Air Quality Consultants

Air Quality Assessment: Swadlincote Energy Recovery Facility, South Derbyshire

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Experts in air quality
management & assessment

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Contents

1 Introduction

1.1 This report describes the air quality and odour assessments undertaken for the Swadlincote Energy Recovery Facility (SERF) (Energy from Waste (EfW) installation) in Swadlincote, South Derbyshire.

1.2 The Site consists of an Energy Recovery Facility (ERF) for the incineration of non-hazardous residual (post-recycled) waste. The Site also includes one diesel generator to provide power during start-up and shut-down and to provide back-up power in emergencies.

1.3 This assessment has been undertaken to the support the application for an Environmental Permit to operate a Part A(1) installation under the Environmental Permitting (England and Wales) Regulations 2016, as amended ('EPR'). The activities that will be undertaken at the Site fall under Section 5.1 (Incineration and co-incineration of waste).

1.4 An air quality assessment has been carried out to determine the local air quality impacts associated with emissions from the main stack at the ERF and the diesel generator. The pollutants considered are:

- nitrogen dioxide (NO_2)
- total dust (PM_{10} and $PM_{2.5}$);
- carbon monoxide (CO);
- volatile organic compounds (VOCs)
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- ammonia (NH_3);
- dioxins and furans (PCDD/F);
- polyaromatic hydrocarbons (PAH) as benzo[a]pyrene (B[a]P);
- polychlorinated biphenyls (PCBs); and
- the following 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).

1.5 An odour assessment has also been undertaken to consider the impact on the amenity at nearby sensitive receptors due odour emissions from the Site.

1.6 The approach and findings of the assessment are described within this report, while the model input files have been packaged as a zip file and sent alongside this report.

1.7 Table 1 gives the site location, whilst Table 2 summarises the modelled scenarios and sensitivity tests that have been carried out.

Table 1: Site Location

Parameter	Entry
Site Name	Swadlincote Energy Recovery Facility
Site Address	Land adjacent to Willshee's Waste and Recycling Limited, Keith Willshee Way, Swadlincote, DE11 9EN
Grid Reference (Centre of Site) (O.S. X,Y)	427000, 319045

Table 2: Summary of Model Scenarios and Sensitivity Tests

Parameter	Entry
Year for Baseline Conditions	Most recent year of available measurements/predictions – no improvement assumed into the future (see Section 5).
Operating Hours	The dispersion model for the main stack has been run assuming continuous operation. The generator model has also been run assuming continuous operation but the annual mean results have been adjusted in post-processing to consider a maximum of 168 hours of operation per year.
Meteorological Conditions	Five years of meteorological data used. Each modelled separately. Receptor-specific maxima out of the five years are reported (see Section 6).
Building Wake Effects	Model run with and without nearby buildings.
Surface Roughness	Sensitivity test to determine the effect of variable surface roughness

Parameter	Entry
	and fixed surface roughness value on the core scenario.
Terrain Effects	Sensitivity test to determine the effect of terrain, based on the ‘with building’ scenario run with terrain, and without terrain.

2 Site Description

Nearby Sensitive Features

2.1 The facility is located on the eastern edge of Swadlincote, within the local authority area of South Derbyshire, adjacent to the river Wyre. Within 2 km of the Site, there is the Hall Wood Ancient Woodland (AW) and Badgers Hollow/Coton Park Local Nature Reserve (LNR) and a number of Local Wildlife Sites (LWS). Within 10 km of the Site, there is the River Mease, a European designated Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), and the Carver's Rocks, Ticknall Quarries and Calke Park SSSIs. Figure 1 and Figure 2 show the location of these ecological sites within 2 km and 10 km, respectively, of the site's location.

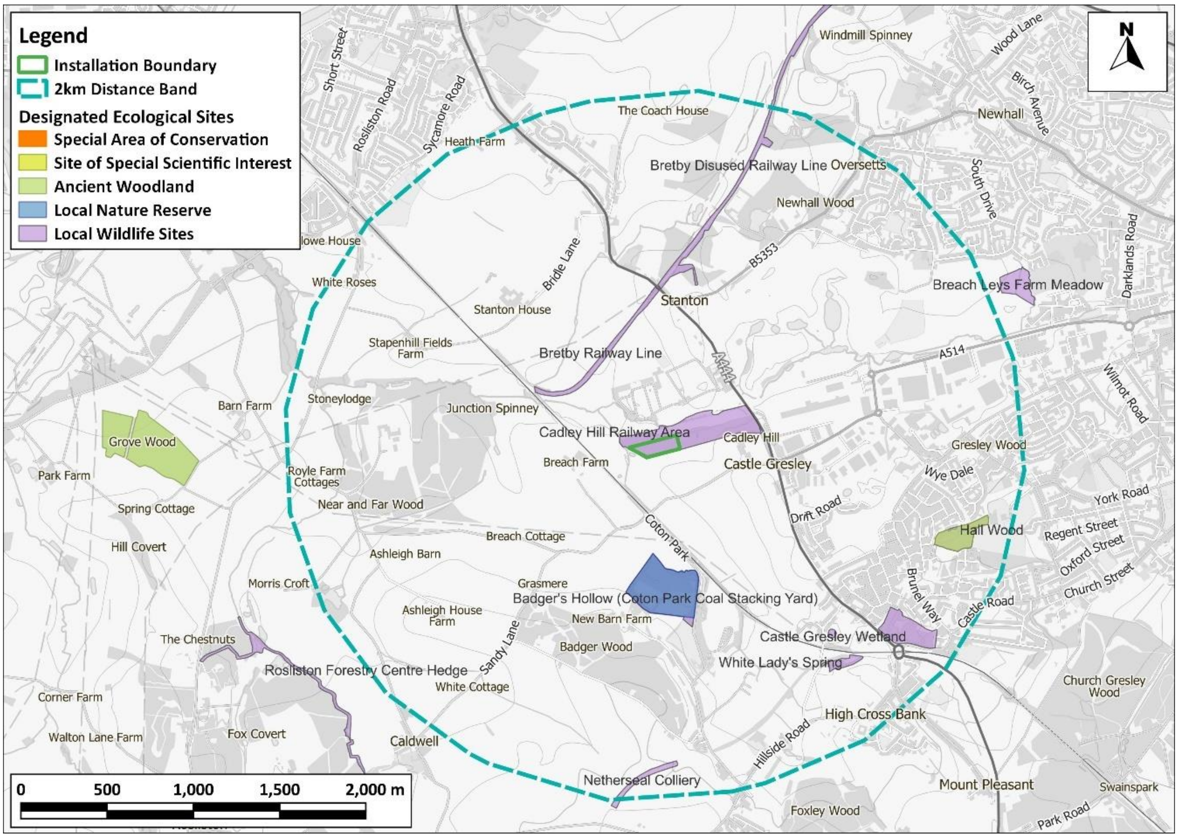

Figure 1: Site Location, AWs, LNRs and LWSs within 2 km

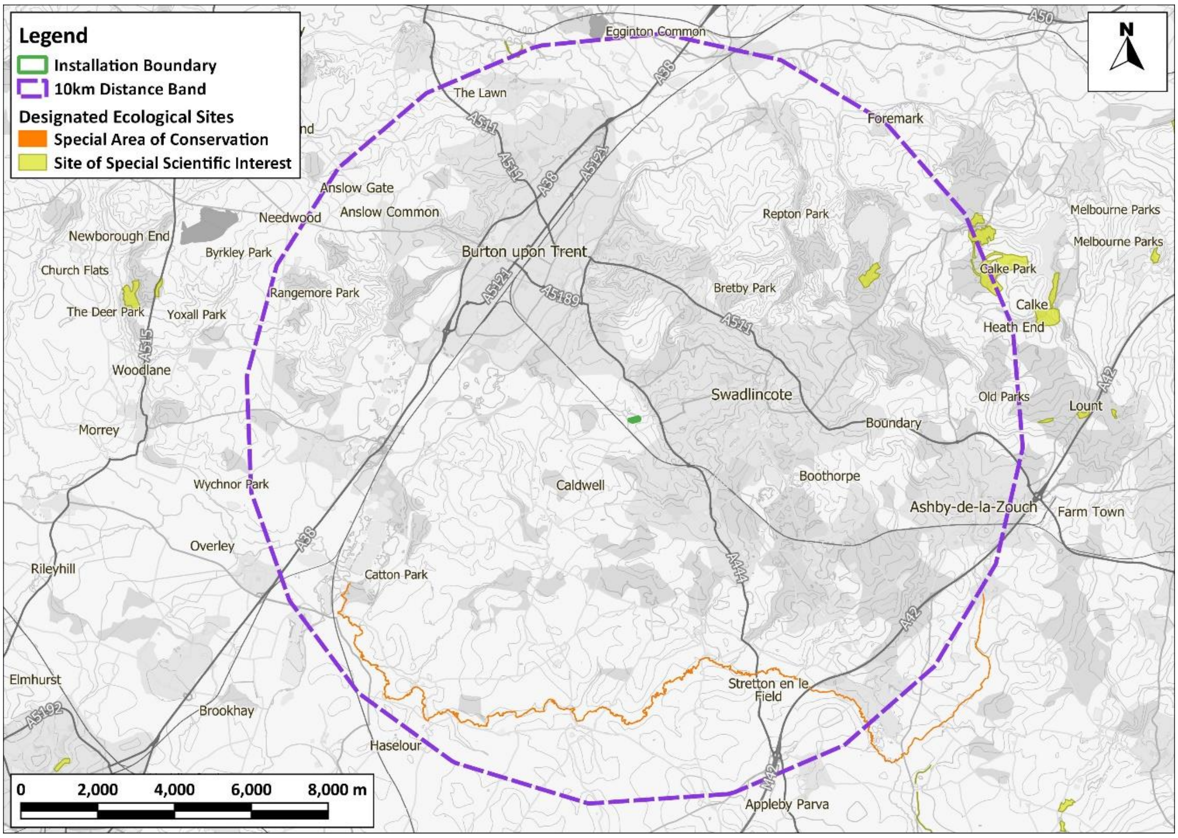

Figure 2: Site Location, SAC and SSSIs within 10 km

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2.2 Table 3 summarises the proximity of nearby sensitive receptors.

Table 3: Summary of Nearby Sensitive Features

Feature	Description	Distance from nearest Stack
Nearest Roadside [a] Human Health Receptor	Residential property on Woodland Road (A444)	550 m
Nearest Non-roadside Human Receptor	Residential property at Breach Farm	380 m
Nearest SAC, SPA, Ramsar Site	River Mease SAC/SSSI	6,400 m
Receptors within the Downwash Cavity Length from the Nearest Edge/Side of the Building?	No	N/A
Sensitive Receptor Setting	Residential	n/a
Sensitive Receptors Near an A Road or Motorway Network?	Yes – A444	580 m
Sensitive Receptors within an AQMA Declared for NO_2?	No	N/A

[a] Defined as those receptors within 15 m of a busy road, carrying more than 10,000 vehicles daily.

Topography and Terrain

2.3 Figure 3 shows the terrain across the modelled study area using Ordnance Survey (OS) Terrain 50 data. The area immediately surrounding the site is broadly flat, such that the base of the building from which the stacks exhaust is approximately at the same elevation as the nearest human health receptors. However, in the wider area there are slopes with gradients greater than 10% and consequently, a sensitivity test for terrain has been included. Further discussion on terrain effects is provided in Section 6.

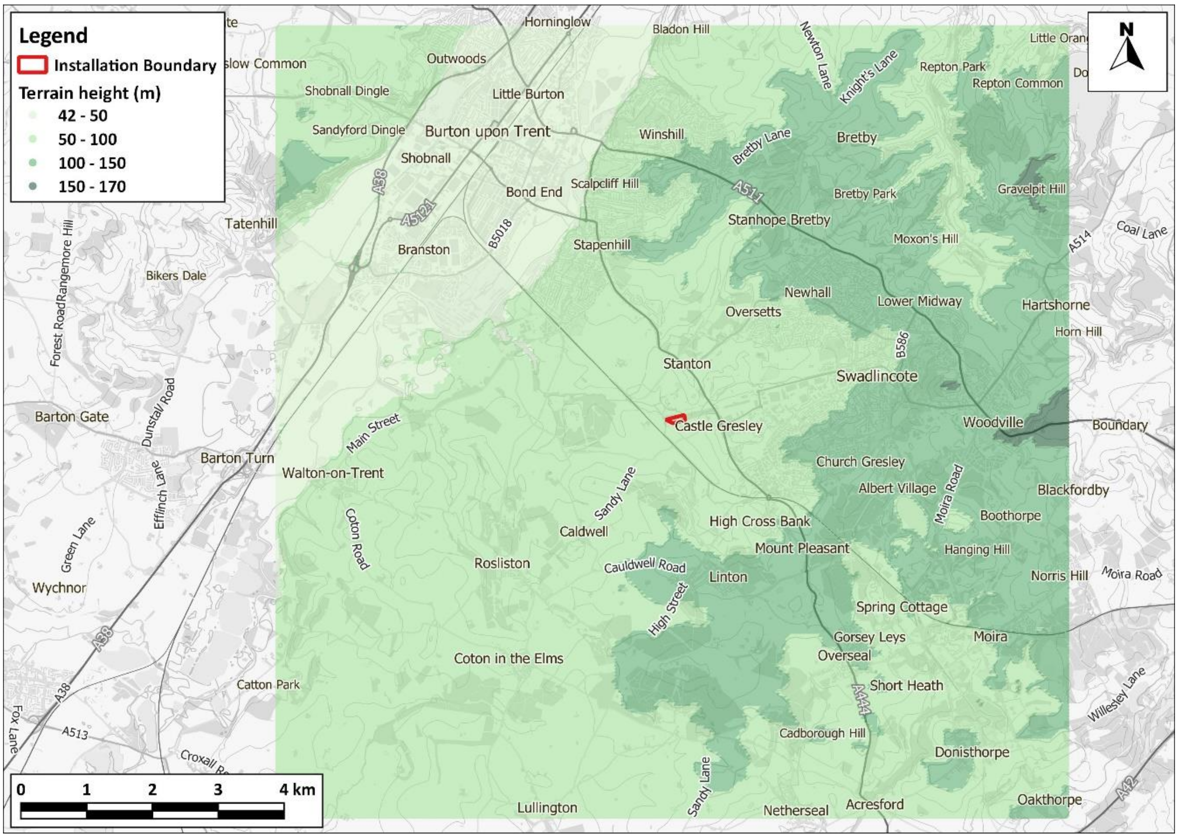

Figure 3: Terrain across Modelled Area

3 Description of Process

Overview of Plant

3.1 The SERF comprises of a multifueled conventional combustion plant, based on moving grate technology. The ERF will have a gross electricity generating capacity of approximately 20.5 MW. It has been designed to provide combined heat and power (CHP) and will be "CHP ready" from the outset, being capable of supplying heat to local consumers by means of a future heat network. The anticipated fuel throughput would be a maximum of 230,000 tonnes per annum (tpa) of non-hazardous residual (post-recycled) waste including Refuse Derived Fuel (RDF) from the adjacent Willshee's MRF. To support operation of the ERF, a 2.3MWth diesel generator will provide power during start-up and shut-down, as well as in the case of emergencies.

Air Emissions from the Site

3.2 The sources of air pollutants at the facility are from the main stack of the ERF and the diesel generator. A range of pollutants (as outlined in section 1.4) would be released from the main stack of the ERF from the incineration of non-hazardous waste while the diesel generator would primarily emit NO_2 and PM_{10}.

3.3 The ERF will operate all year, except for a 4-week shutdown period when routine maintenance will be undertaken. The diesel generator will provide power during start-up and shut-down, as well as in case of emergencies, which will be tested regularly as part of routine maintenance checks. This is expected to amount to a total operation of approximately 168 hours per year.

3.4 Air emissions from the ERF and generator are exhausted from individual, vertical flues; the ERF stacks terminate at 60 m above ground level, while the generator stack terminates at 6 m above ground level. Figure 4 shows the site plan and layout, including the locations of these flues. Basic plant details are given in Table 4.

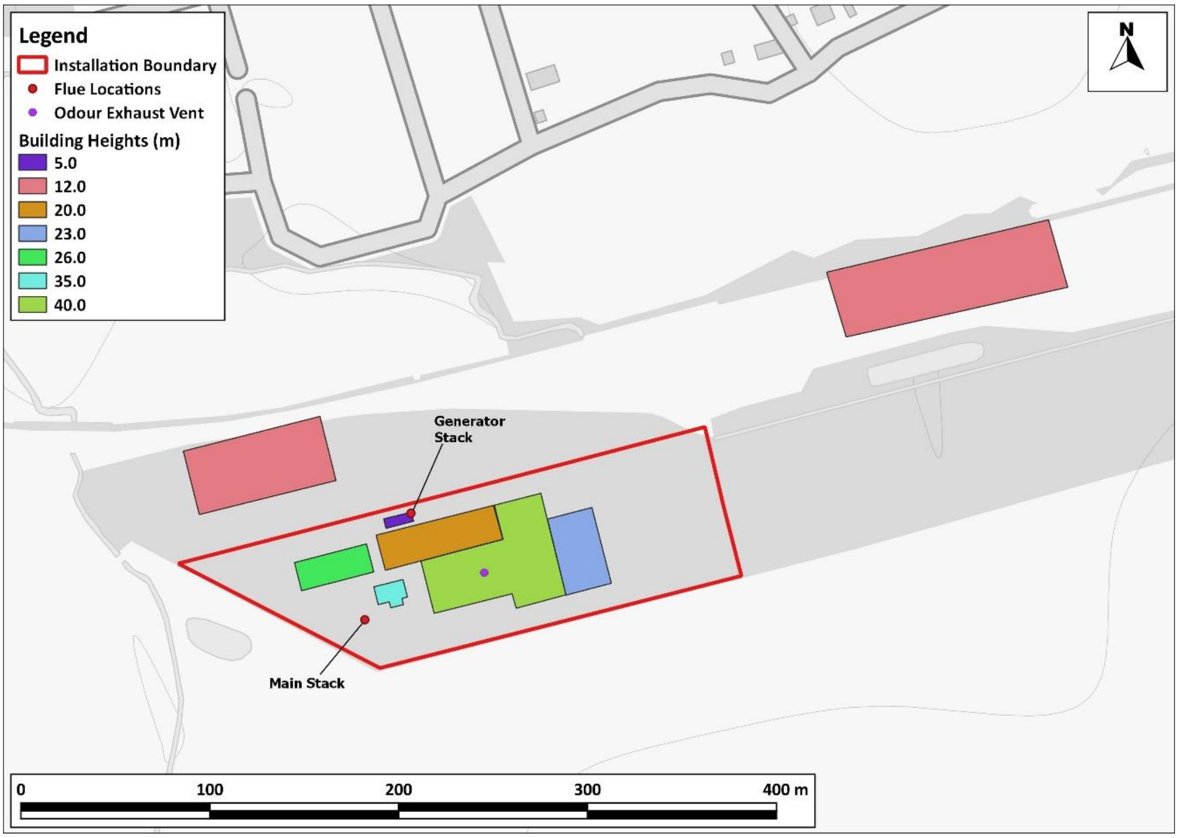

Figure 4: Site Layout

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Table 4: Stack and Building Information

Parameter	Main Stack	Generator
Stack height above ground	60 m	6 m
Internal flue diameter at point of release	2.2 m	0.5 m
Is there one or more buildings within 5L and with heights more than 40% of the stack height?	Yes	Yes
Height of tallest building within 5L	40 m	40 m
Length of tallest building within 5L	70 m	60 m
Width of tallest building within 5L	55 m	55 m

Odour Emissions from the Site

3.5 The flue gas emitted from the main stack is highly unlikely to be especially odorous, as most odorous compounds will either be destroyed in the high-temperature combustion process or removed by the flue gas treatment system. The greatest risk of odour emissions from the site is instead associated with maintenance periods when the incineration process is offline (typically around 30 days per year).

To help minimise the source of odours, quantities of fuel within the reception hall will be run down prior to periods of planned maintenance, until there is minimal residual waste retained within. During maintenance period itself, a deodorising misting system will be in operation and the air extracted from the fuel reception hall will pass through an odour abatement system, which utilises carbon filtration, before being exhausted to air from an exhaust vent on the roof of the building. Figure 4 shows the location of this exhaust vent. The odour abatement system will be designed to provide three air charges per hour, in accordance with the EA's Odour Guidance, from waste reception areas and will meet the requirements of the Waste Incineration BAT Conclusions (BAT 21).

3.6 Should an extended period of unplanned shutdown occur, there will be procedures in place to divert waste away from the installation and, if required, to transport any remaining residual waste off-site to suitable waste treatment facilities.

3.7 With respect to other operations on site which have the potential to generate odours from the handling of residual wastes prior to incineration, there are measures in place to prevent the emissions of odours, for example:

- waste will be pre-processed off site and delivered to the site as residual derived fuel (RDF), either in covered Heavy Good Vehicles (HGVs) or in wrapped bales;
- HGVs will enter the process building via the fuel reception hall, whose doors will be open for as little time as possible, with fast acting roller shutter doors to minimise the escape of air from the building;
- all waste handling will take place within the fuel reception hall building, which will be maintained under negative pressure using an induced draft fan for use in the combustion process to ensure that the escape of air to the outdoors is kept to an absolute minimum; and,
- a deodorising misting system will also be in use periodically within the building.

Consequently, the only source of odour emissions considered within this assessment are those exhausted from the reception hall building during the periods when the incinerator is not in operation.

4 Environmental Standards

Air

4.1 The relevant Environmental Assessment Levels (EALs) for human health impacts are set out in Table 5. They are based on the air quality objectives (AQOs) set out in the Air Quality (England) Regulations (2000), the Air Quality (England) (Amendment) Regulations (2002) and the 2010 Air Quality Standards Regulations (2010). Where there is no AQO, the EALs outlined in the Environment Agency's '*Air Emissions Risk Assessment for your Environmental Permit*' (EA, 2023) have been used.

4.2 The EALs for nitrogen dioxide and PM_{10} are air AQOs, which were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. For $PM_{2.5}$, in the absence of a numerical objective, it is convention to assess local air quality impacts against the limit value, originally set at 25 µg/m^3 and currently set at 20 µg/m^3. Defra has also recently set two new targets, and two new interim targets, for $PM_{2.5}$ concentrations in England. One set of targets focuses on absolute concentrations. The long-term target is to achieve an annual mean $PM_{2.5}$ concentration of 10 µg/m^3 by the end of 2040, with the interim target being a value of 12 µg/m^3 by the start of 2028[1]. The second set of targets relate to reducing overall population exposure to $PM_{2.5}$. By the end of 2040, overall population exposure to $PM_{2.5}$ should be reduced by 35% compared with 2018 levels, with the interim target being a reduction of 22% by the start of 2028. However, for the time being, no assessment is required, and indeed no robust assessment is possible, in relation to the new $PM_{2.5}$ targets and they are not considered further.

4.3 The IED specifies a maximum emission of Total Organic Carbon (TOC). In order to assess the potential emissions of TOCs, a worst-case approach has been taken of assuming that all TOCs are Volatile Organic Compounds (VOCs); and that all VOCs are both benzene and 1,3 butadiene with respect to annual mean concentrations. This situation could not happen in practice and provides an extremely conservative assessment.

4.4 There are no airborne exposure limits or formal assessment criteria for dioxins and furans. The World Health Organisation (WHO, 2000) provides an indicator for the air concentrations above which it considers it necessary to identify and control local emission sources; this value is 0.3 pg/m^3 (300 fg/m^3) and has been used as an EAL in this assessment.

4.5 Table 5 shows that 18 exceedances of 200 µg/m^3 as a 1-hour mean nitrogen dioxide concentration are allowed before the objective is exceeded. For a typical year with complete data capture, the 19th highest hour is represented by the 99.79th percentile of 1-hour mean concentrations. Thus,

1 Meaning that it will be assessed using measurements from 2027. The 2040 target will be assessed using measurements from 2040. National targets are assessed against concentrations expressed to the nearest whole number, for example a concentration of 10.4 µg/m^3 would not exceed the 10 µg/m^3 target.

comparing the 99.79th percentile of 1-hour mean concentrations with the 200 µg/m^3 standard shows whether the 1-hour mean nitrogen dioxide objective would be exceeded. Similarly, the 90.4th percentile of 24-hour mean PM_{10} concentrations represents the 36th highest 24-hour period, the 99.7th percentile of 1-hour mean SO_2 concentrations represents the 25th highest hour, the 99.9th percentile of 15-minute SO_2 concentrations represents the 36th highest 15-minute period, and the 99.18th percentile of 24-hour mean SO_2 concentrations represents the 4th highest 24-hour period.

Table 5: Relevant Air Quality Objectives and Environmental Assessment Levels for the Protection of Human Health

Pollutant	Averaging Period	Concentration (µg/m^3)	Number of Periods Allowed to Exceed per Year	AQO	EAL
Nitrogen Dioxide	Annual mean	40	N/A	X	
	1-hour mean	200	18	X	
Fine Particles (PM_{10})	Annual mean	40	N/A	X	
	24-hour mean	50	35	X	
Fine Particles ($PM_{2.5}$) [a]	Annual mean	20	N/A	X	
SO_2	24-hour mean	125	3	X	
	1-hour mean	350	24	X	
	15-minute mean	266	35	X	
CO	8-hour rolling mean	10,000	N/A	X	
	1-hour mean	30,000	N/A		X
HF	Monthly mean	16	N/A		X
	1-hour mean	160	N/A		X
HCl	1-hour mean	750	N/A		X
Benzene	Annual mean	5 [b]	N/A	X	
	24-hour mean	30 [b]	N/A	X	
1,3-butadiene	Annual mean	2.25 [b]	N/A	X	
Cadmium	Annual mean	0.005	N/A	X	
Mercury	Annual mean	0.25	N/A		X
	1-hour mean	7.5	N/A		X
Antimony	Annual mean	5	N/A		X
	1-hour mean	150	N/A		X
Arsenic	Annual mean	0.006	N/A		X
Lead	Annual mean	0.25	N/A	X	
Chromium (III)	Annual mean	5	N/A		X
	1-hour mean	150	N/A		X

Pollutant	Averaging Period	Concentration (µg/m³)	Number of Periods Allowed to Exceed per Year	AQO	EAL
Chromium (VI)	Annual mean	0.00025	N/A		X
Copper	Annual mean	10	N/A		X
	1-hour mean	200	N/A		X
Manganese	Annual mean	0.15	N/A		X
	1-hour mean	1,500	N/A		X
Nickel	Annual mean	0.02	N/A	X	
Vanadium	Annual mean	5	N/A		X
	24-hour mean	1	N/A		X
NH_3	Annual mean	180	N/A		X
	24-hour mean	1	N/A		X
PCDD/F	Annual mean	0.0000003	N/A		X
PAH (as B[a]P)	Annual mean	0.00025	N/A	X	
PCBs	Annual mean	0.2	N/A		X
	1-hour mean	6	N/A		X

[a] There is no numerical $PM_{2.5}$ objective for national and local authorities. Convention is to assess against the UK limit value which is currently 20 µg/m³.

[b]

TOCs assessed against the EALs for benzene and 1,3-butadiene, since these are the most stringent EALs for any VOC.

4.6 The EALs apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the EAL. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2022), and the Environment Agency applies the same approach with its Assessment Levels. The annual mean EALs are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 1-hour mean EALs applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets. The 24-hour EALs is taken to apply at residential properties as well as in the gardens of residential properties. The EALs for periods of 8 hours or less have been taken to potentially apply anywhere within the study area, even though, in practice, members of the public would need to be regularly exposed in a non-occupational setting for the averaging period of the EAL.

4.7 The EALs do not apply in places of work where members of the public have no free access and where relevant provisions concerning health and safety at work apply (AQC, 2016).

Designated Habitats

4.8 Table 6 sets out the relevant critical levels and critical loads for the designated ecological sites in the study area, as taken from the Air Pollution Information System (APIS) website (APIS, 2023); the lowest critical level or load for any species within the habitat has been used as the EAL. Where APIS does not provide critical levels for a given pollutant, they have been taken from Table 7 of the EA's H1 guidance (Environment Agency, 2022). For ammonia and sulphur dioxide, there are more stringent critical levels which only apply for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity. No critical loads for nutrient nitrogen or acid deposition have been assigned for the River Mease SAC or Calke Park SSSI, and no critical loads for acid deposition have been assigned for the Castle Gresley Wetland LWS or Netherseal Colliery LWS.

4.9 For local sites within 2 km of the facility, critical loads have been determined from the assumed habitat. Relevant critical levels and critical loads are set out in Table 6.

Table 6: Environmental Assessment Levels (Critical Levels and Critical Load) for Vegetation and Ecosystems [a]

Pollutant and Averaging Period	Species/Habitat	Critical Level or Load
Annual Mean NOx	All sensitive communities	30 µg/m^3
24-hour Mean NOx	All sensitive communities	75 µg/m^3 [b]
Annual Mean NH_3	All higher plants [c]	3 µg/m^3
Annual Mean SO_2	All higher plants [c]	20 µg/m^3
Daily Mean HF	All sensitive communities	5 µg/m^3
Weekly Mean HF	All sensitive communities	0.5 µg/m^3
Nutrient Nitrogen Critical Load [d]	The River Mease SAC, Calke Park SSSI	- [e]
	Hall Wood Ancient Woodland [f], Badgers Hollow, Coton Park LNR, Carver's Rocks SSSI, Ticknall Quarries SSSI, Bretby Railway LWS, Bretby Disused Railway LWS, Cadley Hill Railway Area LWS, Breach Leys Farm Meadow LWS, Castle Gresley Wetland LWS, White Lady's Spring LWS, Netherseal Colliery LWS	10 kgN/ha/yr
	Castle Mound LWS	5 kgN/ha/yr
Acid Deposition Critical Load [d]	The River Mease SAC, Calke Park SSSI, Castle Gresley Wetland LWS, Netherseal Colliery LWS	- [e]
	Ticknall Quarries SSSI	2.756 keq/ha/yr
	Carver's Rocks SSSI	1.284 keq/ha/yr

Pollutant and Averaging Period	Species/Habitat	Critical Level or Load
	Hall Wood Ancient Woodland [f], Bretby Disused Railway LWS, Cadley Hill Railway Area LWS	2.982 keq/ha/yr
	Badgers Hollow, Coton Park Local Nature Reserve [f], White Lady's Spring LWS	2.728 keq/ha/yr
	Bretby Railway LWS	2.727 keq/ha/yr
	Castle Gresley Mound LWS	1.113 keq/ha/yr
	Netherseal Colliery LWS	4.856 keq/ha/yr
	Breach Leys Farm Meadow LWS	5.071 keq/ha/yr

a Taken from APIS (2023) and from Table B4 of the EA's H1 Guidance (Environment Agency, 2010).

b This is the worst-case critical level to assess against. IAQM guidance (IAQM, 2019) states that a suitable 24-hour mean NOx critical level to assess against is 200 µg/m^3 and the EA's guidance (Environment Agency, 2022) states that 200 µg/m^3 can be used where ozone and sulphur dioxide concentrations are below their critical levels.

c No lichens or bryophytes are present.

d Minimum location-specific critical loads as defined by APIS (2023).

e No critical load is provided by APIS (2023).

f Based on Broadleaved, Mixed and Yew Woodland habitats.

Odour

4.10 The EA has produced a horizontal guidance note (H4) on odour assessment and management (Environment Agency, 2011), which is designed for operators of EA-regulated processes (i.e., those which classify as Part A(1) processes under the EPR regime). Within this document, a set of suggested odour modelling benchmarks are set out. Depending on the offensiveness of the odour, the predicted 98th percentile of 1-hour odour concentrations are compared to one of the below benchmarks:

- 1.5 OU_E/m^3 for most offensive odours;
- 3 OU_E/m^3 for moderately offensive odours; and
- 6 OU_E/m^3 for less offensive odours.

The guidance also suggests which benchmarks should be used for a range of industrial processes. The precise composition and contents of the residual waste on site is unknown but has the potential to fall under the most offensive benchmark, which includes biological landfill odours. For such odours, H4 suggests assessing against the benchmark for highly offensive odours. However, waste gas odours will be treated via the odour abatement system which will modify the character of the odour, potentially making the odours less offensive. As a conservative approach, the modelling outputs will be compared against the 1.5 OU_E/m^3 concentration benchmark.

5 Baseline Conditions

Relevant Features

5.1 The Site is located approximately 2.7 km to the west of Swadlincote town centre. The application site is bounded by the A444 to the east and agricultural land or woodland on all other sides. It is currently occupied by Willshees Materials Recycling Facility (MRF). The nearest residential properties are located approximately 120 m to the north and south of the Site.

Industrial sources

5.2 The Site will be located adjacent to the Willshees MRF and is approximately 80 m south of a Severn Trent waste-water treatment site and approximately 500 m west of a Bison Precast concrete supplier. However, none of these facilities are anticipated to have onsite combustion processes which will emit the same pollutants as the Site; a search of the EA's Public Register (EA, 2023b) only identifies Willshees MRF within 1 km of the facility, which currently holds an Environmental Permit for Waste Operations (Physical Treatment Facility).

5.3 The Severn Trent waste-water treatment site will be the main source of existing odours in the area surrounding the proposed development. However, the character and intensity of odours from this site are unknown. Nonetheless, for the odour modelling assessment, the odour baseline will be zero. This reflects that odours from different sources/processes are not additive and the assessment should focus on the process contribution of odour from the Site only.

Local Air Quality Monitoring

5.4 South Derbyshire District Council does not operate any automatic monitoring stations within its area, while East Staffordshire Borough Council operates one automatic monitoring station in Burton on Trent. Both Councils operate a number of nitrogen dioxide monitoring sites; South Derbyshire District Council use diffusion tubes prepared and analysed by Socotec (using the 50% TEA in acetone method), while East Staffordshire Borough Council use tubes prepared and analysed by Staffordshire Scientific Services (using the 20% TEA in water method).

5.5 Annual mean results for the years 2016 to 2022 are summarised in Table 7 for the locations closest to the development site while results relating to the 1-hour mean objective for the automatic monitor are summarised in Table 8. Exceedances of the objectives are shown in bold. The monitoring locations are shown in Figure 5. The monitoring data for South Derbyshire have been taken from the Council's 2023 Annual Status Report (South Derbyshire District Council, 2023), while data for East Staffordshire have been taken from the Council's 2020 and 2023 Annual Status Reports (East Staffordshire Borough Council, 2020) (East Staffordshire Borough Council, 2023).

5.6 While 2020 and 2021 results have been presented in this Section where available for completeness, they are not relied upon in any way as they will not be representative of 'typical' air quality conditions due to the considerable impact of the Covid-19 pandemic on traffic volumes and thus pollutant concentrations.

Table 7: Summary of Annual Mean NO_2 Monitoring (2016-2022) ($\mu g/m^3$) [a]

Site No.	Site Type	Location	2016	2017	2018	2019	2020	2021	2022
South Derbyshire									
3	Urban background	Community Centre, Church Gresley	13.4	15.5	12.8	11.3	9.2	9.6	9.8
9	Roadside	97 Woodland Road, Stanton	31.3	30.7	31.4	32.3	24.8	26.1	24.5
10	Kerbside	160 Burton Road, Castle Gresley	32.9	35.4	32.7	29.0	24.8	26.1	24.5
19	Roadside	9 Church Street, Church Gresley	25.5	28.3	23.4	24.8	17.0	17.4	17.4
East Staffordshire									
CM1	Urban Centre	Derby Turn	**51**	**46**	39	37	32	25.2	31.0
CM3	Urban Background	Burton on Trent Horninglow	**-**	**-**	19	18	14	15	16
DT2	Roadside	St Peters Bridge	**47.3**	**49.8**	**45.8**	**43.5**	38.4	37.8	36.8
DT18	Roadside	A444 – Stapenhill	36.6	**42.7**	39.3	33.4	30.3	30.6	29.0
Objective			**40**						

[a] Exceedances of the objectives are shown in bold.

[b] Data not yet published for these years

Table 8: Number of Hours With NO_2 Concentrations Above 200 $\mu g/m^3$

Site No.	Site Type	Location	2016	2017	2018	2019	2020	2021	2022
CM1	Urban Centre	Derby Turn	0	0	4	0	0	0	0
CM3	Urban Background	Burton on Trent Horninglow	-	-	0	0	0	0	0
Objective			**18**						

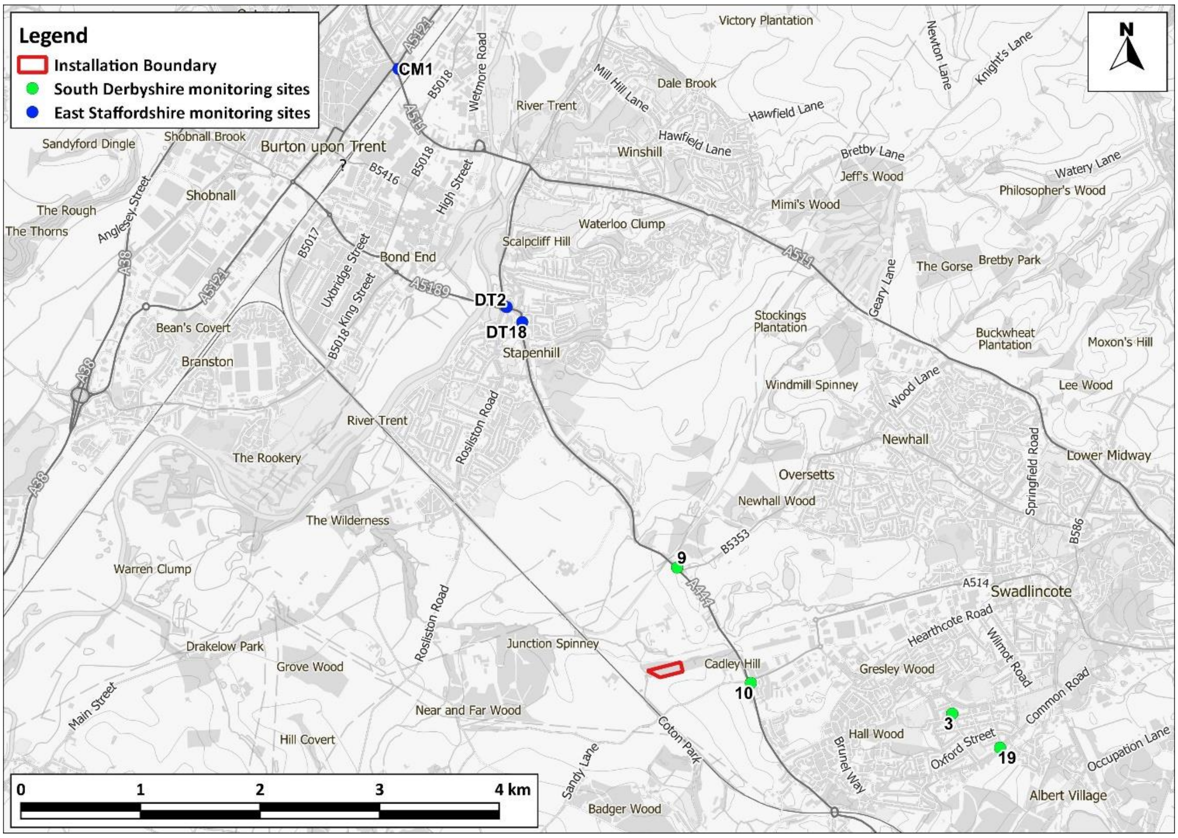

Figure 5: Monitoring Locations

5.7 Concentrations have remained below the objective at the South Derbyshire sites since 2016. Concentrations in East Staffordshire exceeded the annual mean objective at site DT2, located within the nearest AQMA (at Stappenhill Burton on Trent), between 2016 and 2019 but were below the objective in 2022. Concentrations at the remaining East Staffordshire sites have remained below the objective since 2018. No exceedances of the hourly mean objective have been recorded. Concentrations have fluctuated across these monitoring sites since 2016 however, overall, concentrations have decreased between 2016 and 2022.

5.8 The East Staffordshire Borough Council automatic monitoring station in Burton on Trent also monitors PM_{10} or $PM_{2.5}$ concentrations. Annual mean results for the 2022[2] are summarised in Table 9, while results relating to the daily mean objective are summarised in Table 10. In 2022, PM_{10} and $PM_{2.5}$ concentrations were well below the respective air quality objectives.

[2] monitoring of these pollutants only commenced in 2022, so only one year of data is available

Table 9: Summary of Annual Mean PM_{10} and $PM_{2.5}$ Monitoring (2022) (µg/m^3)

Site No.	Site Type	Location	2022
PM_{10}			
CM3	Urban Background	Burton on Trent Horninglow	11
Objective			**40**
$PM_{2.5}$			
CM3	Urban Background	Burton on Trent Horninglow	7
Objective			**20[a]**

[a] The 20 µg/m^3 $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Table 10: Number of Days With PM_{10} Concentrations Above 50 µg/m^3

Site No.	Site Type	Location	2022
CM3	Urban Background	Burton on Trent Horninglow	0
Objective			**35 [a]**

Background Concentrations and Fluxes

National Background Pollution Maps

5.9 Estimated background concentrations in the study area have been determined from background pollutant maps published by Defra. The values presented are the range of concentrations across the study area, which covers multiple 1x1 km grid squares. All of the background concentrations are well below the objectives.

Table 11: Estimated Annual Mean Background Pollutant Concentrations in 2022 (µg/m^3)

Pollutant	Background (µg/m^3)	Objective
NOx	8.8 – 27.5	-
NO_2	6.9 – 18.9	40
PM_{10}	11.2 - 14.0	40
$PM_{2.5}$ [a]	7.2 - 9.5	20
SO_2 [b]	0.8 – 2.6	20
CO [c]	242 – 341	10,000
Benzene [b]	0.25 – 0.44	5
1,3-butadiene [d]	0.10 – 0.18	2.25

[a] There is no numerical $PM_{2.5}$ objective for national and local authorities. Convention is to assess against the UK limit value which is currently 20 µg/m^3.

[b] Background concentrations are based on the 2021 base year. No later year is available.

[c] Background concentrations are based on the 2010 base year. No later year is available.

[d] Background concentrations are based on the 2003 base year. No later year is available.

Trace Metals

5.10 Defra has undertaken monitoring of trace elements at a number of locations in the UK since 1976 as part of the UK Urban and Rural Heavy Metals Monitoring Network. The current Heavy Metals Network consists of 24 sites across the UK. Measured concentrations at the nearest five sites to the proposed facility in 2022 are summarised in Table 12.

5.11 The maximum concentrations from the five sites presented are at the Walsall Pleck Park and Sheffield Tinsley sites. However the Sheffield Tinsley site is close to both the M1 motorway and to a number of heavy industrial land uses and is not representative of conditions surrounding the Site. The maximum concentrations measured at the Sheffield Devonshire Green and Walsall Pleck Park site have thus been used as the background concentrations in the assessment. All concentrations, with the exception of Chromium VI at Sheffield Tinsley, are well below the relevant EALs.

Table 12: Heavy Metal Background Concentrations 2022 ($\mu g/m^3$) [a]

<table>
<tr><th colspan="2">Pollutant</th><th>Walsall Pleck Park</th><th>Fenny Compton</th><th>Chesterfield Loundsley Green</th><th>Sheffield Tinsley</th><th>Sheffield Devonshire Green</th><th>Annual Mean EAL</th></tr>
<tr><td colspan="2">Antimony (Sb)</td><td colspan="5">Not measured</td><td>5</td></tr>
<tr><td colspan="2">Arsenic (As)</td><td>0.0009</td><td>0.0006</td><td>0.0006</td><td>0.0009</td><td>0.0007</td><td>0.006</td></tr>
<tr><td colspan="2">Cadmium (Cd)</td><td>0.0009</td><td>0.0001</td><td>0.0001</td><td>0.0003</td><td>0.0001</td><td>0.005</td></tr>
<tr><td rowspan="2">Chromium (Cr) [b]</td><td>Total</td><td>0.0023</td><td>0.0012</td><td>0.0022</td><td>0.0325</td><td>0.0049</td><td>5 [c]</td></tr>
<tr><td>Cr(VI)</td><td>0.00018</td><td>0.00010</td><td>0.00018</td><td>0.00260</td><td>0.00039</td><td>0.00022</td></tr>
<tr><td colspan="2">Cobalt (Co)</td><td>0.00013</td><td>0.00004</td><td>0.00008</td><td>0.00144</td><td>0.00019</td><td>1</td></tr>
<tr><td colspan="2">Copper (Cu)</td><td>0.016</td><td>0.002</td><td>0.005</td><td>0.017</td><td>0.008</td><td>10</td></tr>
<tr><td colspan="2">Lead (Pb)</td><td>0.0070</td><td>0.0030</td><td>0.0052</td><td>0.0117</td><td>0.0054</td><td>0.25</td></tr>
<tr><td colspan="2">Manganese (Mn)</td><td>0.0085</td><td>0.0023</td><td>0.0050</td><td>0.0344</td><td>0.0083</td><td>0.15</td></tr>
<tr><td colspan="2">Mercury (Hg)</td><td colspan="5">Not measured</td><td>0.25</td></tr>
<tr><td colspan="2">Nickel (Ni)</td><td>0.0009</td><td>0.0004</td><td>0.0010</td><td>0.0172</td><td>0.0024</td><td>0.02</td></tr>
<tr><td colspan="2">Thallium (Tl)</td><td colspan="5">Not measured</td><td>1</td></tr>
<tr><td colspan="2">Vanadium (V)</td><td>0.0007</td><td>0.0005</td><td>0.0006</td><td>0.0013</td><td>0.0008</td><td>5</td></tr>
</table>

[a] The maximum of the four sites is shown in bold.

[b] The Heavy Metals Network measures total chromium. The Expert Panel on Air Quality Standards (EPAQS) report that ambient Cr(VI) concentrations may typically constitute between 3 and 8% of total ambient chromium. The higher value (8%) has been used to derive a background concentration of Cr(VI) from total monitored chromium.

[c] EAL for Cr(III).

Acid Gases and Ammonia

5.12 Defra monitors concentrations of HCl at around 30 monitoring sites across the UK as part of the UKEAP Acid Gas and Aerosol Network. The closest monitoring site to the Site is located at Sutton Bonnington, 24 km to the northeast. The measured concentration in 2015 (the latest year for which data are available) at Sutton Bonnington was 0.21 µg/m^3, which has therefore been used in this assessment.

5.13 Defra monitors background concentrations of ammonia as part of the National Ammonia Monitoring Network (NAMN). The closest monitoring site to the Site is also located at Sutton Bonnington. The measured concentration in 2022 was 3.58 µg/m^3, which has therefore been used in this assessment.

5.14 The backgrounds used in the assessment are summarised in Table 13. There is currently no UK monitoring of HF, and no background data are available.

Table 13: HCl and Ammonia Background Concentrations (µg/m^3)

Pollutant	Background Concentration (µg/m^3)	Annual Mean EAL
HCl	0.21	20
NH_3	3.58	3

Dioxins and Furans

5.15 Monitoring of PCDD/Fs (dioxins and furans) is currently carried out by Defra at six locations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) Network. To provide an indication of the range of PCDD/Fs concentrations in the UK, a summary of the annual mean concentrations between 2014 and 2016 is presented in Table 14; no data for later years is available as data capture is extremely low (<1%). The maximum of these sites is Manchester, with an average concentration of 11.7 fg/m^3, and is assumed to be representative of the baseline dioxin and furan concentration in the study area. This is very conservative assumption as the Site is in a far less urbanised location as Greater Manchester.

Table 14: UK PCDD/Fs Concentrations (fg/m^3) [a]

Site	2014	2015	2016	Average
Auchencorth	<0.1	<0.1	0.2	0.1
Hazelrigg	2.6	5.3	4.6	4.2
High Muffles	1.4	0.5	3.7	1.9
London	2.9	5.5	24.3	10.9
Manchester	**17.0**	**6.0**	**12.3**	**11.7**
Weybourne	1.6	1.4	5.7	2.9

[a] 1,000,000,000 fg = 1 µg.

Polyaromatic Hydrocarbons

5.16 Defra monitors polyaromatic hydrocarbons (PAHs) as part of the PAH Network. The latest annual mean concentrations of B[a]P for 2022 at the four closest monitoring sites to the Site are presented in Table 15. The maximum of these sites (0.25 ng/m^3) has been used in this assessment.

Table 15: PAH Concentrations (as B[a]P) 2022 (ng/m^3)

Site	Annual Mean Concentration (ng/m^3)
Birmingham Ladywood	0.12
Bolsover	0.15
Nottingham Centre	0.19
Sheffield Tinsley	0.25

Background Deposition and Acidity

5.17 Background nitrogen deposition fluxes to the SAC, SSSIs, Ancient Woodland, Local Nature Reserve and Local Wildlife Sites are presented in Table 16. Background nutrient and acid nitrogen deposition rates both exceeded the critical loads.

Table 16: Estimated Annual Mean Background Nitrogen and Acid Deposition [a]

Site	Nutrient Nitrogen Deposition (kgN/ha/yr)	Acid Nitrogen Deposition (keq/ha/yr)	Acid Sulphur Deposition (keq/ha/yr)
The River Mease SAC [b]	9.9 - 13.8 (-)	0.7-1.0 (-)	0.2 (-)
Carver's Rocks SSSI	37.6 - 38.3 (10)	2.7 (1.284)	0.2 (1.284)
Ticknall Quarries SSSI	37.1 - 37.9 (10)	2.7 (2.756)	0.2 (2.756)
Calke Park SSSI [b]	12.0 - 12.5 (-)	0.9 (-)	0.2 (-)
Hall Wood Ancient Woodland	41.6 (10)	2.97 (2.982)	0.23 (2.982)
Badgers Hollow, Coton Park Local Nature Reserve	41.6 (10)	2.97 (2.728)	0.23 (2.728)
Bretby Railway LWS	35.6 (10)	2.54 (2.727)	0.21 (2.727)
Bretby Disused Railway LWS, Cadley Hill Railway Area LWS	35.6 (10)	2.54 (2.982)	0.21 (2.982)
Breach Leys Farm Meadow LWS	20.0 (10)	1.43 (5.071)	0.17 (5.071)
Castle Gresley Wetland LWS	20.0 (10)	1.43 (-) [c]	0.17 (-) [c]
Castle Mound LWS	20.0 (5)	1.43 (1.113)	0.17 (1.113)
White Lady's Spring LWS	35.6 (10)	2.54 (2.728)	0.21 (2.728)
Netherseal Colliery LWS	20.0 (10)	1.43 (4.856)	0.17 (4.856)

[a] Critical load relevant to each habitat are in parentheses after the background value.

[b] There are no critical loads defined for the River Mease SAC or Calke Park SSSI.

[c] This habitat is not sensitive to acidity.

6 Modelling Methodology

6.1 Modelling has been carried out in line with the following EA documents:

- Air emissions risk assessment for your environmental permit (EA, 2023); and
- Environmental permitting: air dispersion modelling reports (EA, 2021).

Dispersion Model

6.2 There are two primary dispersion models which are used extensively throughout the UK for assessments of this nature and accepted as appropriate air quality modelling tools by the Regulators and local planning authorities alike:

- The ADMS model, developed in the UK by Cambridge Environmental Research Consultants (CERC) in collaboration with the Met Office, National Power and the University of Surrey; and
- The AERMOD model, developed in the United States by the American Meteorological Society (AMS)/United States Environmental Protection Agency (EPA) Regulatory Model Improvement Committee (AERMIC).

6.3 Both models are termed 'new generation' Gaussian plume models, parameterising stability and turbulence in the planetary boundary layer (PBL) by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the PBL to be more accurately defined than by the stability classification methods of earlier dispersion models. Like these earlier models, ADMS and AERMOD adopt a symmetrical Gaussian profile of the concentration distribution in the vertical and crosswind directions in neutral and stable conditions. However, unlike earlier models, the ADMS and AERMOD vertical concentration profile in convective conditions adopts a skewed Gaussian distribution to take account of the heterogeneous nature of the vertical velocity distribution in the Convective Boundary Layer (CBL).

6.4 Numerous model inter-comparison studies have demonstrated little difference between the output of ADMS and AERMOD, except in certain scenarios, such as in areas of complex terrain (Carruthers et al., 2011). For the purposes of this particular study, the use of the ADMS model (version 6) is adopted. ADMS is widely used for assessments of this type and has been extensively validated (CERC, 2023)). Consequently, it is considered suitable for the current assessment.

Modelling Scenarios

6.5 Predictions of pollutants from the main stack have been modelled assuming that the facility operates continuously throughout the year, at full load, which is conservative given that it will be shut down for routine maintenance for approximately 4 weeks each year. Predictions have been made assuming that the facility operates at the IED (or BREF) emission limits, however measurements at modern energy from waste facilities demonstrates these plant operate well below the emissions limits for most pollutants. Modelling assuming constant operation at the maximum emissions limits therefore represents a very conservative assessment. An abnormal operation scenario has also been considered, which assumes higher emissions from the main stack at the ERF as a result of a failure of abatement technology. Further details of this assessment are detailed in Paragraphs 6.12 to 6.18.

6.6 Predictions of odour emissions during the periods when the incinerator is not operational have also been modelled assuming that the exhaust vent on the main reception building is emitting odours continuously all year. This is a highly conservative assumption given that the vent will only be operational when the incinerator is shut down for routine maintenance 4 weeks each year.

6.7 Meanwhile, the generator has been modelled assuming operation for a maximum of 168 hours per year. This includes start-up and shutdown periods, as well as routine testing. As it is unknown the precise hours the generator will operate in any given year, the model has assumed the generator will operate continuously and the annual mean concentrations have been prorated during post-processing to account for the actual hours of operation.

Emission Parameters

6.8 The applicant has provided data on the stack diameter, volumetric flow rate, temperature and gas composition in terms of the volume of water and oxygen for the main stack at the ERF. This information has been provided for actual operating conditions and has been used to calculate the exit velocity and 'normalised' conditions. The data provided, and the calculated parameters, for the main stack are set out in Table 17.

Table 17: Main Stack Emissions and Release Conditions

Stack Parameter	Value
Actual Volume Flow Rate (Am^3/s)	63.9
Exhaust Temperature (°C)	145
Water Volume (%)	17.9
Oxygen by Wet Volume (%)	5.7
Stack Internal Diameter (m)	2.2
Stack Height above Ground Level (m)	60
Stack Location (O.S. x,y)	426850.0, 318956.6
Calculated Parameters	
Actual Exit Velocity	16.8
Normalised Volume Flow Rate (Nm^3/s) [a]	48.1

[a] Normalised to 273 K, 1 atm, dry gas, 11% O_2.

6.9 The pollutant emission rates used in the assessment have been derived from a combination of sources, and are set out in Table 18; where new BAT-AELs are presented for a given averaging period in the Waste Incineration BAT Conclusions, these have been used. Where no new BAT-AELs for a given averaging period are presented in the Waste Incineration BAT Conclusions, the ELVs from Annex VI of IED have been used. An emission rate for PAH (as B[a]P) has been taken from Figure 8.121 of the BREF, which presents typical measured concentrations at municipal solid waste incineration sites. The maximum "average" emission concentration from any site included in the graph has been estimated from the graph, and used as the emission concentration, which is considered worst-case. The relevant calculated emission rates (g/s) are presented in Table 18, based on combining the relevant limit with the release conditions.

Table 18: Pollutant Emission Parameters for the Proposed Facility

Pollutant	Averaging Period for AQO/EAL	Maximum Emission Concentration (mg/Nm^3)	Emission Rate (g/s) [a, b]
NOx	Annual mean	120	5.77
	1-hour mean	400	19.22
PM	Annual mean	5	0.24
	24-hour mean	30	0.24
SO_2	Annual mean	30	1.44
	1-hour / 15-minute mean	200	9.61
	24-hour mean	200	9.61
CO	Annual mean	50	2.40
	8-hour rolling mean	100	4.81
TOC	Annual mean	10	0.48
	1-hour mean	20	0.96
HCl	1-hour mean	60	2.88
HF	Monthly mean/168-hour mean	1	0.048
	1-hour mean	4	0.048
	24-hour mean	4	0.048
Cd and Tl	Annual mean	0.02	0.00096
Hg	Annual mean	0.01	0.00048
	1-hour mean	0.01	0.00048
Group III Metals [c]	Annual mean	0.3	0.014
	1-hour mean	0.3	0.014
NH_3	Annual mean	10	0.48
	1-hour mean	10	0.48
Dioxins and Furans	Annual mean	0.00000006	2.88×10^{-9}
Cr(VI) [d]	Annual mean	0.00013 (max)	6.25×10^{-6}
		0.000035 (mean)	1.68×10^{-6}
		0.0000023 (min)	1.11×10^{-7}

Pollutant	Averaging Period for AQO/EAL	Maximum Emission Concentration (mg/Nm^3)	Emission Rate (g/s) [a, b]
PAH	Annual mean	0.00015	7.21×10^{-6}
PCB	Annual mean	0.00000008	3.84×10^{-9}
	1-hour mean	0.00000008	3.84×10^{-9}

a The emission rate is calculated by multiplying the normalised emission concentration by the efflux normalised volume flow rate, and dividing by 1000.

b Rounded values are presented, but unrounded values were used in the model.

c Group III metals include Sb, As, Pb, Cr(III), Co, Cu, Mn, Ni and V.

d Minimum, mean and maximum measured emission rates of Cr(VI) specified in the EA's Guidance Note for Metals (Environment Agency, 2016).

6.10 The emissions and release conditions for the generator, as provided by the applicant, are presented in Table 19below.

Table 19: Emergency Diesel Generator Emission and Release Conditions

Parameter	Value
Gross Peak Fuel Input (kW)	2,417
Hours of Use per Annum	168
Annual Fuel Input (kWh/annum)	406,113
Exhaust Temperature (°C)	510
Flue Internal Diameter (m)	0.5
Efflux Velocity (m/s)	22.2
NOx Emission Rate (mg/kWh)	6,000
PM Emission Rate (mg/kWh)	300

6.11 The odour emissions and release conditions for the exhaust vent on the main reception building roof, as provided by the applicant, are presented in Table 20 below.

Table 20: Odour Emission and Release Conditions

Parameter	Value
Vent height	42.75
Exhaust Temperature (°C)	25
Flue Internal Diameter (m)	1.5
Efflux Velocity (m/s)	11.2
Actual volumetric flow rate (Nm^3/s)	19.7
Odour Emission Concentration (OU_E/m^3)	1,000
Odour Emission Rate (OU_E/s)	19708

Abnormal operation

6.12 Article 46(6) of IED allows ELVs to be exceeded for no more than 4 hours uninterrupted and up to 60 hours per annum. In such scenarios, Annex VI, Part 3, Paragraph 2 specifies that the CO and TOC ELVs must not be exceeded and total PM concentrations must not exceed 150 mg/Nm^3. Limits not to be exceeded are, however, not specified for the other pollutants.

6.13 For those other pollutants, consideration of the short-term impacts on air quality during abnormal operating conditions has been made assuming theoretical failures in the following flue gas treatment (FGT) infrastructure:

- Failure of a filter bag (affecting particulate matter and metal emissions);
- Failure of the lime dosing system (affecting emissions of acid gases, including SO_2, HF and HCl);
- Failure of the activated carbon dosing system (affecting emissions of mercury, PCBs and dioxins); and
- Failure of the urea dosing system (affecting emissions of NOx).

6.14 Emission rates during abnormal operation have been derived assuming the FGT plant achieves the following abatement efficiencies:

- SNCR (NO_X control) – 50% (i.e., NOx emission rates would increase by a factor of 2 during abnormal operation);
- Dry scrubbing (acid gas control) – 90% for HCl and HF (factor of 10 increase during abnormal operation) and 50% for SO_2 (factor of 2 increase);
- Activated carbon dosing – 90% for mercury (factor of 10 increase) and 99% for PCBs and dioxins (factor of 100 increase); and
- As most metals (other than mercury) are solids or bound to particulate matter, emissions of metals (other than mercury) have been pro-rated based on the permitted increase in the dust ELV during abnormal conditions as established under Annex VI, Part 3, Paragraph 2 of IED i.e., metal emissions (other than mercury) would increase by a factor of 5 during abnormal operation.

6.15 Should the Continuous Emissions Monitoring System (CEMS) installed on the stack detect continued exceedances of the ELVs, an automatic interlock will prevent further waste being charged. As the controls in place will minimise any time spent in exceedance to less than 4 hours, only those pollutants with an EAL averaging period of 1 hour or less have been considered. The exception to this is dioxins where, despite the impacts of dioxins being related to chronic effects, where consideration of annual mean concentrations is relevant, based on previous consultation with the Environment Agency on other EfW applications, an assessment of abnormal emissions of dioxins in the context of the TDI has been made.

6.16 The increase in the total bodily uptake of dioxins from that predicted for the normal operation scenario can be calculated using an adjustment factor which reflects 8,700 hours of operation at the normal operation emission concentration, and 60 hours of operation at the abnormal emission concentration:

Adjustment factor = (100 x (60/8760)) + (1 x (8700/8760)) = 1.68 (or a 68% increase in the annual mean dioxins process contribution).

6.17 The effects of the following potential failures or operating conditions have not been considered in the abnormal emissions assessment:

- Failure of combustion air fan – in this scenario, combustion efficiency would be reduced potentially resulting in elevated emissions of CO, VOCs and particulate matter. However, in such a scenario, emissions of CO and VOCs would still be regulated by the ELVs for normal operation as per Annex VI, Part 3, Paragraph 2 of IED. The relevant EAL averaging period for PM_{10} and $PM_{2.5}$ is an annual average (PM_{10} and $PM_{2.5}$) and a daily averaged with up to 35 days of exceedance permitted in a calendar year (PM_{10} only). As operation under abnormal conditions would be restricted to an aggregated 60 hours per annum and less than 4 hours in any one instance, temporary increases to emissions of particulate matter would not make a significant contribution to these metrics.
- Start-up or shut-down – the BAT-AELs and ELVs do not apply to start-up and shut-down conditions. Start-up of the EfW CHP Facility from cold will be conducted with clean support fuel (low sulphur fuel oil). During start-up, waste will not be introduced onto the grate unless the temperature within the secondary chamber is above the 850ºC as required by Article 50 of IED. During startup, the FGT plant will be operational as will the combustion control systems and emissions monitoring equipment.
- The same is true during plant shutdown where waste will cease to be introduced to the grate. The waste remaining on the grate will be combusted, the temperature not being permitted to drop below 850ºC through the combustion of clean support auxiliary fuel. During this period the FGT plant is fully operational, as will be the control systems and monitoring equipment. After complete combustion of the waste, the auxiliary burners will be gradually reduced in load and then turned off before the plant will be allowed to cool.

6.18 It is theoretically possible during certain phases of start-up and shut-down that emission concentrations of certain pollutants could temporarily elevate above normal operating conditions. However, importantly, the reduced load on the EfW CHP Facility during such conditions means that the stack volumetric flow reduces substantially. Hence, although a higher emission concentration may result, the emission rate (i.e., the product of the emission concentration and volumetric flow rate) is not significantly affected. For example, a measurement study carried out for the Environment

Agency[3] identified emission concentrations of dioxins and furans were increased during shutdown and start-up but that the mass of dioxin emitted during shutdown and start-up for a four day planned outage was similar to the emission which would have occurred during normal operation in the same period. Importantly, it is the emission rate which determines the impact on air quality, not the emission concentration.

Receptors and Study Area

6.19 Human health impacts have been predicted over a 10 km x 10 km model domain, with the main stack at the centre. Concentrations have been predicted over this area using nested Cartesian grids (see Figure 6).

6.20 These grids have a spacing of:

- 25 m x 25 m within 1,000 m of the facility; and
- 100 m x 100 m within 5,000 m of the facility.

6.21 This grid is considered to provide a sufficiently high resolution to enable the identification of worst-case impacts throughout the study area. The receptor grid has been modelled at a height of 1.5 m above ground level.

[3] Environment Agency (2008). "Investigation of Waste Incinerator Dioxins During start-up and shutdown operating phases," Report Ref. 10499 – 30140898 AEAT/ENV/R/2563 prepared by AEA Technology

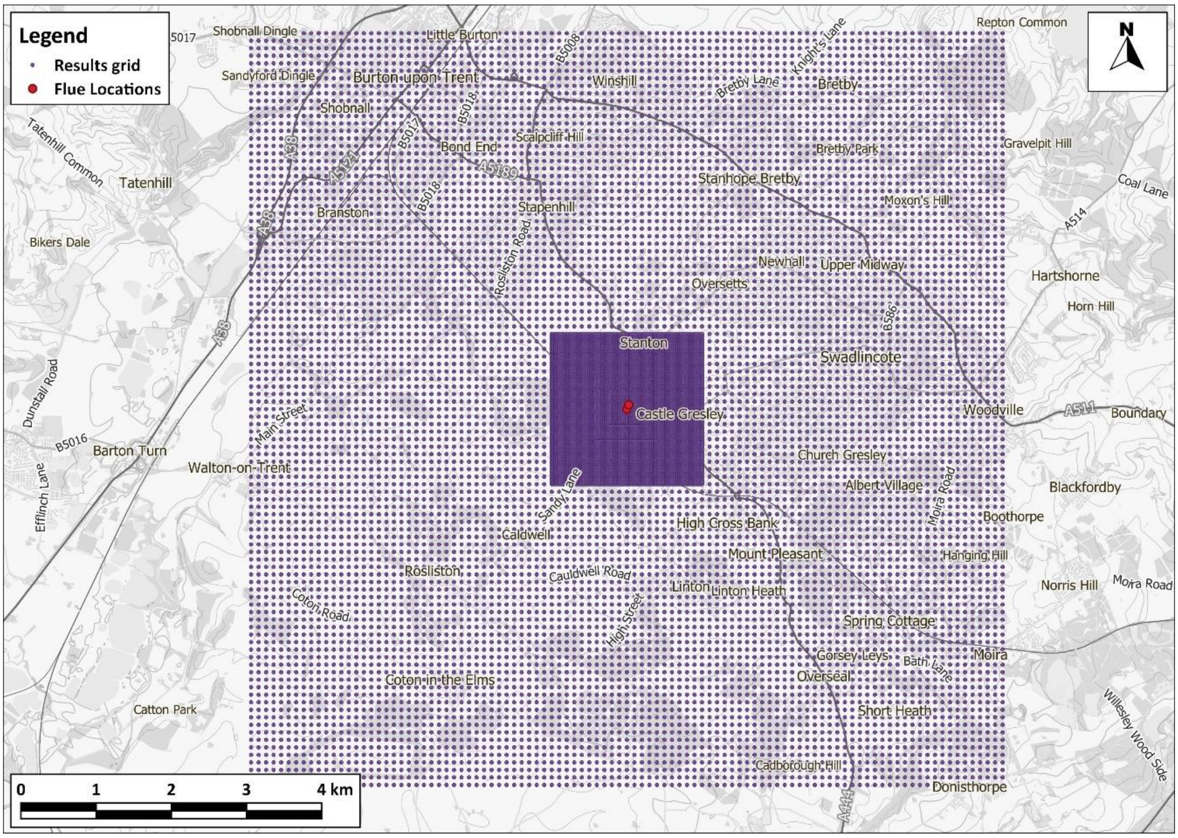

Figure 6: Modelled Receptors Nested Grid

6.22 Specific receptors have also been selected to help determine impacts at locations where the EALs would apply. The specific receptors identified are detailed in Table 21 and shown in Figure 7.

Table 21: Specific Human Health Receptor Coordinates [a]

Receptor ID	Description	X Coordinate	Y Coordinate
H1	Residential	426484	318844
H2	Residential	427068	319256
H3	Residential	427336	319333
H4	Residential	427378	319237
H5	Residential	427388	319018
H6	Residential	427670	318755
H7	Residential	427137	319612
H8	Allotments	426956	319449

[a] All receptors have been modelled at a height of 1.5 m

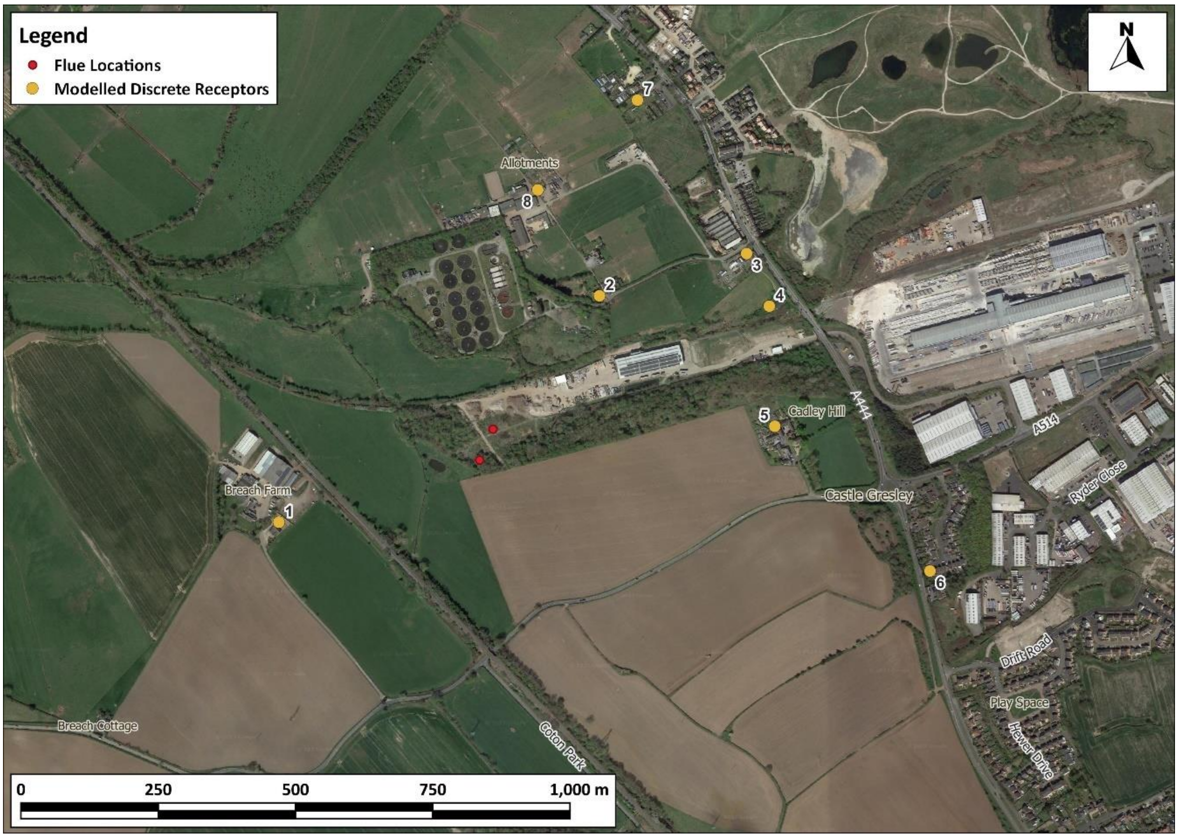

Figure 7: Modelled Discrete Receptors

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Buildings

6.23 Where buildings are a significant height relative to the stack height, building downwash effects may occur. The downwash effects should be accounted for within modelling where the stack is less than 2.5 times the height of the buildings within a distance which is five times the minimum of the stack height and the maximum projected width of the building.

6.24 In order to test the sensitivity of the model domain to building downwash effects, the model has been run with and without buildings.

6.25 Modelled buildings are shown in Figure 4, and the dimensions of all buildings are given in Table 22. The sensitivity of the model domain to building configuration is provided in Table 26.

Table 22: Modelled Building Dimensions

Building	Height (m)	Width (m)	Length / Diameter (m)	Rotation (º)
Building005	40	36.7	46.0	76.0
Building001	35	13.8	15.4	74.9
Building002	26	15.4	39.9	76.1
Building003	20	18.3	64.5	76.1
Building004	40	55.1	25.7	74.6
Building006	23	42.0	23.5	74.7
Building007	12	33.8	74.1	76.0
Building008	12	36.7	120.2	77.0
Building009	5	4.9	14.9	76.5

Surface Roughness

6.26 The study area encompasses a range of land types. A variable surface roughness file has been used to represent the spatial variation of the surface roughness over each land type as shown in Figure 8. In order to test the sensitivity of the model domain to variability in surface roughness, the model has also been run using a uniform surface roughness length of 0.2 m throughout the entire model domain.

6.27 The following parameters have been used regarding surface roughness and land type:

- forest – 1 m;
- built-up area – 0.5 m;
- grassland – 0.2 m; and
- water – 0.0001 m.

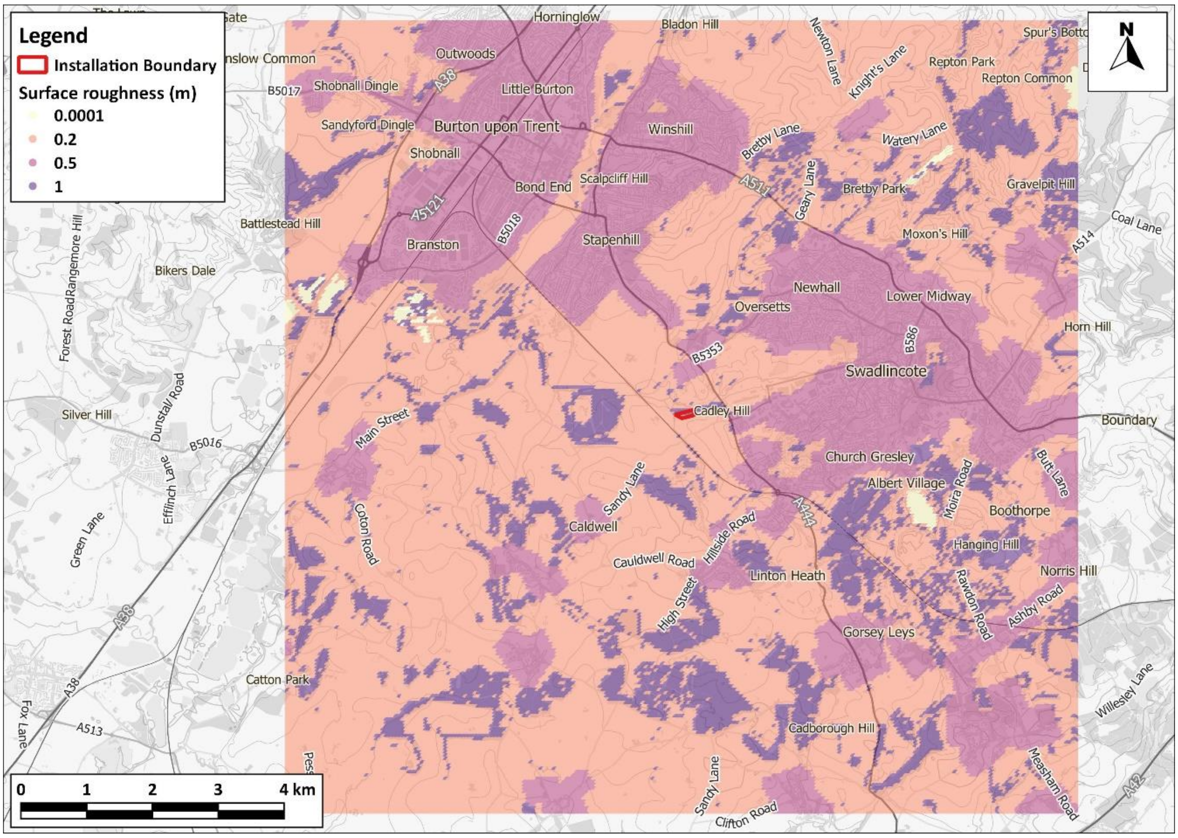

Figure 8: Surface Roughness across Modelled Area

Terrain Effects

6.28 The ADMS User Guide recommends that the effect of terrain should only be included if the gradient in the study area exceeds 1:10. The focus of the study area (i.e., where the sensitive receptors are located) extends across an area which is predominantly flat, although there are some slopes with gradients above the 1:10 threshold. On this basis, the assessment has considered a core modelling scenario with OS Terrain 50 data, as shown in Figure 3, in line with the model developers' recommendations. A terrain sensitivity test without terrain has also been included.

Meteorological Data

6.29 In order to allow for uncertainties in local and future-year conditions, the dispersion model has been run five times, with each run using a different full year of hour-by-hour meteorological data from the nearest appropriate meteorological site. For each individual receptor point on the nested Cartesian grids, the maximum predicted concentration across any of the five meteorological datasets has then been determined. It is these maxima which are presented.

6.30 Hourly sequential meteorological data from the Sutton Bonnington have been used for the years 2017-2021 inclusive. The Sutton Bonnington meteorological monitoring station is located approximately 24.7 km to the northeast of the site. It is deemed to be the nearest monitoring station representative of meteorological conditions at the site. The Sutton Bonnington meteorological station is operated by the UK Meteorological Office. Raw data were provided by the Met Office, and processed by AQC for use in ADMS.

6.31 The meteorological parameters entered into the model are shown in Table 23. Wind roses for each year are presented in Appendix A1.

Table 23: Meteorological Parameters Entered into the ADMS Model

Parameter	Modelled Receptors (including Cartesian Grids)	Meteorological Site
Surface Roughness	Variable Surface Roughness File	0.2 m
Minimum MO length	10 m	1 m
Surface Albedo	0.23[a]	0.23[a]
Priestly-Taylor Parameter	1[a]	1[a]

[a] Model default value

Model Post-Processing

6.32 The model has been run assuming constant operation. This ensures that all potential meteorological conditions are accounted for and provides a worst-case assessment. The maximum predicted concentrations from the core model scenario in any meteorological year have been determined and presented for the worst-case receptor points.

6.33 However, modelled annual mean concentrations from the generator have been scaled down by a factor of 168/8760 to more accurately reflect the operating profile of the generator, which will only be operating for up to 168 hours per year.

Deposition

6.34 Deposition of nitrogen oxides to ecosystems has not been calculated within the dispersion model because the principal depositing component of concern is nitrogen dioxide and this is calculated from nitrogen oxides outside of the model. Instead, deposition of nitrogen dioxide, as well as sulphur dioxide, has been calculated from the predicted ambient concentrations using the deposition velocities taken from AQTAG06 (2011), as outlined in Table 24. Deposition velocities refer to a height above ground, typically 1 or 2 m, although in practice the precise height makes little difference and here they have been applied to concentrations predicted at a height of 1.5 m above ground. The velocities are applied by multiplying the predicted pollutant concentration (µg/m^3) by the velocity (m/s) to predict a deposition flux (µg/m^2/s). Subsequent calculations required to present the data as kg/ha/yr (nutrient nitrogen) or keq/ha/yr (acidification) follow chemical and mathematic rules. Dry deposition of ammonia and HCl have been modelled explicitly.

Table 24: Dry Deposition Velocities

Pollutant	Habitat Type	Velocity (m/s)
NO_2	Grassland	0.0015
	Forest	0.003
SO_2	Grassland	0.012
	Forest	0.024

6.35 Wet deposition of the emitted pollutants close to the emission source will be restricted to wash-out, or below cloud scavenging. For this to occur, rain droplets must come into contact with the gas molecules before they hit the ground. Falling raindrops displace the air around them, effectively pushing gasses away. AQTAG06 guidance (2011) is that the wet deposition of sulphur dioxide, nitrogen dioxide and ammonia is not significant within a short range. It has thus not been included. In the case of HCl, wet deposition has been modelled explicitly using the default washout coefficients in ADMS-6.

6.36 Deposition may have an acidifying effect through the release of acid protons during chemical transformation in the soil or biota. Thus, even alkaline gases such as ammonia can have an acidifying effect. The acidity Critical Loads are expressed as equivalents ('eq'), referring to the molar equivalent of potential acidity. This is calculated from the mass (in g) of the deposited element, taking account of both its atomic mass and its valency. For example, the acidifying potential (in eq) of both ammonium (NH_4^+) and nitrate (NO_3^-) is 1/14 times the deposited mass in grammes (with 14 being the atomic mass of nitrogen), while for sulphate (SO_4^{2-}) it is 2/32 (with 32 being the atomic mass of sulphur). The species included in the calculation of acid deposition, and their calculated acidifying potentials, are set out in Table 25.

Table 25: Species Included in Acid Deposition Calculations

Pollutant	Calculation (kg deposition to keq)
N (from deposited NO_2, Ammonia)	0.071
S (from deposited SO_2)	0.062
Cl (from deposited HCl)	0.028

Uncertainty

6.37 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which are both variable and uncertain. The general conservativeness of the method to calculate the emission rates reduces the uncertainties as much as practically possible.

6.38 There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. Where these parameters have been estimated the approach has been to use reasonable worst-case assumptions.

Sensitivity Tests

6.39 As discussed above, the point source dispersion model used in this assessment is required to simplify real-world conditions into a series of algorithms. This is because atmospheric turbulence is a stochastic (random) process which cannot be completely resolved by deterministic methods. These simplifications introduce uncertainties that cannot be easily quantified, and it is generally not possible to verify point-source model outputs. Acknowledging this fact, a number of sensitivity tests have been undertaken to investigate some of the key modelling uncertainties associated with the model created for this assessment. Based on this model setup, it is deemed appropriate to run sensitivity tests of the following parameters:

- Surface Roughness;
- Buildings; and
- Terrain.

6.40 It is important to emphasise that the aim of the sensitivity analysis is not to find a model setup that obtains the maximum possible prediction from the model, but to provide greater understanding of how assumptions on key input variables may affect the assessment, so that these factors can be considered when evaluating the significance of potential effects.

6.41 Sensitivity tests have been undertaken by running the model, with and without the above parameters, or with different configurations, in order to quantify the impact these model options may have on predicted concentrations. In the case of the surface roughness sensitivity test, the model was run using a fixed surface roughness of 0.2 m instead of variable surface roughness.

6.42 The results of the sensitivity test at the worst-case receptor have been compared and presented as a ratio to the base model (assuming the base model is that described in Section 8). For example, a value of 0.8 in the table indicates the maximum result from the sensitivity test is 20% smaller than the base model, whilst a value of 1.2 indicates the maximum result from the sensitivity test is 20% greater than the base model.

6.43 Table 26 presents the sensitivity tests for the annual and 1-hour (99.79th percentile) means for NO_2 (as this pollutant resulted in the largest modelled concentrations). The analysis indicated that the 1-hour averaging period is more sensitive to model configuration than the annual mean. The model setup is most sensitive to the removal of buildings with maximum modelled concentrations approximately four times lower than in the core model run. This is because the removal of buildings removes downwash effects, resulting in lower concentrations at nearby receptors. The model is also sensitive to surface roughness, particularly for the 1-hour averaging period; maximum 1-hour concentrations are more than two-thirds of those from the core model when a fixed surface roughness is used rather than variable surface roughness. The model is relatively insensitive to the effects of terrain, with the long-term results within 5% of the core model outputs. This is likely a consequence of the largely flat nature of terrain within the model domain, particularly within the vicinity of the Site.

Table 26: Model Sensitivity Results (Maximum at Receptor)

Model Sensitivity Test	NO_2 Annual (Dimensionless)	NO_2 1 hour (99.79th %ile) (Dimensionless)
Core Model (with buildings, variable surface roughness and no terrain)	1	1
Fixed Surface Roughness (with buildings, fixed surface roughness of 0.2 m for model domain and with terrain)	0.93	0.61
No Buildings (variable surface roughness and with terrain)	0.77	0.27
No Terrain (with buildings and variable surface roughness)	1.05	1.02

6.44 To illustrate how inter-year variations in meteorological conditions affect the model output, Table 27 presents the normalised maximum process contribution (i.e., the result for each year expressed as a ratio of the year producing the highest prediction) at the receptor location with the maximum concentration for the individual years assessed. In the assessment in Section 8, the highest prediction from any year for each individual receptor is reported.

Table 27: Normalised Maximum PCs for Each Modelled Year

Year	NO_2 Annual (Dimensionless)	NO_2 1 hour (99.79th %ile) (Dimensionless)
2017	1.000	0.799
2018	0.747	1.000
2019	0.883	0.998
2020	0.913	0.988
2021	0.749	0.777

Summary

6.45 On balance, the approach taken to meteorological conditions, emission rates and the assumption that all sources will operate continuously throughout the year, the core scenario can be expected to represent a realistic worst-case impact of site emissions.

7 Assessment Approach

Air

7.1 The Environment Agency's *air emissions risk assessment for your environmental permit*[4] (previously Horizontal Guidance Note H1) provides methods for quantifying the environmental impacts of emissions to air. This compares predicted process contributions (PC) and predicted environmental concentrations (PEC, i.e., PC in addition to background) to both long- and short-term environmental standards. These standards primarily include guideline Environmental Assessment Levels and statutory AQS.

7.2 Air emission risk assessments for environmental permits require a three-tiered approach to assessing the significance of emissions to atmosphere. The first stage is to 'screen out' insignificant emissions to air using the H1 screening tool; these are emissions which are emitted in such small quantities that they are unlikely to cause a significant impact on ground level concentrations. The Environment Agency's guidance suggests that emissions are insignificant where PCs are less than:

- 10% of a short-term environmental standard (includes hourly or 8-hourly mean values); or
- 1% of a long-term environmental standard (applies to annual mean values).

7.3 This is the case regardless of the total concentration or deposition flux (i.e. the PC + the local baseline, or the Predicted Environmental Concentration 'PEC').

7.4 For local nature conservation sites (such as LWS and ancient woodlands), the EA states that PCs are insignificant where they are less than 100% of either a long-term or short-term standard (EA, 2023).

7.5 For those emissions that cannot be screened out as insignificant, the guidance indicates that further modelling of emissions may be appropriate for long term effects where the PEC is greater than 70% of the long-term environmental benchmark. For short-term effects, further modelling of emissions is required where the PC is more than 20% of the difference between twice the (long term) background concentration and the relevant short term environmental benchmark (i.e., more than 20% of the model 'headroom').

7.6 In any resultant modelling assessment, the EA guidance explains no further action is required where impacts are below the above insignificance criteria or the assessment shows that both of the following apply:

- Emissions comply with Best Available Technique Associated Emission Levels (BAT-AELs) or the equivalent requirements where there is no BAT-AEL; and

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

- The resulting PECs will not exceed environmental standards.

7.7 On the basis of the above, in the first instance, the approach has been to present PCs at both human health and ecological receptors as a result of operation of the Site. Where impacts cannot be screened out as insignificant on the basis of the PCs, the PECs have then been considered.

7.8 For human health receptors, contour plots have also been provided to highlight the area within which PCs from the Site cannot be considered insignificant using the PC criteria outlined in Paragraph 7.2. A judgement of significance has then been reached based on the potential for the Site to cause an exceedance of the AQS.

7.9 For the designated ecological sites, the assessment has focused on the maximum PCs within the designated sites.

7.10 For the assessment of trace metals, the Environment Agency's Guidance Note for Metals (Environment Agency, 2016) has been used. The guidance note strictly only applies to Group III metals in stack emissions, but the approach has been used for all metals. It provides a three-step approach to the assessment, which is outlined below:

- Step 1 (Screening Scenario): Model predictions assume each metal is emitted at the maximum BREF Emission Limit Value (ELV) of 0.3 mg/Nm^3 as a worst-case[5]. Assessment of the impact is then made against the following parameters:
  - Long-term PC <1% or short-term PC <10% of the AQO or EAL; or
  - Long-term and short-term PEC <100% of the AQO or EAL (taking likely modelling uncertainties into account).
- Step 2 (Worst Case Scenario Based on Operational Plant): Where the Step 1 screening criteria set out in the guidance are not met, an emission concentration equal to the maximum measured concentration of the pollutant as per the EA guidance has been assumed, and an assessment made against the same criteria specified for Step 1.
- Step 3: If the screening criteria are not met in Step 2, typical emission concentrations for energy from waste plants have been used, as specified in the guidance.

Odour

7.11 For assessment against the odour benchmarks, if the odour concentrations are less than the relevant odour benchmarks in Paragraph 4.10, the effects are judged to be not significant.

5 The BREF-EAL of 0.3 mg/Nm^3 has been used in preference to the IED ELV, since the plant will need to comply with the more stringent emission limits.

8 Results

ERF Main Stack

Human Health

8.1 The maximum predicted PCs from the main stack at the ERF at any location on the modelled receptor grid have been compared with the relevant screening criteria described in Paragraph 7.2. The results are set out in Table 28, with the conclusions based on the screening criteria for the PCs set out in the final column.

8.2 The PCs can be screened as insignificant for most pollutants and averaging periods; more detailed assessment for those that cannot be screened at this stage is provided in the sections below.

Table 28: Maximum Predicted PCs in the Study Area (µg/m^3)

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Nitrogen Dioxide	Annual mean	1.3	40	**3.2**	**Yes**
	1-hour mean	40.4	200	**20.2**	**Yes**
PM_{10}	Annual mean	0.07	40	0.2	No
	24-hour mean	2.03	50	4.1	No
$PM_{2.5}$ [a]	Annual mean	0.07	20	0.4	No
SO_2	24-hour mean	6.4	125	5.1	No
	1-hour mean	57.4	350	**16.4**	**Yes**
	15-minute mean	62.5	266	**23.5**	**Yes**
CO	8-hour rolling mean	29.0	10,000	0.3	No
	1-hour mean	39.2	30,000	0.1	No
HF	Monthly mean	0.02	16	0.1	No
	1-hour mean	1.57	160	1.0	No
HCl	1-hour mean	23.5	750	3.1	No
TOC as Benzene [b]	Annual mean	0.15	5	**3.0**	**Yes**
	24-hour mean	5.2	30	**17.5**	**Yes**
1,3-butadiene	Annual mean	0.15	2.25	**6.7**	**Yes**
Cadmium	Annual mean	0.0003	0.005	**6.0**	**Yes**
Mercury	Annual mean	0.0002	0.25	0.1	No
	1-hour mean	0.004	7.5	0.1	No
Antimony	Annual mean	0.005	5	0.1	No
	1-hour mean	0.118	150	0.1	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Arsenic	Annual mean	0.005	0.006	**75.2**	**Yes**
Lead	Annual mean	0.005	0.25	**1.8**	**Yes**
Chromium (III)	Annual mean	0.005	5	0.1	No
	1-hour mean	0.118	150	0.1	No
Chromium (VI)	Annual mean	0.005	0.00025	**1805**	**Yes**
Copper	Annual mean	0.005	10	<0.1	No
	1-hour mean	0.118	200	0.1	No
Manganese	Annual mean	0.005	0.15	**3.0**	**Yes**
	1-hour mean	0.118	1,500	<0.1	No
Nickel	Annual mean	0.005	0.02	**22.6**	**Yes**
Vanadium	Annual mean	0.005	5	0.1	No
	24-hour mean	0.08	1	7.9	No
NH_3	Annual mean	0.15	180	0.1	No
	1-hour mean	3.9	2500	0.2	No
PCDD/F	Annual mean	$9.02x10^{-10}$	$3x10^{-7}$	0.3	No
PAH (as B[a]P)	Annual mean	$2.26x10^{-6}$	0.00025	0.9	No
PCBs	Annual mean	$1.20x10^{-9}$	0.2	<0.1	No
	1-hour mean	$3.14x10^{-8}$	6	<0.1	No

[a] There is no numerical $PM_{2.5}$ objective for national and local authorities. Convention is to assess against the UK limit value which is currently 20 µg/m³.

[b] TOC assessed against the AQO for benzene.

Nitrogen Dioxide

Annual Mean

8.3 Table 29 sets out the maximum predicted annual mean nitrogen dioxide PC and PEC from the main stack at the ERF. The maximum PEC is less than 70% of the EAL, and so following EA guidance, the impact on annual mean nitrogen dioxide concentrations can be described as not significant.

Table 29: Maximum PC and PEC for Annual Mean Nitrogen Dioxide (µg/m³)

Objective	EAL	PC	Background	PEC	PEC as % of EAL
Annual mean	40	1.26	18.9	20.2	50.4

8.4 A contour plot of the area where the maximum annual NO_2 PC from any of the five meteorological years considered is greater than 0.4 µg/m³ (1% of the AQ) is presented in Figure 9. This area extends up to approximately 1.5 km from the stacks and encompasses multiple residential properties.

However, as demonstrated by the maximum PEC presented in Table 29 above, the impacts at these receptors would not be significant.

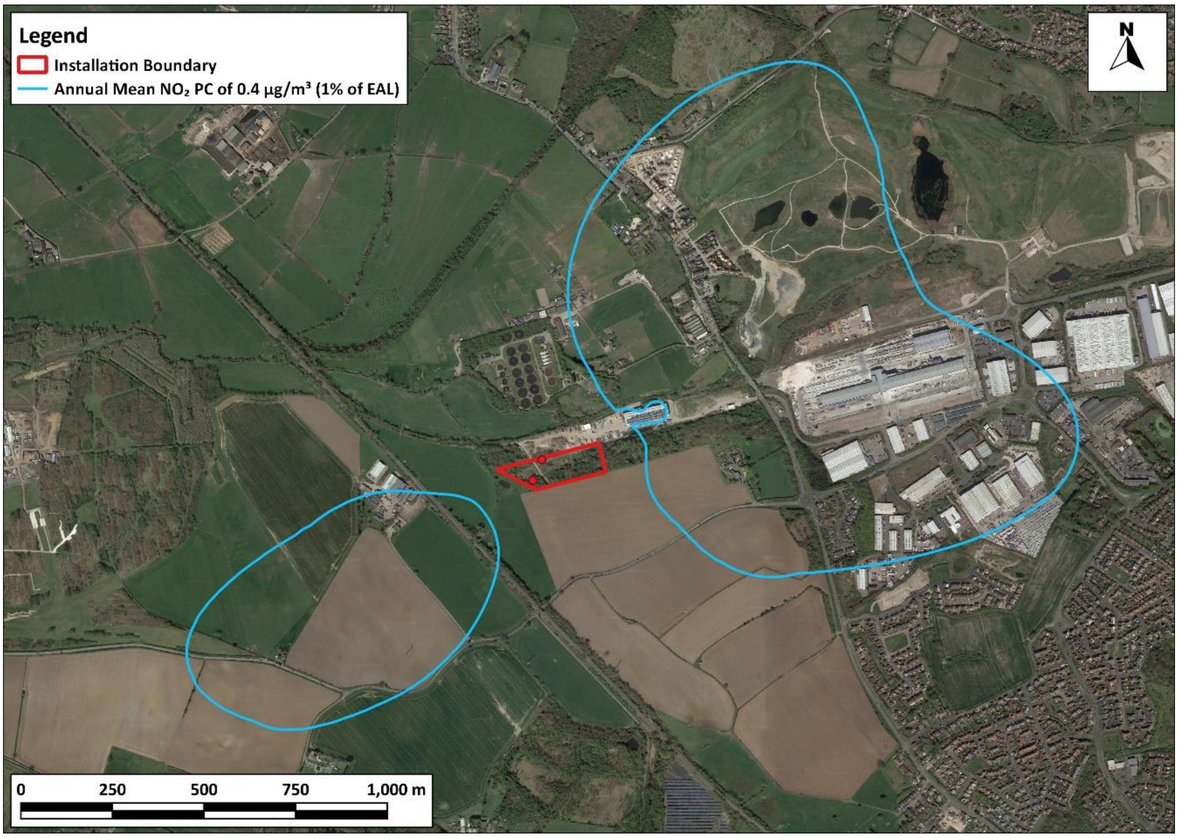

Figure 9: Annual Mean Nitrogen Dioxide Process Contributions (Ground Level)

Imagery ©2023 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

1-hour Mean

8.5 Table 30 sets out the maximum predicted 99.79th percentile nitrogen dioxide PC, and the adjusted EAL for 1-hour mean nitrogen dioxide i.e., the EAL minus the baseline concentration. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 1-hour mean nitrogen dioxide can be described as not significant.

Table 30: Maximum PC and Adjusted EAL 1-hour Mean Nitrogen Dioxide (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL (EAL minus background)	PC as % of Adjusted EAL	PEC	PEC as % of EAL
1-hour mean	200	40.4	37.8	162.2	24.9	78.2	39.1

[a] Equal to twice the annual mean background concentration, in accordance with EA guidance. The maximum background concentration anywhere within the study area has been used, to provide a robust assessment.

8.6 A contour plot of the area where the maximum hourly NO_2 PCs from any of the five meteorological years considered is greater than 20 µg/m^3 (10% of the AQ) is presented in Figure 10. This area extends up to approximately 700 m from the stack and encompasses a few residential properties. However, as demonstrated by the maximum PEC presented in Table 30 above, the impacts at these receptors would not be significant.

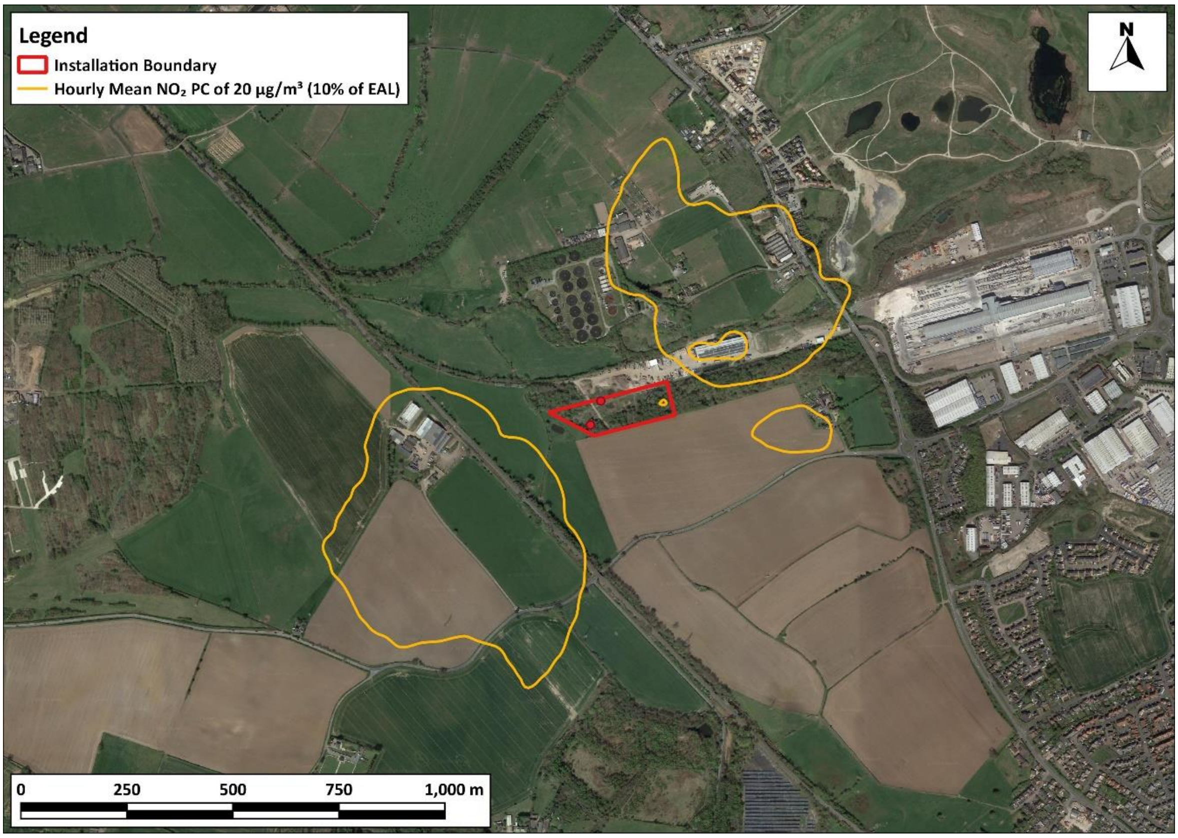

Figure 10: 99.79th Percentile Nitrogen Dioxide Process Contributions (Ground Level)

Imagery ©2023 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

Sulphur Dioxide

1-hour Mean

8.1 Table 31 sets out the maximum predicted 99.73th percentile sulphur dioxide PC, and the adjusted EAL for 1-hour mean sulphur dioxide. The maximum PC is less than 20% of the adjusted EAL, and so following EA guidance, the impact on 1-hour mean sulphur dioxide can be described as not significant.

Table 31: Maximum PC and Adjusted EAL 1-hour Mean Sulphur Dioxide (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL
1-hour mean	350	57.4	5.2	344.8	16.6

15-minute Mean

8.2 Table 32 sets out the maximum predicted 99.9th percentile sulphur dioxide PC, and the adjusted EAL for 15-minute mean sulphur dioxide. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 15-minute mean sulphur dioxide can be described as not significant.

Table 32: Maximum PC and Adjusted EAL 15-minute Mean Sulphur Dioxide (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
15-minute mean	266	62.5	5.2	260.8	24.0	67.7	25.4

TOC as Benzene

Annual Mean

8.3 Table 33 sets out the maximum predicted PC to annual mean TOC concentrations (as benzene), and the maximum PEC for annual mean TOC concentrations. The maximum PEC is less than 70% of the relevant EAL for benzene, and so the impact is considered to be not significant.

Table 33: Maximum PC and PEC for TOC (as Benzene) (µg/m^3)

Objective	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	5	0.15	0.44	0.59	11.8

[a] See Table 11.

24-hour Mean

8.4 Table 34 sets out the maximum predicted PC to 24-hour mean TOC (as benzene) concentrations, and the adjusted EAL for annual mean TOC concentrations. The maximum PC is less than 20% the adjusted EAL for benzene, and so the impact is considered to be not significant.

Table 34: Maximum PC and Adjusted EAL for TOC (as Benzene) (µg/m^3)

Objective	EAL	PC	Background [a]	Adjusted EAL	PC as % of Adjusted EAL
24-hour mean	30	5.2	0.88	29.1	18.0

[a] See Table 11.

TOC as 1,3-butadiene

8.5 Table 35 sets out the maximum predicted PC to annual mean 1,3-butadiene concentrations, and the maximum PEC for annual mean 1,3-butadiene concentrations at any sensitive receptor. The maximum PEC is less than 70% of the relevant EAL, and the impact is considered to be not significant.

Table 35: Maximum PC and PEC for TOC (as 1,3-butadiene) (µg/m^3)

Averaging Period	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	2.25	0.15	0.18	0.33	14.7

[a] See Table 11.

Cadmium

8.6 Table 36 sets out the maximum predicted PC to annual mean cadmium concentrations, and the maximum PEC for annual mean cadmium concentrations at any sensitive receptor. The maximum PEC is less than 70% of the relevant EAL, and the impact is considered to be not significant.

Table 36: Maximum PC and PEC for Cadmium (µg/m^3)

Averaging Period	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	0.005	0.0003	0.0003	0.0006	11.9

[a] See Table 12.

Group III Metals

8.7 The assessment of Group III metals follows the recommended methodology described by the Environment Agency in its ‘Guidance to Applicants on Impacts for Group 3 Metals’ (Environment Agency, 2016). The methodology set out in the EA guidance describes a three-step approach to the assessment of trace metals in stack emissions, as outlined in Paragraph 7.10.

Step 1: Worst-case Screening Scenario

8.8 On the basis of initial screening of the PCs (Table 28), further assessment is required for long-term concentrations of arsenic, lead, chromium (VI), manganese and nickel. The impacts from all other Group III metals for long-term concentrations, and for all Group III metals for short-term concentrations, are considered to be not significant.

8.9 The annual mean PECs for Group III metals that could not be initially screened out are shown in Table 37. Using the screening criteria for the PEC, the impacts of lead, manganese and nickel can be considered not significant, as the PECs are less than 70% of the EAL. Assessment of arsenic and chromium (VI) must proceed to Step 2, as the PEC is greater than 70% of the EAL.

Table 37: Group III Metals Assessment Step 1: Emissions at 100% BREF Emission Limit (μg/m³)

Metal	EAL	PC	Background [a]	PEC	PEC as % of EAL [b]
Arsenic	0.006	0.005	0.001	0.005	**88.5**
Lead	0.25	0.005	0.008	0.012	4.8
Chromium (VI)	0.00025	0.005	0.00033	0.005	**1,937**
Manganese	0.15	0.005	0.008	0.012	8.2
Nickel	0.02	0.005	0.002	0.006	31.6

[a] See Table 12.

[b] Based on unrounded values.

Step 2: Case Specific Screening Based on Operational Plant

8.10 Step 2 of the EA's approach then advises that the Group III metal emissions are factored in accordance with the *maximum* measured emission concentration (derived from 34 measured values at plant operating between 2007 and 2015) listed in Appendix A of the Guidance. The revised PCs (and if necessary, PECs) are then compared to the screening criteria. The results of the Step 2 screening stage are presented in Table 38.

Table 38: Group III Metals Assessment Step 2: Process Contributions at Maximum Measured Emission Concentration (μg/m³)

Metal	Averaging Period	EAL	PC	PC as % EAL	Further Assessment Required
Arsenic	Annual mean	0.006	0.00038	6.3	**Yes**
Chromium (VI)	Annual mean	0.00025	1.96×10^{-5}	0.8	No

8.11 On the basis of the maximum measured emission concentrations, the impact on annual mean chromium (VI) can be screened as not significant, as the revised PC does not exceed 1% of the long-term EAL. Further assessment, involving the calculation of the PEC, is required for arsenic, as the revised PC exceeds 1% of the long-term EAL. The results of the PEC assessment are presented in Table 39.

Table 39: Group III Metals Assessment Step 2: PECs at Maximum Measured Emission Concentration (μg/m³)

Metal	EAL	PC	Background [a]	PEC	PEC as % of EAL
Arsenic	0.006	0.00038	0.001	0.001	19.6

8.12 The PEC based on the maximum measured emission concentration for arsenic is less than 70% of the long-term EAL, and as such the impacts for long-term arsenic concentrations are also not significant. Consequently, there is no requirement to proceed to the third stage of assessment (justification of emission concentrations and assumptions on background concentrations other than those specified in the guidance).

Ecosystems

8.13 The predicted nitrogen oxides, sulphur dioxide, hydrogen fluoride and ammonia PCs, and the nutrient nitrogen deposition and acid deposition rates associated with the main stack from the ERF have been compared to the EA screening criteria. The results are set out in Table 40 for the River Mease SAC/SSSI and the Carver's Rocks, Ticknall Quarries and Calke Park SSSIs, in Table 41 for the Hall Wood ancient woodland site and the Badgers Hollow LNR, and in Table 42 for the LWS.

8.14 Results are only presented for nutrient nitrogen deposition and acid deposition at the sites for which critical loads have been defined. A screening criterion of 1% is used for annual mean averaging periods while 10% used for all other (shorter) averaging periods to define the need for a detailed assessment for SACs and SSSIs. A screening criterion of 100% of the EAL is used for both long and short-term averaging periods for local nature sites (ancient woodland, LNR and LWS).

Table 40: Maximum Predicted PCs to River Mease SAC/SSSI, Carver's Rocks SSSI, Ticknall Quarries SSSI and Calke Park SSSI

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
River Mease SAC/SSSI					
Nitrogen Oxides	Annual mean	0.058 µg/m³	30 µg/m³	0.2	No
	24-hour mean	0.89 µg/m³	75 µg/m³	1.2	No
Sulphur Dioxide	Annual mean	0.015 µg/m³	20 µg/m³	0.1	No
Hydrogen Fluoride	24-hour mean	0.030 µg/m³	5 µg/m³	0.6	No
	Weekly mean	0.004 µg/m³	0.5 µg/m³	0.8	No
Ammonia	Annual mean	0.005 µg/m³	3 µg/m³	0.2	No
Carver's Rocks SSSI					
Nitrogen Oxides	Annual mean	0.105 µg/m³	30 µg/m³	0.3	No
	24-hour mean	0.922 µg/m³	75 µg/m³	1.2	No
Sulphur Dioxide	Annual mean	0.026 µg/m³	20 µg/m³	0.1	No
Hydrogen Fluoride	24-hour mean	0.031 µg/m³	5 µg/m³	0.6	No
	Weekly mean	0.004 µg/m³	0.5 µg/m³	0.7	No
Ammonia	Annual mean	0.009 µg/m³	3 µg/m³	0.3	No
Nutrient Nitrogen Deposition	Annual mean	0.027 kgN/ha/yr	10 kgN/ha/yr	0.3	No
Acid Deposition	Annual mean	0.011 keq/ha/yr	1.284 keq/ha/yr	0.96	No
Ticknall Quarries SSSI					
Nitrogen Oxides	Annual mean	0.086 µg/m³	30 µg/m³	0.3	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
	24-hour mean	0.760 µg/m^3	75 µg/m^3	1.0	No
Sulphur Dioxide	Annual mean	0.02 µg/m^3	20 µg/m^3	0.1	No
Hydrogen Fluoride	24-hour mean	0.025 µg/m^3	5 µg/m^3	0.5	No
	Weekly mean	0.003 µg/m^3	0.5 µg/m^3	0.7	No
Ammonia	Annual mean	0.007 µg/m^3	3 µg/m^3	0.2	No
Nutrient Nitrogen Deposition	Annual mean	0.018 kgN/ha/yr	10 kgN/ha/yr	0.2	No
Acid Deposition	Annual mean	0.009 keq/ha/yr	2.756 keq/ha/yr	0.3	No
Calke Park SSSI					
Nitrogen Oxides	Annual mean	0.091 µg/m^3	30 µg/m^3	0.3	No
	24-hour mean	0.662 µg/m^3	75 µg/m^3	0.9	No
Sulphur Dioxide	Annual mean	0.023 µg/m^3	20 µg/m^3	0.1	No
Hydrogen Fluoride	24-hour mean	0.022 µg/m^3	5 µg/m^3	0.4	No
	Weekly mean	0.003 µg/m^3	0.5 µg/m^3	0.6	No
Ammonia	Annual mean	0.008 µg/m^3	3 µg/m^3	0.3	No

Table 41: Maximum Predicted PCs to Hall Wood Ancient Woodland Site and Badgers Hollow Local Nature Reserve

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Hall Wood Ancient Woodland					
Nitrogen Oxides	Annual mean	0.329 µg/m^3	30 µg/m^3	1.1	No
	24-hour mean	2.86 µg/m^3	75 µg/m^3	3.8	No
Sulphur Dioxide	Annual mean	0.082 µg/m^3	20 µg/m^3	0.4	No
Hydrogen Fluoride	24-hour mean	0.095 µg/m^3	5 µg/m^3	1.9	No
	Weekly mean	0.01 µg/m^3	0.5 µg/m^3	2.1	No
Ammonia	Annual mean	0.027 µg/m^3	3 µg/m^3	0.9	No
Nutrient Nitrogen Deposition	Annual mean	0.067 kgN/ha/yr	10 kgN/ha/yr	0.7	No
Acid Deposition	Annual mean	0.047 keq/ha/yr	2.982 keq/ha/yr	1.6	No
Badgers Hollow Local Nature Reserve					
Nitrogen Oxides	Annual mean	0.220 µg/m^3	30 µg/m^3	0.7	No
	24-hour mean	6.256 µg/m^3	75 µg/m^3	8.3	No
Sulphur Dioxide	Annual mean	0.055 µg/m^3	20 µg/m^3	0.3	No
Hydrogen Fluoride	24-hour mean	0.209 µg/m^3	5 µg/m^3	4.2	No
	Weekly mean	0.012 µg/m^3	0.5 µg/m^3	2.3	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Ammonia	Annual mean	0.018 µg/m^3	3 µg/m^3	0.6	No
Nutrient Nitrogen Deposition	Annual mean	0.045 kgN/ha/yr	10 kgN/ha/yr	0.5	No
Acid Deposition	Annual mean	0.035 keq/ha/yr	2.728 keq/ha/yr	1.3	No

Table 42: Maximum Predicted PCs to Local Wildlife Sites

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Bretby Railway LWS					
Nitrogen Oxides	Annual mean	0.353 µg/m^3	30 µg/m^3	1.2	No
	24-hour mean	6.86 µg/m^3	75 µg/m^3	9.1	No
Sulphur Dioxide	Annual mean	0.088 µg/m^3	20 µg/m^3	0.4	No
Hydrogen Fluoride	24-hour mean	0.229 µg/m^3	5 µg/m^3	4.6	No
	Weekly mean	0.023 µg/m^3	0.5 µg/m^3	4.7	No
Ammonia	Annual mean	0.030 µg/m^3	3 µg/m^3	1.0	No
Nutrient Nitrogen Deposition	Annual mean	0.073 kgN/ha/yr	10 kgN/ha/yr	0.7	No
Acid Deposition	Annual mean	0.054 keq/ha/yr	2.727 keq/ha/yr	2.0	No
Bretby Disused Railway LWS					
Nitrogen Oxides	Annual mean	0.535 µg/m^3	30 µg/m^3	1.8	No
	24-hour mean	5.63 µg/m^3	75 µg/m^3	7.5	No
Sulphur Dioxide	Annual mean	0.134 µg/m^3	20 µg/m^3	0.7	No
Hydrogen Fluoride	24-hour mean	0.188 µg/m^3	5 µg/m^3	3.8	No
	Weekly mean	0.015 µg/m^3	0.5 µg/m^3	3.0	No
Ammonia	Annual mean	0.045 µg/m^3	3 µg/m^3	1.5	No
Nutrient Nitrogen Deposition	Annual mean	0.110 kgN/ha/yr	10 kgN/ha/yr	1.1	No
Acid Deposition	Annual mean	0.078 keq/ha/yr	2.982 keq/ha/yr	2.6	No
Cadley Hill Railway Area LWS					
Nitrogen Oxides	Annual mean	1.25 µg/m^3	30 µg/m^3	4.2	No
	24-hour mean	12.00 µg/m^3	75 µg/m^3	16	No
Sulphur Dioxide	Annual mean	0.313 µg/m^3	20 µg/m^3	1.6	No
Hydrogen Fluoride	24-hour mean	0.400 µg/m^3	5 µg/m^3	8.0	No
	Weekly mean	0.033 µg/m^3	0.5 µg/m^3	6.6	No
Ammonia	Annual mean	0.104 µg/m^3	3 µg/m^3	3.5	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Nutrient Nitrogen Deposition	Annual mean	0.257 kgN/ha/yr	10 kgN/ha/yr	2.6	No
Acid Deposition	Annual mean	0.191 keq/ha/yr	2.982 keq/ha/yr	6.4	No
Breach Leys Farm Meadow LWS					
Nitrogen Oxides	Annual mean	0.281 µg/m^3	30 µg/m^3	0.9	No
	24-hour mean	2.19 µg/m^3	75 µg/m^3	2.9	No
Sulphur Dioxide	Annual mean	0.070 µg/m^3	20 µg/m^3	0.4	No
Hydrogen Fluoride	24-hour mean	0.073 µg/m^3	5 µg/m^3	1.5	No
	Weekly mean	0.007 µg/m^3	0.5 µg/m^3	1.5	No
Ammonia	Annual mean	0.023 µg/m^3	3 µg/m^3	0.8	No
Nutrient Nitrogen Deposition	Annual mean	0.029 kgN/ha/yr	10 kgN/ha/yr	0.3	No
Acid Deposition	Annual mean	0.029 keq/ha/yr	5.071 keq/ha/yr	0.6	No
Castle Gresley Wetland LWS					
Nitrogen Oxides	Annual mean	0.208 µg/m^3	30 µg/m^3	0.7	No
	24-hour mean	2.28 µg/m^3	75 µg/m^3	3.0	No
Sulphur Dioxide	Annual mean	0.052 µg/m^3	20 µg/m^3	0.3	No
Hydrogen Fluoride	24-hour mean	0.076 µg/m^3	5 µg/m^3	1.5	No
	Weekly mean	0.007 µg/m^3	0.5 µg/m^3	1.4	No
Ammonia	Annual mean	0.017 µg/m^3	3 µg/m^3	0.6	No
Nutrient Nitrogen Deposition	Annual mean	0.022 kgN/ha/yr	10 kgN/ha/yr	0.2	No
Castle Mound LWS					
Nitrogen Oxides	Annual mean	0.170 µg/m^3	30 µg/m^3	0.6	No
	24-hour mean	2.88 µg/m^3	75 µg/m^3	3.8	No
Sulphur Dioxide	Annual mean	0.042 µg/m^3	20 µg/m^3	0.2	No
Hydrogen Fluoride	24-hour mean	0.096 µg/m^3	5 µg/m^3	1.9	No
	Weekly mean	0.007 µg/m^3	0.5 µg/m^3	1.3	No
Ammonia	Annual mean	0.014 µg/m^3	3 µg/m^3	0.5	No
Nutrient Nitrogen Deposition	Annual mean	0.018 kgN/ha/yr	5 kgN/ha/yr	0.4	No
Acid Deposition	Annual mean	0.019 keq/ha/yr	1.113 keq/ha/yr	1.7	No
White Lady's Spring LWS					
Nitrogen Oxides	Annual mean	0.123 µg/m^3	30 µg/m^3	0.4	No
	24-hour mean	2.393 µg/m^3	75 µg/m^3	3.2	No
Sulphur Dioxide	Annual mean	0.031 µg/m^3	20 µg/m^3	0.2	No
Hydrogen Fluoride	24-hour mean	0.080 µg/m^3	5 µg/m^3	1.6	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
	Weekly mean	0.005 µg/m^3	0.5 µg/m^3	1.0	No
Ammonia	Annual mean	0.010 µg/m^3	3 µg/m^3	0.3	No
Nutrient Nitrogen Deposition	Annual mean	0.025 kgN/ha/yr	10 kgN/ha/yr	0.3	No
Acid Deposition	Annual mean	0.019 keq/ha/yr	2.728 keq/ha/yr	0.7	No
Netherseal Colliery LWS					
Nitrogen Oxides	Annual mean	0.083 µg/m^3	30 µg/m^3	0.3	No
	24-hour mean	2.174 µg/m^3	75 µg/m^3	2.9	No
Sulphur Dioxide	Annual mean	0.021 µg/m^3	20 µg/m^3	0.1	No
Hydrogen Fluoride	24-hour mean	0.072 µg/m^3	5 µg/m^3	1.4	No
	Weekly mean	0.005 µg/m^3	0.5 µg/m^3	0.9	No
Ammonia	Annual mean	0.007 µg/m^3	3 µg/m^3	0.2	No
Nutrient Nitrogen Deposition	Annual mean	0.009 kgN/ha/yr	10 kgN/ha/yr	0.1	No
Acid Deposition	Annual mean	0.009 keq/ha/yr	4.856 keq/ha/yr	0.2	No

8.15 The PCs for all designated sites are below the respective screening criteria and therefore, in accordance with EA guidance, the impacts of the main stack at the ERF on designated sites can be considered to be not significant.

ERF Main Stack – Abnormal Operation

8.16 This section discusses the potential impacts on air quality associated with abnormal operation of the Site which assumes higher emissions from the main stack at the ERF as a result of a failure of abatement technology. As discussed in Paragraph 6.13, only the pollutants with EALs with an averaging period of 1-hour or less have been considered based on the likely duration of any abnormal operation. Consequently, only the impacts at human health receptors have been considered as the EALs averaging periods for ecological sites are only for the 24-hour or annual periods. Based on previous consultation with the EA on other EfW sites, the abnormal operation assessment has also considered the impact from annual mean dioxin emissions at human health receptors.

Human Health

8.17 The maximum predicted PCs from the main stack at the ERF during abnormal operation at any location on the modelled receptor grid have been compared with the relevant screening criteria described in Paragraph 7.2. The results are set out in Table 28, with the conclusions based on the screening criteria for the PCs set out in the final column.

8.18 The PCs can be screened as insignificant for most pollutants and averaging periods; more detailed assessment for those that cannot be screened at this stage is provided in the sections below.

Table 43: Maximum Predicted PCs in the Study Area (µg/m³)

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
Nitrogen dioxide	1-hour mean	80.9	200	**40.4**	**Yes**
SO_2	1-hour mean	114.8	350	**32.8**	**Yes**
	15-minute mean	124.9	266	**47.0**	**Yes**
HF	1-hour mean	15.69	160	9.8	No
HCl	1-hour mean	235.3	750	**31.4**	**Yes**
Mercury	1-hour mean	0.039	7.5	0.5	No
Antimony	1-hour mean	0.588	150	0.4	No
Chromium (III)	1-hour mean	0.588	150	0.4	No
Copper	1-hour mean	0.588	200	0.3	No
Manganese	1-hour mean	0.588	1,500	<0.1	No
NH_3	1-hour mean	7.8	2,500	0.3	No
PCDD/F	Annual mean	$1.52x10^{-9}$	$3x10^{-7}$	0.5	No
PCBs	1-hour mean	$3.14x10^{-6}$	6	<0.1	No

Nitrogen Dioxide

1-hour Mean

8.19 Table 30 sets out the maximum predicted 99.79th percentile nitrogen dioxide PC, and the adjusted EAL for 1-hour mean nitrogen dioxide i.e., the EAL minus the background concentration for the abnormal operation scenario. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 1-hour mean nitrogen dioxide during abnormal operation can be described as not significant.

Table 44: Maximum PC and Adjusted EAL 1-hour Mean Nitrogen Dioxide (µg/m³)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
1-hour mean	200	80.9	37.8	162.2	49.9	118.7	59.3

[a] Equal to twice the annual mean background concentration, in accordance with EA guidance. The maximum background concentration anywhere within the study area has been used, to provide a robust assessment.

Sulphur Dioxide

1-hour Mean

8.20 Table 31 sets out the maximum predicted 99.73th percentile sulphur dioxide PC, and the adjusted EAL for 1-hour mean sulphur dioxide for the abnormal operation scenario. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 1-hour mean sulphur dioxide can be described as not significant.

Table 45: Maximum PC and Adjusted EAL 1-hour Mean Sulphur Dioxide (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
1-hour mean	350	114.8	5.2	344.8	33.3	120.0	34.3

15-minute Mean

8.21 Table 32 sets out the maximum predicted 99.9th percentile sulphur dioxide PC, and the adjusted EAL for 15-minute mean sulphur dioxide for the abnormal operation scenario. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 15-minute mean sulphur dioxide can be described as not significant.

Table 46: Maximum PC and Adjusted EAL 15-minute Mean Sulphur Dioxide (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
15-minute mean	266	124.9	5.2	260.8	47.9	130.1	48.9

HCl

8.22 Table 36 sets out the maximum predicted PC to 1-hour mean HCl concentrations, and the adjusted EAL for 1-hour mean HCl for the abnormal operation scenario. While the maximum PC is more than 10% of the EAL and more than 20% of the adjusted EAL, the PEC does not exceed the EAL and so, following EA guidance, the impact on 1-hour mean HCL during abnormal operation can be described as not significant.

Table 47: Maximum PC and Adjusted EAL for HCl (µg/m^3)

Objective	EAL	PC	Background	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
1-hour mean	750	235.3	0.21	749.79	31.4	235.5	31.4

Generator Emissions

8.23 The generator operates on diesel and therefore the only pollutants of concern which have been assessed are nitrogen dioxide and PM_{10}. As discussed in Paragraph 6.33, the generator has been modelled as operating continuously and the annual mean results have been scaled down by a factor of 168/8760 to reflect the proposed operating profile of the generator.

Human Health

Annual Mean Concentrations

8.24 The predicted annual mean NO_2 and PM_{10} PCs at the specific human health receptors from operation of the generator for 168 hours per year are set out in Table 48 and Table 49 respectively. Across all receptors, the maximum PCs are less than 1% of the EALs and therefore the impacts are considered not significant. The highest annual PCs are predicted at receptor H2, a residential property northeast of the Site.

Table 48: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL
H1	40	<0.1	0.1
H2		0.1	0.2
H3		<0.1	0.1
H4		<0.1	0.1
H5		<0.1	0.1
H6		<0.1	<0.1
H7		<0.1	0.1
H8		<0.1	0.1

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

Table 49: Predicted Impacts on Annual Mean PM_{10} Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL
H1	40	<0.1	<0.1
H2		<0.1	<0.1
H3		<0.1	<0.1

Receptor ID	EAL	PC	PC as % of EAL
H4		<0.1	<0.1
H5		<0.1	<0.1
H6		<0.1	<0.1
H7		<0.1	<0.1
H8		<0.1	<0.1

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

8.25 A contour plot of the area where the maximum annual mean nitrogen dioxide PC from operation of the generator, from any of the five meteorological years considered, is greater than 0.4 µg/m^3 is shown in Figure 11. There are no receptors present in the areas where the screening threshold of 0.4 µg/m^3 is exceeded (1% of the EAL) – the majority of the area where the threshold is exceeded is within the Site boundary, where there would be no public access. The PCs in areas where receptors are present are all below the screening threshold, thus the impacts will be not significant.

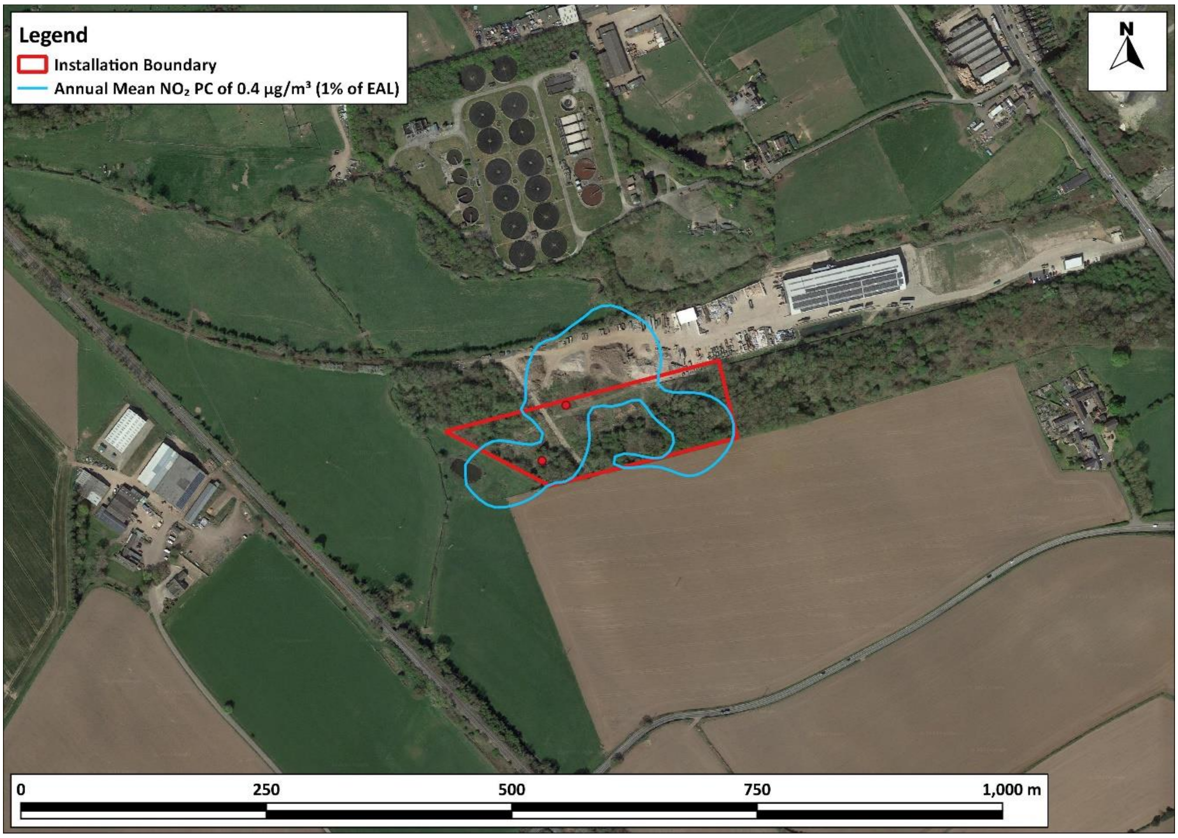

Figure 11: Annual Mean Nitrogen Dioxide Process Contributions from the Generator (Ground Level)

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8.26 A contour plot of the area where the maximum annual mean PM_{10} PCs from operation of the generator, from any of the five meteorological years considered, is greater than 0.4 µg/m^3 is shown in Figure 12. There are no receptors present in the areas where the screening threshold of 0.4 µg/m³ is exceeded (1% of the EAL) – the threshold is only exceeded within the Site boundary, where there would be no public access. The PCs in areas where receptors are present are all below the screening threshold, thus any impacts will be not significant.

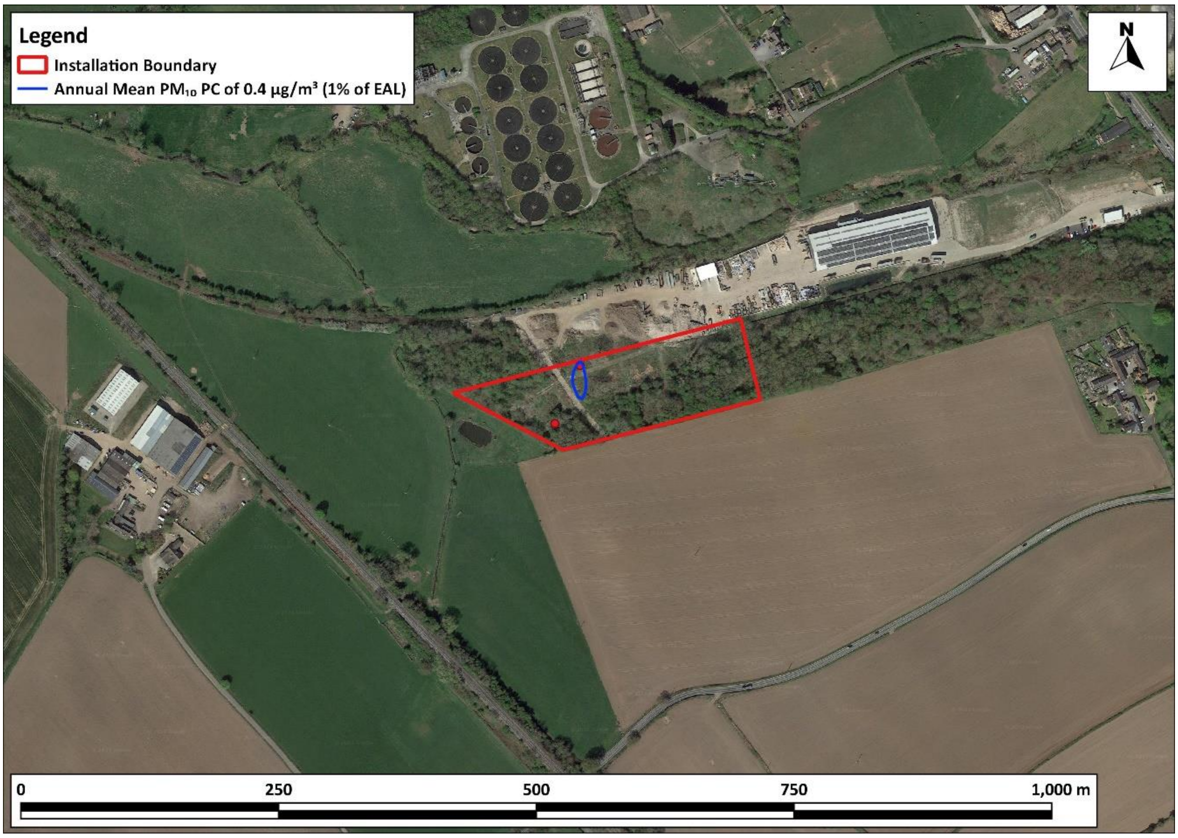

Figure 12: Annual Mean PM_{10} Process Contributions from the Generator (Ground Level)

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Short Term Concentrations

The maximum predicted 1-hour NO_2 PCs for the 99.79th percentile at the specific human health receptors from continuous operation of the generator are set out in

8.27 Table 56. Across all receptors except H2 and H8, the maximum PCs are less than 10% of the respective EALs and therefore considered not significant. The highest short-term PCs are at receptor H2, a residential property northeast of the Site. At this receptor, the PC is more than 20% of the adjusted EAL but the PEC is well below the EAL (despite the conservative modelling assumptions) while at H8, the PC is less than 20% of the adjusted EAL. Therefore, across all specific human health receptors, the impact on hourly NO_2 concentrations is considered not significant.

Table 50: Predicted Impacts on 1-Hour Mean Nitrogen Dioxide Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL	Background	Adjusted EAL (EAL minus background)	PC as % of Adjusted EAL	PEC	PEC as % of EAL
H1	200	12.3	6.1	37.8	162.2	7.6	50.1	25.0
H2		40.8	20.4	37.8	162.2	25.2	78.6	39.3
H3		17.4	8.7	37.8	162.2	10.7	55.2	27.6
H4		14.1	7.0	37.8	162.2	8.7	51.9	25.9
H5		17.2	8.6	37.8	162.2	10.6	55.0	27.5
H6		13.6	6.8	37.8	162.2	8.4	51.4	25.7
H7		16.7	8.4	37.8	162.2	10.3	54.5	27.3
H8		24.2	12.1	37.8	162.2	14.9	62.0	31.0

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

8.28 The maximum predicted 24-hour PM_{10} PCs for the 90.4th percentile at the specific human health receptors from continuous operation of the generator are set out to Table 51. Across all receptors, the maximum PCs are less than 10% of the EALs and therefore considered not significant. The highest short-term PC is also at receptor H2, a residential property northeast of the Site.

Table 51: Predicted Impacts on 24-Hour Mean PM_{10} Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL
H1	50	0.4	0.7
H2		0.9	1.7
H3		0.3	0.6
H4		0.3	0.6
H5		0.4	0.8
H6		0.2	0.3
H7		0.3	0.6
H8		0.4	0.8

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

8.29 A contour plot of the area where the maximum predicted 99.79th percentile of hourly mean nitrogen dioxide PCs, from any of the five meteorological years considered, is greater than 20 µg/m^3 is shown in Figure 13. A contour plot of the area where the maximum predicted 90.4th percentile of 24-hourly mean PM_{10} PCs is greater than 5 µg/m^3 is shown in Figure 14. The hourly mean nitrogen dioxide figure demonstrates that most of the area where the PCs are greater than 20 µg/m^3 there are no human health receptors (as it covers mostly the surrounding agricultural land). Meanwhile, the 24-hourly mean PM_{10} figure shows that there are no sensitive receptors in the area where the PC exceeds 10% of the EAL. The short-term impacts of the generator emissions can, therefore, be screened out as not significant.

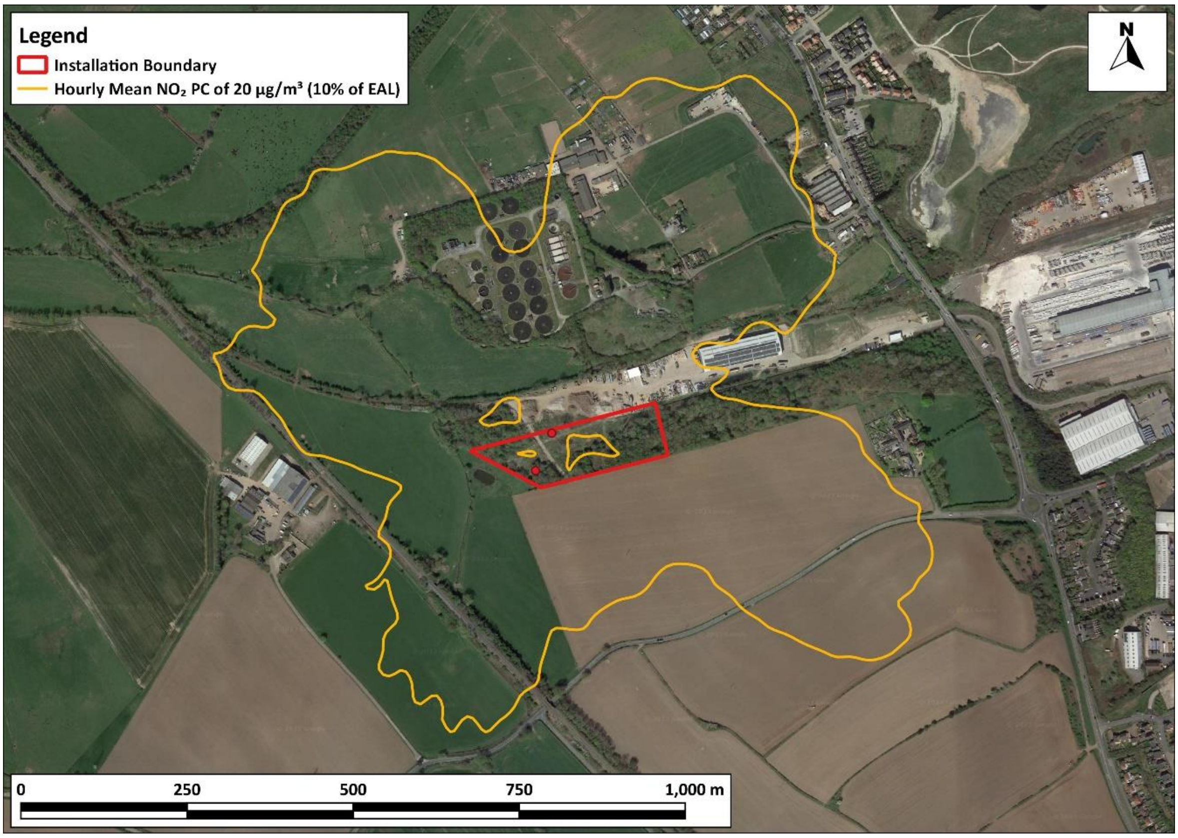

Figure 13: 99.79th Percentile PC to hourly mean nitrogen dioxide concentrations

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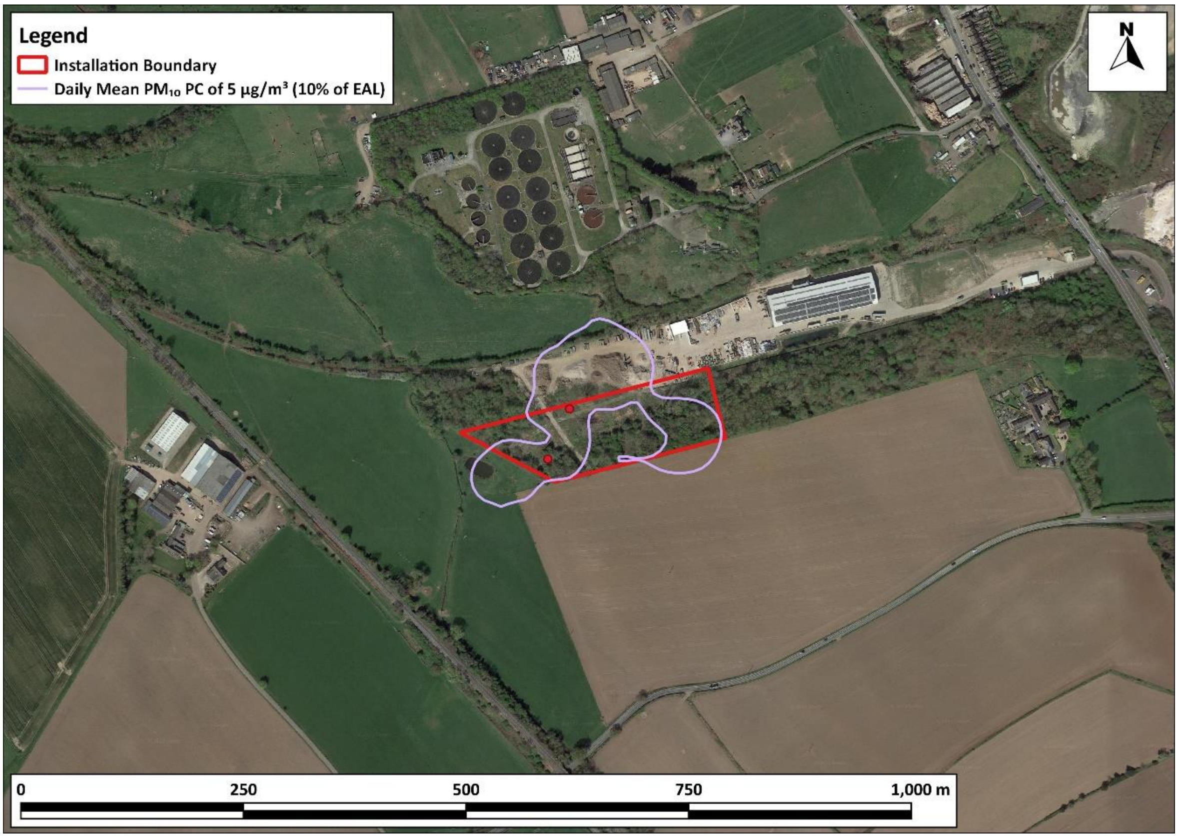

Figure 14: 90.4th Percentile PC to 24-hourly mean PM_{10} concentrations

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Ecological

8.30 The maximum predicted nitrogen oxides PCs and nutrient nitrogen deposition and acid deposition rates at designated ecological sites associated with operation of the generator for 168 hours per year have been compared to the EA screening criteria. The results are set out in Table 52 for the River Mease SAC/SSSI and the Carver's Rocks, Ticknall Quarries and Calke Park SSSIs, in Table 53 for the Hall Wood ancient woodland site and the Badgers Hollow LNR, and in Table 54 for the LWS.

8.31 Results are only presented for nutrient nitrogen deposition and acid deposition at the sites for which critical loads have been defined. A screening criterion of 1% is used for annual mean averaging periods while 10% used for all other (shorter) averaging periods to define the need for a detailed assessment for SACs and SSSIs. A screening criterion of 100% of the EAL is used for both long and short-term averaging periods for local nature sites (ancient woodland, LNR and LWS).

Table 52: Maximum Predicted PCs to River Mease SAC/SSSI, Carver's Rocks SSSI, Ticknall Quarries SSSI and Calke Park SSSI

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
River Mease SAC/SSSI					
Nitrogen Oxides	Annual mean	0.001 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	0.765 µg/m^3	75 µg/m^3	1.0	No
Carver's Rocks SSSI					
Nitrogen Oxides	Annual mean	0.001 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	0.795 µg/m^3	75 µg/m^3	1.1	No
Nutrient Nitrogen Deposition	Annual mean	0.0003 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	1.284 keq/ha/yr	<0.1	No
Ticknall Quarries SSSI					
Nitrogen Oxides	Annual mean	0.001 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	0.522 µg/m^3	75 µg/m^3	0.7	No
Nutrient Nitrogen Deposition	Annual mean	0.0002 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.756 keq/ha/yr	<0.1	No
Calke Park SSSI					
Nitrogen Oxides	Annual mean	0.001 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	0.528 µg/m^3	75 µg/m^3	0.7	No

Table 53: Maximum Predicted PCs to Hall Wood Ancient Woodland Site and Badgers Hollow Local Nature Reserve

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Hall Wood Ancient Woodland					
Nitrogen Oxides	Annual mean	0.008 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	3.866 µg/m^3	75 µg/m^3	5.2	No
Nutrient Nitrogen Deposition	Annual mean	0.002 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.982 keq/ha/yr	<0.1	No
Badgers Hollow Local Nature Reserve					
Nitrogen Oxides	Annual mean	0.010 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	10.466 µg/m^3	75 µg/m^3	14.0	No
Nutrient Nitrogen Deposition	Annual mean	0.002 kgN/ha/yr	10 kgN/ha/yr	<0.1	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.728 keq/ha/yr	<0.1	No

Table 54: Maximum Predicted PCs to Local Wildlife Sites

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Bretby Railway LWS					
Nitrogen Oxides	Annual mean	0.013 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	7.080 µg/m^3	75 µg/m^3	9.4	No
Nutrient Nitrogen Deposition	Annual mean	0.003 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.727 keq/ha/yr	<0.1	No
Bretby Disused Railway LWS					
Nitrogen Oxides	Annual mean	0.017 µg/m^3	30 µg/m^3	0.1	No
	24-hour mean	7.950 µg/m^3	75 µg/m^3	10.6	No
Nutrient Nitrogen Deposition	Annual mean	0.003 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.982 keq/ha/yr	<0.1	No
Cadley Hill Railway Area LWS					
Nitrogen Oxides	Annual mean	0.046 µg/m^3	30 µg/m^3	0.2	No
	24-hour mean	17.6 µg/m^3	75 µg/m^3	23.5	No
Nutrient Nitrogen Deposition	Annual mean	0.009 kgN/ha/yr	10 kgN/ha/yr	0.1	No
Acid Deposition	Annual mean	0.001 keq/ha/yr	2.982 keq/ha/yr	<0.1	No
Breach Leys Farm Meadow LWS					
Nitrogen Oxides	Annual mean	0.007 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	3.78 µg/m^3	75 µg/m^3	5.0	No
Nutrient Nitrogen Deposition	Annual mean	0.001 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	5.071 keq/ha/yr	<0.1	No
Castle Gresley Wetland LWS					
Nitrogen Oxides	Annual mean	0.005 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	4.820 µg/m^3	75 µg/m^3	6.4	No
Nutrient Nitrogen Deposition	Annual mean	0.001 kgN/ha/yr	10 kgN/ha/yr	<0.1	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Castle Mound LWS					
Nitrogen Oxides	Annual mean	0.005 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	3.490 µg/m^3	75 µg/m^3	4.7	No
Nutrient Nitrogen Deposition	Annual mean	0.001 kgN/ha/yr	5 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	1.113 keq/ha/yr	<0.1	No
White Lady's Spring LWS					
Nitrogen Oxides	Annual mean	0.004 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	4.790 µg/m^3	75 µg/m^3	6.4	No
Nutrient Nitrogen Deposition	Annual mean	0.001 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	2.728 keq/ha/yr	<0.1	No
Netherseal Colliery LWS					
Nitrogen Oxides	Annual mean	0.002 µg/m^3	30 µg/m^3	<0.1	No
	24-hour mean	1.800 µg/m^3	75 µg/m^3	2.4	No
Nutrient Nitrogen Deposition	Annual mean	0.0004 kgN/ha/yr	10 kgN/ha/yr	<0.1	No
Acid Deposition	Annual mean	<0.001 keq/ha/yr	4.856 keq/ha/yr	<0.1	No

8.32 The PCs for all designated sites are below the respective screening criteria and therefore, in accordance with EA guidance, the impacts of operation of the generator for 168 hours per year can be considered as not significant.

All Emissions Sources

Human Health

Annual Mean Concentrations

8.33 The predicted annual mean NO_2 and PM_{10} PCs at the specific human health receptors from the main stack operating continuously and the generator operating for 168 hours per year are set out in Table 55 to Table 56. Across all receptors, the maximum NO_2 PCs from the facility for the annual mean are more than 1% of the EAL, but less than 70% of the PEC and therefore considered to be not significant. The annual mean PM_{10} PCs are also considered to be not significant as the PCs are less than 1% of the EALs. The highest annual PCs are at receptor H5, a residential property off Castle Gresley.

Table 55: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL	Background	PEC	PEC as % of EAL
H1	40	0.8	2.0	18.9	19.7	49.3
H2		0.7	1.7	18.9	19.6	48.9
H3		0.8	2.1	18.9	19.7	49.3
H4		0.8	2.1	18.9	19.7	49.3
H5		1.0	2.4	18.9	19.9	49.7
H6		0.5	1.2	18.9	19.4	48.4
H7		0.6	1.6	18.9	19.5	48.8
H8		0.4	1.1	18.9	19.3	48.4

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

Table 56: Predicted Impacts on Annual Mean PM_{10} Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL
H1	40	<0.1	0.1
H2		<0.1	0.1
H3		0.1	0.1
H4		<0.1	0.1
H5		0.1	0.1
H6		<0.1	0.1
H7		<0.1	0.1
H8		<0.1	0.1

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

8.34 A contour plot of the area where the maximum annual mean nitrogen dioxide PC from operation of the main stack and generator, from any of the five meteorological years, is greater than 0.4 µg/m^3 is shown in Figure 15. This area extends up to approximately 1.5 km from the stacks and encompasses multiple residential properties. However, as demonstrated by the maximum PECs presented in Table 55 above, the impacts at these worst-case receptors would not be significant.

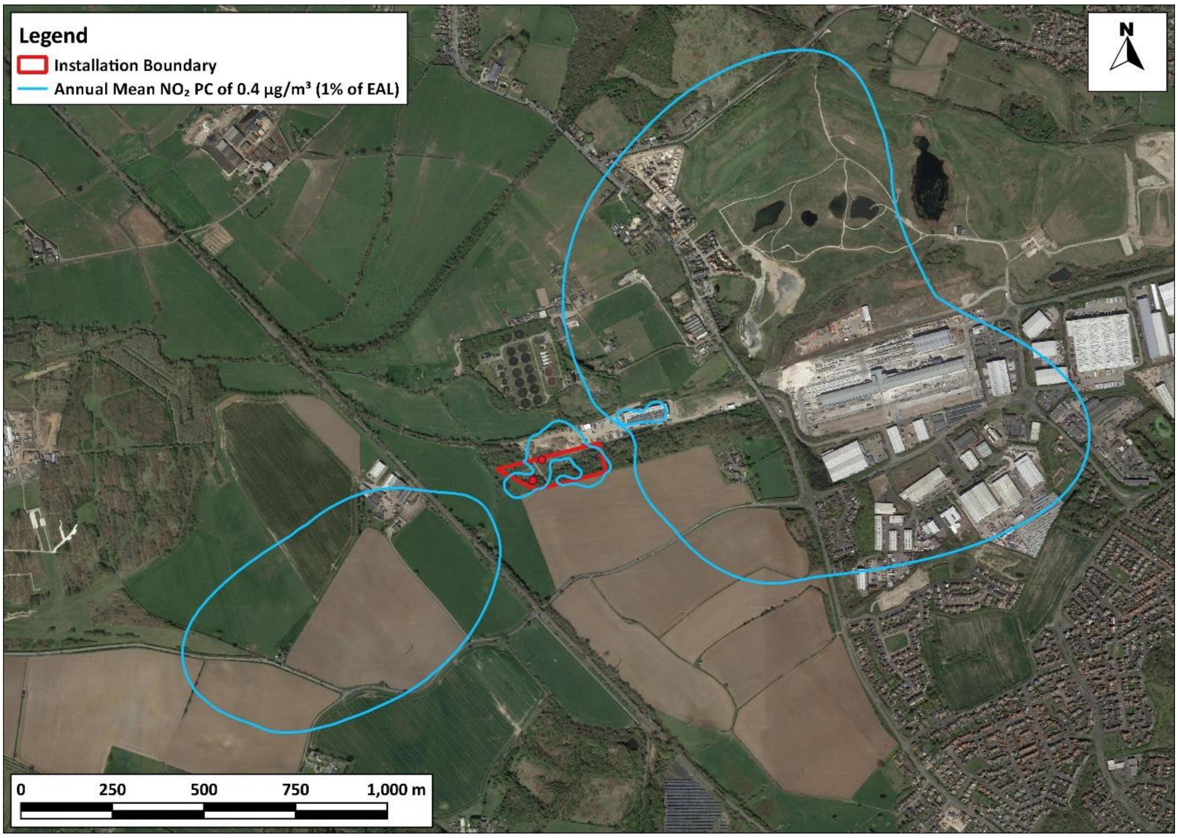

Figure 15: Annual Mean Nitrogen Dioxide Process Contributions (Ground Level)

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Short Term Concentrations

8.35 The maximum 1-hour NO_2 99.79th percentile and 24-hour PM_{10} 90.4th percentile PCs for each emission source have then been combined to determine the maximum short-term concentrations. This will result in highly conservative PCs as this assumes that the generators operate continuously all year and that the maximums for each source would have occurred during the same meteorological conditions. Nonetheless, the results are presented to provide an indication of worst-case short-term concentrations from operation of the Site.

8.36 The predicted 1-hour NO_2 PCs and the adjusted EAL i.e., the EAL minus the baseline concentration, at the specific human health receptors from operation of the main stack and the generator for the 99.79th percentile for are set out in Table 57.

8.37 While the maximum PCs are more than 10% of the EAL and more than 20% of the adjusted EAL at most receptors, the PECs do not exceed the EAL (even when using conservative modelling assumptions). Therefore, following EA guidance, the impact of the Site on 1-hour mean nitrogen dioxide can be described as not significant. The highest hourly mean NO_2 PCs are at receptor H2, a residential property northeast of the Site.

Table 57: Maximum PC and Adjusted EAL 1-hour Mean Nitrogen Dioxide (µg/m^3)

Receptor ID	EAL	PC	PC as % of EAL	Baseline [a]	Adjusted EAL	PC as % of Adjusted EAL	PEC	PEC as % of EAL
H1	200	40.1	20.1	37.8	162.2	24.7	77.9	39.0
H2		67.5	33.7	37.8	162.2	41.6	105.3	52.6
H3		39.3	19.6	37.8	162.2	24.2	77.1	38.5
H4		37.1	18.5	37.8	162.2	22.8	74.9	37.4
H5		36.5	18.3	37.8	162.2	22.5	74.3	37.2
H6		25.7	12.9	37.8	162.2	15.9	63.5	31.8
H7		33.4	16.7	37.8	162.2	20.6	71.2	35.6
H8		48.7	24.3	37.8	162.2	30.0	86.5	43.2

[a] Equal to twice the annual mean background concentration, in accordance with EA guidance. The maximum background concentration anywhere within the study area has been used, to provide a robust assessment.

8.38 Table 58sets out the maximum predicted 90.42nd percentile PM_{10} PC for the main stack and the generator at the specific human health receptors. The maximum PCs are less than 10% of the EAL (despite the conservative assumptions regarding combining the percentiles for the different emission sources discussed above) and so, following EA guidance, the impact of the Site on 24-hour mean PM_{10} can be described as not significant.

Table 58: Predicted Impacts on 24-Hour Mean PM_{10} Concentrations (µg/m^3) [a]

Receptor ID	EAL	PC	PC as % of EAL
H1	50	1.5	3.0
H2		1.6	3.1
H3		1.3	2.6
H4		1.4	2.7
H5		1.5	3.0
H6		0.8	1.5
H7		1.1	2.2
H8		0.9	1.9

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

8.39 A contour plot of the area where the maximum predicted hourly mean nitrogen dioxide PCs for the 99.79th percentile from both the main stack and generator, from any of the five meteorological years considered, is greater than 20 µg/m^3 is shown in Figure 16. This area extends up to approximately 1.1 km from the stacks and encompasses a number of residential properties. However, as demonstrated by the maximum PEC presented in Table 57 above, the impacts at these receptors would not be significant (even when using conservative modelling assumptions).

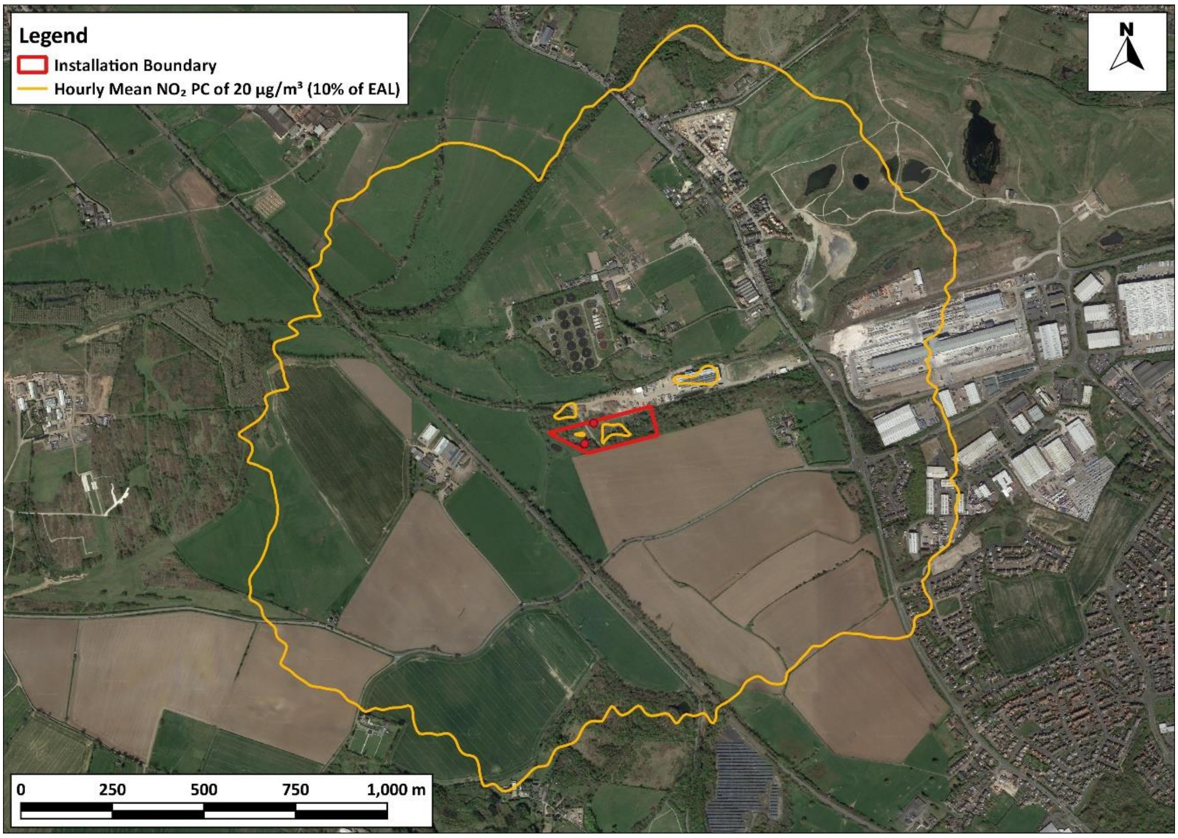

Figure 16: 93.65th Percentile Hourly Mean Nitrogen Dioxide PC for Generator Emissions and 99.79th percentile PC for the Main Stack Emissions

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Ecological

8.40 The maximum predicted nitrogen oxides PCs and nutrient nitrogen deposition and acid deposition rates at designated ecological sites associated with continuous operation of the main stack and operation of the generator for 168 hours per year, have been compared to the EA screening criteria. The results are set out in Table 59 for the River Mease SAC/SSSI and the Carver's Rocks, Ticknall Quarries and Calke Park SSSIs, in Table 60 for the Hall Wood ancient woodland site and the Badgers Hollow local nature reserve, and in Table 61 for the Local Wildlife Sites.

8.41 Results are only presented for nutrient nitrogen deposition and acid deposition at the sites for which critical loads have been defined. A screening criterion of 1% is used for annual mean averaging periods, with 10% used for all other (shorter) averaging periods to define the need for a detailed assessment for SACs and SSSIs. A screening criterion of 100% of the EAL is used for both long and short-term averaging periods for local nature sites (ancient woodland, LNR and LWS).

Table 59: Maximum Predicted PCs to River Mease SAC/SSSI, Carver's Rocks SSSI, Ticknall Quarries SSSI and Calke Park SSSI

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Further Assessment Required
River Mease SAC/SSSI					
Nitrogen Oxides	Annual mean	0.06 µg/m^3	30 µg/m^3	0.2	No
	24-hour mean	1.66 µg/m^3	75 µg/m^3	2.2	No
Carver's Rocks SSSI					
Nitrogen Oxides	Annual mean	0.11 µg/m^3	30 µg/m^3	0.4	No
	24-hour mean	1.72 µg/m^3	75 µg/m^3	2.3	No
Nutrient Nitrogen Deposition	Annual mean	0.02 kgN/ha/yr	10 kgN/ha/yr	0.2	No
Acid Deposition	Annual mean	0.01 keq/ha/yr	1.284 keq/ha/yr	0.9	No
Ticknall Quarries SSSI					
Nitrogen Oxides	Annual mean	0.09 µg/m^3	30 µg/m^3	0.3	No
	24-hour mean	1.28 µg/m^3	75 µg/m^3	1.7	No
Nutrient Nitrogen Deposition	Annual mean	0.02 kgN/ha/yr	10 kgN/ha/yr	0.2	No
Acid Deposition	Annual mean	0.01 keq/ha/yr	2.756 keq/ha/yr	0.3	No
Calke Park SSSI					
Nitrogen Oxides	Annual mean	0.09 µg/m^3	30 µg/m^3	0.3	No
	24-hour mean	1.19µg/m^3	75 µg/m^3	1.6	No

Table 60: Maximum Predicted PCs to Hall Wood Ancient Woodland Site and Badgers Hollow Local Nature Reserve

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Hall Wood Ancient Woodland					
Nitrogen Oxides	Annual mean	0.34 µg/m^3	30 µg/m^3	1.1	No
	24-hour mean	6.73 µg/m^3	75 µg/m^3	9.0	No
Nutrient Nitrogen Deposition	Annual mean	0.07 kgN/ha/yr	10 kgN/ha/yr	0.7	No
Acid Deposition	Annual mean	0.05 keq/ha/yr	2.982 keq/ha/yr	1.6	No
Badgers Hollow Local Nature Reserve					
Nitrogen Oxides	Annual mean	0.23 µg/m^3	30 µg/m^3	0.8	No
	24-hour mean	16.7 µg/m^3	75 µg/m^3	22.3	No
Nutrient Nitrogen Deposition	Annual mean	0.05 kgN/ha/yr	10 kgN/ha/yr	0.5	No
Acid Deposition	Annual mean	0.04 keq/ha/yr	2.728 keq/ha/yr	1.3	No

Table 61: Maximum Predicted PCs to Local Wildlife Sites

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Bretby Railway LWS					
Nitrogen Oxides	Annual mean	0.37 µg/m³	30 µg/m³	1.2	No
	24-hour mean	13.94 µg/m³	75 µg/m³	18.6	No
Nutrient Nitrogen Deposition	Annual mean	0.08 kgN/ha/yr	10 kgN/ha/yr	0.8	No
Acid Deposition	Annual mean	0.05 keq/ha/yr	2.727 keq/ha/yr	2.0	No
Bretby Disused Railway LWS					
Nitrogen Oxides	Annual mean	0.55 µg/m³	30 µg/m³	1.8	No
	24-hour mean	13.58 µg/m³	75 µg/m³	18.1	No
Nutrient Nitrogen Deposition	Annual mean	0.11 kgN/ha/yr	10 kgN/ha/yr	1.1	No
Acid Deposition	Annual mean	0.08 keq/ha/yr	2.982 keq/ha/yr	2.6	No
Cadley Hill Railway Area LWS					
Nitrogen Oxides	Annual mean	1.3 µg/m³	30 µg/m³	4.3	No
	24-hour mean	29.59 µg/m³	75 µg/m³	39.5	No
Nutrient Nitrogen Deposition	Annual mean	0.27 kgN/ha/yr	10 kgN/ha/yr	2.7	No
Acid Deposition	Annual mean	0.19 keq/ha/yr	2.982 keq/ha/yr	6.4	No
Breach Leys Farm Meadow LWS					
Nitrogen Oxides	Annual mean	0.29 µg/m³	30 µg/m³	1.0	No
	24-hour mean	5.97 µg/m³	75 µg/m³	8.0	No
Nutrient Nitrogen Deposition	Annual mean	0.03 kgN/ha/yr	10 kgN/ha/yr	0.3	No
Acid Deposition	Annual mean	0.03 keq/ha/yr	5.071 keq/ha/yr	0.6	No
Castle Gresley Wetland LWS					
Nitrogen Oxides	Annual mean	0.21 µg/m³	30 µg/m³	0.7	No
	24-hour mean	7.10 µg/m³	75 µg/m³	9.5	No
Nutrient Nitrogen Deposition	Annual mean	0.02 kgN/ha/yr	10 kgN/ha/yr	0.2	No
Castle Mound LWS					
Nitrogen Oxides	Annual mean	0.17 µg/m³	30 µg/m³	0.6	No
	24-hour mean	6.37 µg/m³	75 µg/m³	8.5	No
Nutrient Nitrogen Deposition	Annual mean	0.02 kgN/ha/yr	5 kgN/ha/yr	0.4	No
Acid Deposition	Annual mean	0.02 keq/ha/yr	1.113 keq/ha/yr	1.7	No
White Lady's Spring LWS					
Nitrogen Oxides	Annual mean	0.13 µg/m³	30 µg/m³	0.4	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
	24-hour mean	7.18 µg/m^3	75 µg/m^3	9.6	No
Nutrient Nitrogen Deposition	Annual mean	0.03 kgN/ha/yr	10 kgN/ha/yr	0.3	No
Acid Deposition	Annual mean	0.02 keq/ha/yr	2.728 keq/ha/yr	0.7	No
Netherseal Colliery LWS					
Nitrogen Oxides	Annual mean	0.08 µg/m^3	30 µg/m^3	0.3	No
	24-hour mean	3.97 µg/m^3	75 µg/m^3	5.3	No
Nutrient Nitrogen Deposition	Annual mean	0.01 kgN/ha/yr	10 kgN/ha/yr	0.1	No
Acid Deposition	Annual mean	0.01 keq/ha/yr	4.856 keq/ha/yr	0.2	No

8.42 The PCs for all designated sites are below the respective screening criteria and therefore, in accordance with EA guidance, the impacts of the main stack operating continuously and the generator operating for 168 hours per year can be considered as not significant.

Odour

8.43 Table 62 presents the modelled odour concentrations from the Site at all nearby human receptors for the worst case of the five meteorological years modelled. An odour contour plot of the area where the maximum odour PCs from any of the five meteorological years considered is greater than 0.15 OU_E/m^3 (10% of the criteria) is presented in Figure 17 for illustrative purposes; there are no areas where the most offensive odour benchmark (1.5 OU_E/m^3) is exceeded.

8.44 Odour concentrations at the closest modelled human receptors are all well below the most offensive odour benchmark (1.5 OU_E/m^3), even when it is conservatively assumed that the exhaust vent would emit odours continuously (when in reality, it would only emit odours when the incinerator is not operational). It is therefore judged that odour effects from the Site are unlikely to be significant. This is because there are no areas where concentrations are above 1.5 OU_E/m^3. The odour concentration at any residential location or high sensitivity receptor does not approach the most offensive odour benchmark of 1.5 OU_E/m^3.

Table 62: Modelled Odour Concentrations at Nearby Human Receptors

Receptors	Modelled 98th Percentile 1-Hour Odour Concentrations (OU_E/m^3)	Odour Concentration as a % of the 1.5 OU_E/m^3 benchmark (%)
H1	0.18	11.9
H2	0.40	27.0
H3	0.20	13.0
H4	0.22	14.6
H5	0.22	14.8
H6	0.14	9.1
H7	0.21	13.8
H8	0.19	12.5

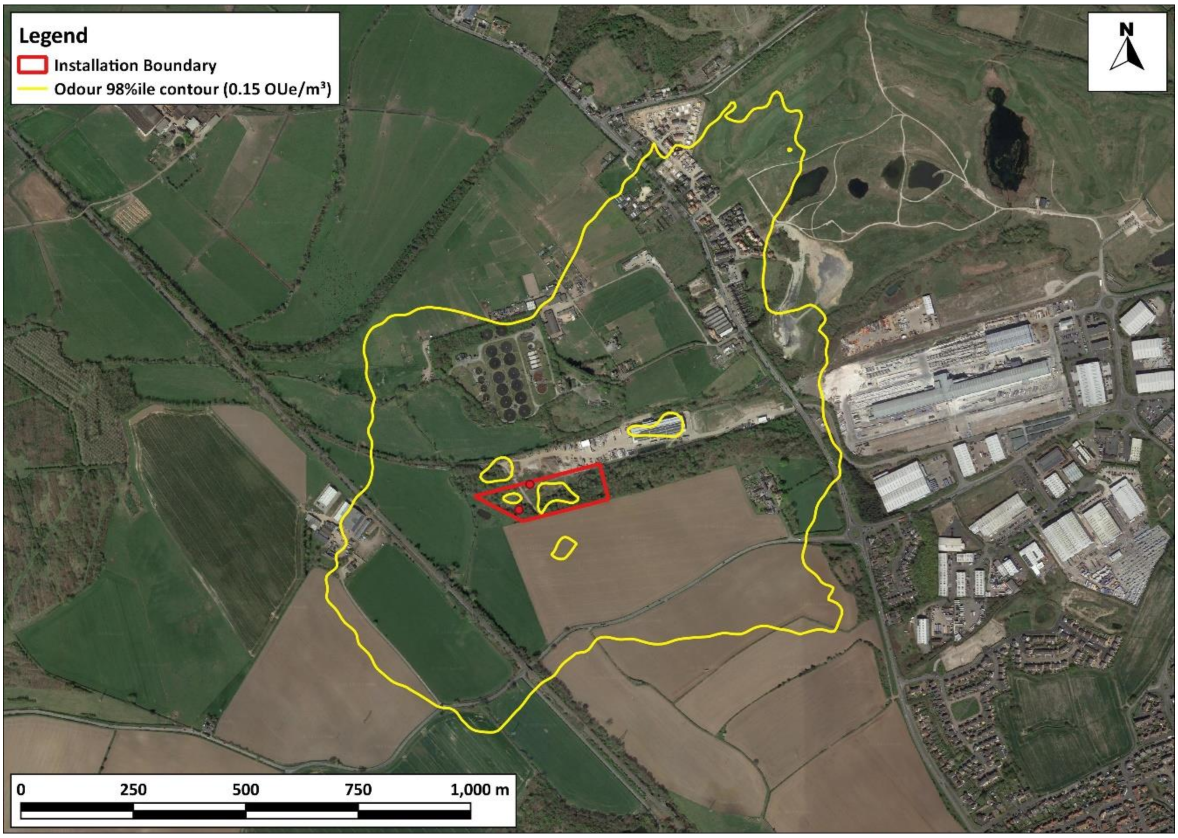

Figure 17: Contour Plot of the 98th Percentile of 1-hour Mean Odour Concentrations

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9 Conclusions

9.1 It is concluded that the air quality impacts of the Site will be ‘not significant’. This is based on an assessment undertaken in accordance with EA guidance which found that:

- the PCs from the main stack for PM_{10}, $PM_{2.5}$, CO, HF, HCl, Mercury, Antimony, Chromium (III), Copper, Vanadium, NH_3, PCDD/F, PAH (as B[a]P) and PCBs would all be below the respective 1% and 10% insignificance criteria at the worst-case locations;
- while the PCs from the main stack for NO_2, SO_2, TOC as Benzene, 1,3-butadiene, Cadmium, Arsenic, Lead, Chromium (VI) and Manganese were above the respective 1% and 10% insignificance criteria, the resulting PECs were all below the EALs;
- during abnormal operation of the main stack (associated with failure of the abatement equipment), the PCs would either be below the respective 1% and 10% insignificance criteria or, where concentrations were above these criteria, the resulting PECs were all below the EALs;
- the PCs from the generator for NO_2 and PM_{10} would all be below the respective 1% insignificance criteria for the annual EALs and the 10% insignificance criteria for the daily mean PM_{10} EAL at the locations of human health receptors. For the hourly NO_2 mean, while some PCs would be above the respective 10% and 20% insignificance criteria, the resulting PECs were well below the EAL;
- the PCs from the generator and the main stack operating together for PM_{10} would be below the respective 1% and 10% insignificance criteria at the locations of human health receptors. While the NO_2 PCs for this scenario would be above the respective 1% and 10% insignificance criteria, the resulting PECs were all below the EALs;
- the nitrogen oxides, sulphur dioxide, hydrogen fluoride and ammonia PCs and the nutrient nitrogen deposition and acid deposition rates would be below the respective 1% and 10% insignificance criteria for SACs and SSSI and the 100% insignificance criteria for ancient woodlands, LNR and LWS at all designated sites for all scenarios (main stack only, generator only and combined main stack and generator impacts).

9.2 The assessment is based on operation for 8,760 hours per year for the main stack at the ERF and 168 hours for the generator (for annual operation only) and includes a number of conservative assumptions, including presenting the maxima from modelling with five separate years of meteorological data and assuming the ERF operates for 8760 hours a year and that for the short-term averaging period, that the generators would also operate continuously. The conclusion also takes account of several sensitivity tests.

9.3 It is thus concluded that the air quality impacts from the Site will be not significant.

9.4 With respect to odour impacts, as there is not predicted to be any exceedances of the most offensive odour benchmark (1.5 OU_E/m^3) at any locations it is concluded that the odour impact of the proposed Site will also be ‘not significant’.

Table 63: EA Checklist for Dispersion Modelling Report for Installations

Item	Included	Comment
Location map	✓	See Figure 1
Site plan	✓	See Figure 4
List of emissions modelled	✓	See Paragraph 1.4
Details of modelled scenarios	✓	See Table 2 and Section 6
Details of relevant ambient concentrations used	✓	See Section 5
Model description and justification	✓	See Paragraph 6.2
Special model treatments used	✓	See Section 6
Table of emission parameters used	✓	See Table 17, Table 18 and Table 19
Details of modelled domain receptors	✓	See Table 21 and Paragraph 6.20
Details of meteorological data used (including origin) and justification	✓	See Paragraphs 6.29 to 6.31
Details of terrain treatment	✓	See Paragraph 6.28
Details of building treatment	✓	See Paragraphs 6.23 and Table 22
Sensitivity analysis	✓	See Table 2 and Section 6
Assessment of impacts	✓	See Sections 8 and 9
Model input files	✓	Sent electronically

10 References

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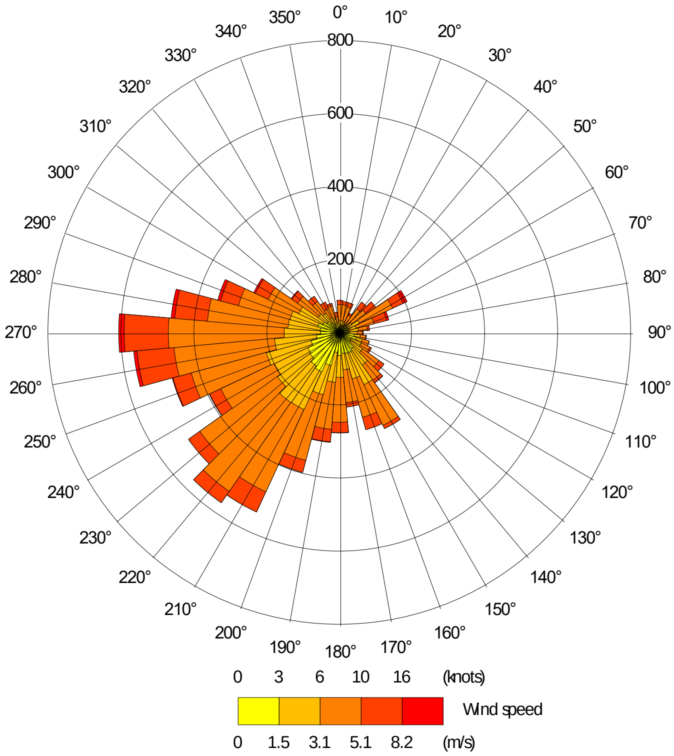
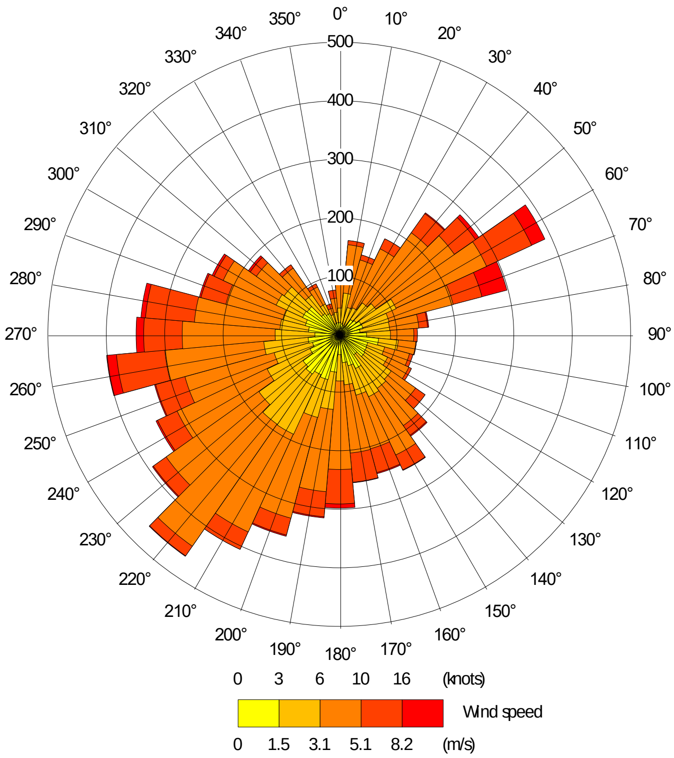
11 Appendices

A1 Wind Roses for Sutton Bonnington

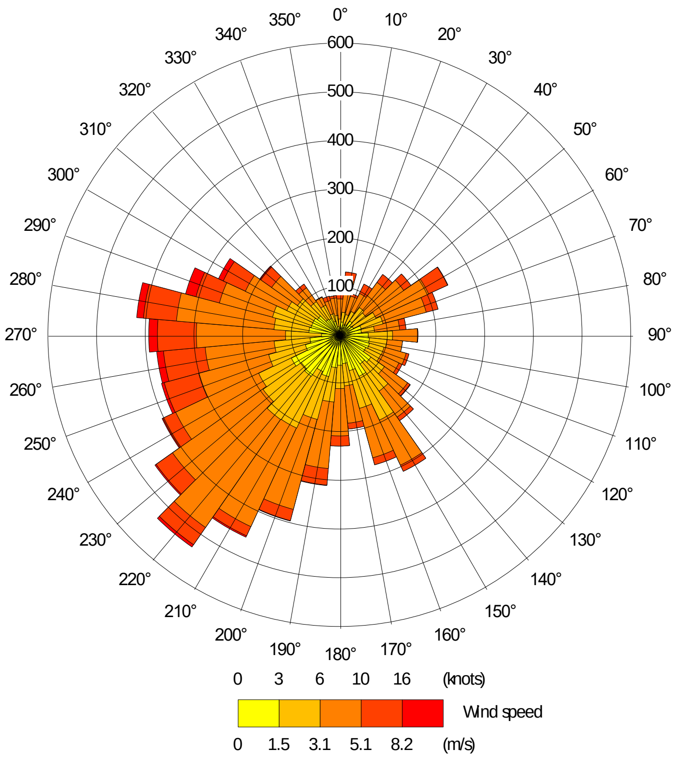
2017



2018



2019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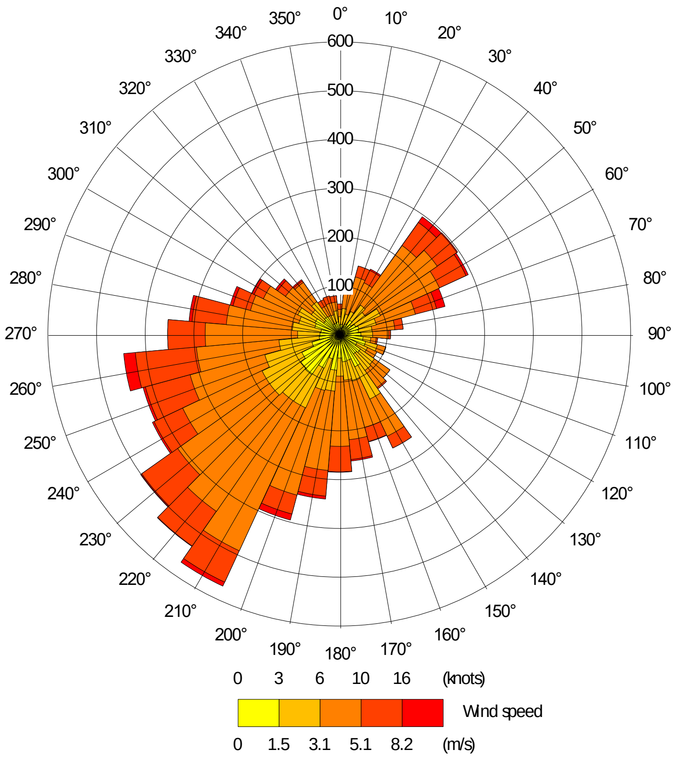
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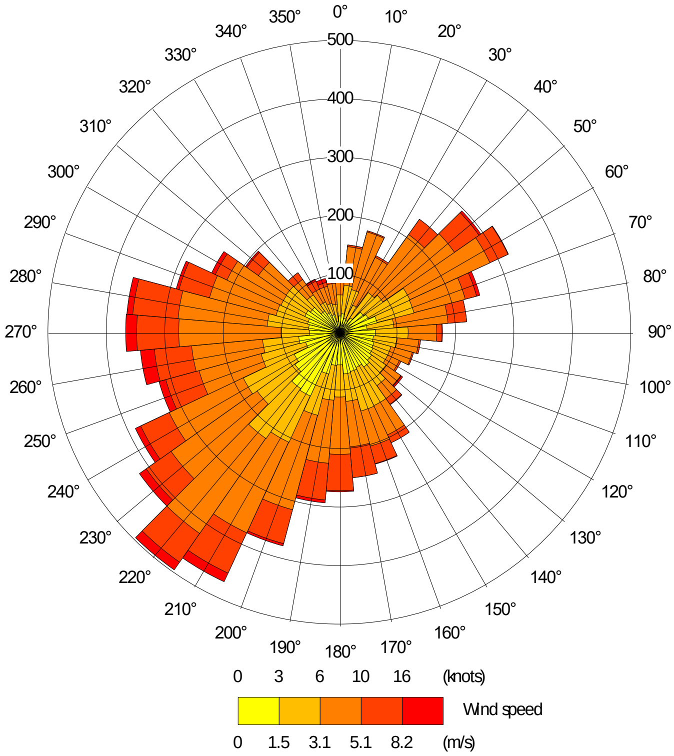
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Wind speed
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