set up to capture high concentrations from the current coal-fired power station. These show lower concentrations than the roadside monitoring sites. These are likely to be more representative of the air quality at the maximum impact point from the Installation than the roadside diffusion tube monitoring site concentrations.

In order to assist local authorities with their responsibilities under Local Air Quality Management (LAQM), the Department for Environment Food and Rural Affairs (DEFRA) provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations of ammonia have been downloaded for the grid squares containing the Installation and immediate surroundings. Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration within the modelling domain has been calculated from the 2017 mapped background concentrations. The maximum annual mean nitrogen dioxide concentration from the 2017 mapped background data within the modelling domain is 24.6 $\mu g/m^3$. This is above the annual mean concentrations measured at the two power station monitoring sites and similar to the annual mean concentrations measured at some of the roadside monitoring locations. The maximum annual mean nitrogen dioxide concentration from the 2017 LAQM mapped data within the modelling domain has been used as a conservative estimate of baseline concentrations for the assessment.

Table C1: Annual mean nitrogen dioxide concentrations measured at local monitoring sites

Local Authority	Site Identifier	Distance from Installation (km)	Automatic (A) or Diffusion Tube (D)	Type	Annual mean NO_2 (DT results bias corrected) (µg/m^3)						
					2013	2014	2015	2016	2017	2018	2019
Broxtowe	8 – The Manor Pub, Toton	3.8	D	Roadside	-	-	-	31	29	-	-
Broxtowe	7 – 31, Hickton Drive, Chilwell	3.9	D	Roadside	27	26	26	27	26	-	-
NW Leicestershire	20N Derby Road Kegworth	4.0	D	Roadside	31	27	29	30	25	-	-
NW Leicestershire	47N 12 Derby Road Kegworth	4.0	D	Roadside	39	31	36	34	30	-	-
NW Leicestershire	51N 40mph sign N of petrol station	4.0	D	Roadside	36	31	31	33	26	-	-
Erewash	EBC 23 – Langdale Drive	4.1	A	Suburban	-	-	-	-	-	19.9	-
-	Ruddington	6.2	A	PS Specific	-	-	11.7	12.6	11.9	11.3	11.4
-	Weston-on-Trent	10.0	A	PS Specific	-	-	12.7	12.9	117	12.9	115
Nottingham City	Nottingham Centre	11.9	A	Urban Background	-	-	31.6	31.2	29.7	27.5	277
Nottingham City	Nottingham Western Boulevard	12.0	A	Roadside	-	-	-	39.0	36.4	34.1	33.1

C2 Sulphur Dioxide

Annual mean sulphur dioxide concentrations measured at the two power station specific monitoring sites at Ruddington and Weston-on-Trent. Annual mean concentrations are also measured at Nottingham Centre urban background monitoring site. Table C2 shows the annual mean sulphur dioxide concentrations recorded at the three monitoring sites from 2015 to 2019.

The LAQM modelled background concentrations from 2001 include sulphur dioxide annual mean concentrations. The highest LAQM modelled background concentration across the full modelling domain for the assessment is 20.5 µg/m^3. This is much higher than the annual mean concentrations measured at the three local monitoring sites over the past five years. This is due to sulphur dioxide concentrations having significantly reduced over the past 15 years. Therefore, the maximum measured concentration from the three local monitoring sites over the past five years has been taken as the baseline concentration of sulphur dioxide for this assessment.

Table C2: Annual mean sulphur dioxide concentrations measured at local monitoring sites

Monitoring location	Distance from Installation (km)	Year	Annual mean concentration (µg/m^3)
Ruddington	6.2	2015	1.5
		2016	1.3
		2017	1.3
		2018	1.6
		2019	1.2
Weston-on-Trent	10	2015	1.0
		2016	1.0
		2017	11
		2018	1.4
		2019	1.1
Nottingham Centre	11.9	2015	2.3
		2016	2.0
		2017	2.0
		2018	2.4
		2019	2.2

C3 Carbon Monoxide

Annual mean carbon monoxide concentrations are not routinely measured at most monitoring sites. The closest monitoring site to measure carbon monoxide concentrations is Leeds Centre which is over 100 km away from the Installations location. Therefore, the maximum annual mean carbon monoxide concentration within the assessments modelling domain from the LAQM mapped background concentrations in 2001 has been used as a conservative estimate of baseline concentrations of carbon monoxide. The maximum annual mean carbon monoxide concentration from the LAQM mapped background within the assessment modelling domain is 458 µg/m^3.

C4 Particulate matter

PM_{10} concentrations are recorded at two local monitoring sites, Nottingham Centre and Nottingham Western Boulevard. The annual mean PM_{10} concentrations from these two monitoring sites are shown in Table C3 from 2015 to 2019.

The LAQM mapped background data from 2017 shows a maximum PM_{10} concentration of 18.7 µg/m^3 across the assessment modelling domain. This is at a similar level to the annual mean concentrations measured at the two monitoring locations in Nottingham. The maximum LAQM mapped background data within the assessment modelling domain of 18.7 µg/m^3 has been used as the baseline concentrations for the assessment.

Table C3: Annual mean PM_{10} concentrations measured at local monitoring sites

Monitoring location	Distance from Installation (km)	Year	Annual mean concentration (µg/m^3)
Nottingham Centre	11.9	2015	17.3
		2016	17.4
		2017	17.9
		2018	16.3
		2019	18.1
Nottingham Western Boulevard	12.0	2015	-
		2016	19.8
		2017	17.8
		2018	18.0
		2019	19.8

$PM_{2.5}$ concentrations are recorded at the Nottingham Centre monitoring site. The annual mean $PM_{2.5}$ concentrations monitored between 2015 and 2019 are shown in Table C4.

The LAQM mapped background data from 2017 shows a maximum $PM_{2.5}$ concentration of 11.9 µg/m^3 across the assessment modelling domain. This is at a similar level to the annual mean concentrations measured at the Nottingham Centre monitoring site. The maximum LAQM mapped background data within the assessment modelling domain of 11.9 µg/m^3 has been used as the baseline concentration for the assessment.

Table C4: Annual mean $PM_{2.5}$ concentrations measured at local monitoring sites

Monitoring location	Distance from Installation (km)	Year	Annual mean concentration (µg/m^3)
Nottingham Centre	11.9	2015	11.5
		2016	11.9
		2017	11.6
		2018	10.0
		2019	10.8

C5 Hydrogen Chloride

Hydrogen Chloride is measured on behalf of DEFRA, as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. The closest monitoring site to the proposed location of the Installation is at Sutton Bonington which is 3.5 km from the proposed site. Hydrogen Chloride concentrations were measured until January 2016. The maximum hourly mean concentrations recorded at the site between 2011 and 2015 has been taken to be a conservative estimate of the annual mean hydrogen chloride concentration which is 0.42 µg/m^3.

C6 Hydrogen Fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally. The EPAQS report "Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects" (EPAQS, 2006) contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 µg/m^3 to 2.35 µg/m^3.

The maximum measured baseline hydrogen fluoride concentration, therefore, has been used as the baseline concentration as a conservative estimate.

C7 Ammonia

Ammonia is measured on behalf of DEFRA, as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. The closest monitoring site to the proposed location of the Installation is at Sutton Bonington which is 3.5 km from the proposed site. Ammonia concentrations were measured until January 2016. The maximum hourly mean concentration recorded at the site between 2015 and 2019 has been taken to be a conservative estimate of the annual mean ammonia concentration which is 5.3 µg/m^3 (gaseous ammonia).

C8 Volatile Organic Compounds

Benzene concentrations are measured as part of the Automatic and Non-automatic Hydrocarbon Network, Benzene is measured at the Nottingham Centre monitoring site which is approximately 11.9 km to the north-east of the proposed site.

Table C5 shows the annual mean concentrations of Benzene measured at Nottingham Centre for the last five years of available data (2014–2018).

Table C5: Annual mean Benzene concentrations measured at Nottingham Centre

Monitoring location	Year	Annual mean concentration (µg/m^3)
Nottingham Centre	2014	0.77
	2015	0.70
	2016	0.59
	2017	0.58
	2018	051

The LAQM mapped background concentrations from 2001 included both Benzene and 1,3-butadiene. The maximum LAQM mapped background concentrations within the assessment modelling domain are 0.81 µg/m^3 and 0.35 µ/m^3 for Benzene and 1,3-Butadiene respectively. These values have been used as baseline concentrations of volatile organic compounds within the assessment.

C9 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are measured as part of the PAH network. There are no monitoring locations near to the Installation. For the purpose of this assessment, benzo[a]pyrene is considered as this is the only PAH for which an AQAL has been set. The annual mean benzo[a]pyrene concentrations monitored at all the UK urban industrial monitoring sites are presented in Table C6.

The maximum monitored concentration over the last 5 years for all urban industrial sites has been used for the purpose of this assessment which is 3.6 ng/m^3. This is more than ten times the AQAL of 0.25 ng/m^3.

Table C6: Annual mean benzo[a]pyrene concentrations measured at all UK urban industrial monitoring sites

Monitoring location	Year	Annual mean concentration (ng/m^3)
Liverpool Speke	2014	0.15
	2015	0.13
	2016	0.18
	2017	0.07
	2018	0.10
Middlesbrough	2014	0.49
	2015	0.29
	2016	0.19
	2017	0.14
	2018	0.17
Port Talbot Margam	2014	0.60
	2015	0.79
	2016	0.93
	2017	0.64
	2018	0.70
Royston	2014	0.92
	2015	0.41
	2016	0.52
	2017	0.34
	2018	0.38
Scunthorpe Low Stanton	2014	3.60
	2015	3.50
	2016	1.10
	2017	0.83
	2018	0.78
Scunthorpe Town	2014	3.50
	2015	1.30
	2016	1.10
	2017	0.80
	2018	1.70
South Hiendley	2014	0.44
	2015	0.26
	2016	0.31
	2017	0.19
	2018	0.23

C10 Polychlorinated Biphenyl (PCBs)

Polychlorinated Biphenyl (PCBs) are monitored on a quarterly basis at several urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. There are no monitoring sites near to the Installation with measure PCBs. Table C7 shows the PCB concentrations from all monitoring sites across the UK. The maximum annual mean concentrations measured across the UK has been used as the baseline concentration for this assessment which is 128.93 pg/m^3.

Table C7: Annual mean concentrations of PCBs

Monitoring location	Year	Annual mean concentration (pg/m^3)
Hazelrigg	2014	25.84
	2015	41.68
	2016	52.58
	2017	33.16
	2018	22.22
High Muffles	2014	26.11
	2015	33.43
	2016	37.76
	2017	31.63
	2018	8.86
London Nobel House	2014	107.49
	2015	121.39
	2016	110.46
	2017	121.87
	2018	46.63
Manchester Law Courts	2014	128.93
	2015	97.99
	2016	92.60
	2017	97.27
	2018	40.10
Weymouth	2014	17.00
	2015	20.95
	2016	38.61
	2017	32.26
	2018	11.23

C11 Heavy Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks. The closest monitoring site to the Installation location which monitors heavy metals is over 40 km away. It is considered that the urban industrial monitoring sites are likely be a conservative estimate of the conditions close to the Installation (UK Urban Industrial Sites which recorded heavy metals are Pontardawe Tawe Terrace, Port Talbot Margam, Runcorn Weston Point, Scunthorpe Low Stanton, Scunthorpe Town and Walsall Bilston Road). A summary of data from all UK urban industrial monitoring sites is presented in Table C8.

On closer examination of the data from the six UK urban industrial monitoring sites, the maximum annual mean nickel concentrations measured at the Pontardawe Tawe Terrace monitoring site are more than ten times higher than at the other five monitoring sites. This is due to the Pontardawe Tawe Terrace monitoring site being close to a metals manufacturing site which emits high concentrations of nickel. As there are no metal manufacturing sites near to the Installation the Pontardawe Tawe Terrace monitoring site annual mean nickel concentrations have not been included in the baseline assessment. The maximum annual mean nickel concentration measured at the other five sites has been reported in Table C8 instead.

Mercury is only measured at the Runcorn Weston point urban industrial site which ceased monitoring mercury in August 2018. The maximum annual mean mercury concentration between 2014 and 2018 from Runcorn Weston Point monitoring site has been used in the assessment.

Antimony is not measured at any of the urban industrial sites and, therefore, maximum annual mean concentrations from Beacon Hill monitoring site between 2010 and 2013 have been used as the nearest monitoring site and the most recent monitoring data.

The maximum annual mean concentration shown in Table C8 for each metal has been used as the baseline concentration for the assessment.

The ratio of total Cr to Cr (VI) in ambient air varies depending on local emission sources. A review by the UK's Expert Panel on Air Quality Standards (EPAQS) indicates that Cr(VI) constitutes between 3 % and 33 % of airborne Chromium (EPAQS, 2009), while the US Department of Health suggests the ratio is between 10 % and 20 % (US Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry, 2008). For this assessment, it is considered that a 20 % Cr (VI) to total Cr ratio is a conservative assumption, given the lack of known local sources of this substance.

Table C8: Maximum annual mean concentrations of heavy metals measured ay any UK urban industrial monitoring site

Substance	**Annual mean concentrations (ng/m^3)**				
	2014	**2015**	**2016**	**2017**	**2018**
Cadmium	2.50	2.20	0.89	1.40	1.20
Mercury	15.0	19.0	15.0	19.0	16.0
Antimony	-	1.20[1]	1.50[2]	0.95[3]	0.88[4]
Arsenic	1.20	0.95	1.00	1.10	0.82
Chromium	11.0	5.6	12.0	5.5	15.0
Chromium (VI)	2.2	1.1	2.4	1.1	3.0
Copper	80	56	23	22	18
Lead	57	63	22	20	19
Manganese	77	93	93	110	93
Nickel	2.3	4.1	2.4	1.5	18
Vanadium	7.1	9.5	9.2	12.0	9.8

[1] 2010 data; [2] 2011 data; [3] 2012 data; [4] 2013 data

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