Amazon Data Services UK Limited

Linmere Island Site, Houghton Regis

Air Quality Assessment - Environmental Permit Application

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Executive Summary

Arup has undertaken detailed air quality dispersion modelling of emergency back-up diesel generators to accompany the planning application of a Data Centre located in Houghton Regis, Bedfordshire (the Proposed Development).

This report reviews the existing baseline and considers and assesses the potential air quality impacts that could arise due to the use of the emergency back-up generators through the regular testing and maintenance routines.

The assessment considers the potential effects on sensitive human and ecological receptors in the vicinity of the Proposed Development.

This assessment has also considered the potential impact from an ‘emergency’ scenario, in the event of a complete grid failure.

A summary of the assessment scenarios is provided below:

- Scenario 1 – the biweekly test. Each generator tested for up to 30 minutes at 25% load every two weeks. Generators tested one at a time.
- Scenario 2 – the biannual test. Each generator tested one at a time for up to 4 hours twice annually. Generators tested at 100% load.
- Scenario 3 – the maintenance test. Each generator tested one at a time for 10 cumulative hours over a year. Generators tested at 100% load.
- Scenario 4 – emergency situation with all generators running together at 100% load. The air quality dispersion modelling has established the maximum emergency run hour availability.

Work was undertaken to review Best Available Techniques (BAT) to reduce the potential air quality impacts as far as reasonably practical.

Following the assessment of each of the testing scenarios, it is considered that there would be **no significant effects as a result of the testing** of the backup generators.

The backup generators were also assessed for an emergency scenario, where it was found that the probability of an exceedance for hourly mean NO_2 was found to be less than 5% for a run time of 55 hours, indicating the **probability of exceedance would be unlikely** for one receptor (HR17) only, with all other modelled receptors found to have a highly unlikely probability (less than 1%) of exceedance**.**. For a run time of 48 hours, the probability of exceedance was found to be less than 1% for all receptors, indicating the probability of **exceedance would be highly unlikely** according to Environment Agency guidance. There are predicted exceedances of the critical level for daily mean NO_x, however the chances of this scenario occurring is considered to be unlikely.

The emergency scenario was also compared against the US Acute Exposure Guideline Levels (AEGLs) for NO_2. Exceedances of the lower AEGL 1 limit were predicted under the emergency scenario (one exceedance for the 10-minute, 30-minute and 1-hour limits). The AEGLs guidance states that effects of exposure to AEGL 1 are “*not disabling and are transient and reversible upon cessation of exposure”*. Additionally, the risk of this scenario occurring is very unlikely based on electrical grid reliability for the area and inbuilt design resilience.

Overall, the assessment has concluded that there would be no significant effects as a result of the Proposed Development.

1. Introduction

1.1 Background

This Air Quality Assessment (AQA) has been prepared by Ove Arup & Partners Ltd (Arup) on behalf of Amazon Data Services UK Limited to accompany an application for the development of a Data Centre in Houghton Regis, Bedfordshire, UK (henceforth referred to as the Proposed Development).

The Air Quality Assessment has been prepared to accompany a bespoke application for an Environmental Permit (EP) for the development.

The Proposed Development comprises 42 containerised generators for emergency-backup purposes with a combined thermal input capacity of 324.6 MWth. Of the 42 generators, four are secondary back-ups ('catcher') and one is a smaller ('house') generator to cover non-critical loads (e.g., office lights, office fire system) during an emergency.

Each generator has an individual flue terminating at 25m above ground level.

The generators will not be used to provide a balancing service of for demand side response operations such as triad avoidance or fast frequency response. No electricity from the proposed development will be exported off-site or fed back into the National Grid.

1.2 Site Location and Context

The Proposed Development site is located within Houghton Regis, Bedfordshire and is approximately 7km northwest of Luton town centre. The Proposed Development site is located off the M1 and comprises a parcel of land measuring approximately 9 hectares (ha). The Proposed Development site forms part of a wider network of sites that comprise a strategic mixed-use development, known as 'HRN1' (Houghton Regis North 1). The HRN1 site obtained outline planning permission (OPP) under application ref: CB/12/03613 on 2nd June 2014, with the Proposed Development site permitted for mixed use, including data centre use. A full planning application was submitted on 04/11/2024 for the construction of two data centre buildings, substation compound, car and cycling parking, access, landscaping, technical plant and associated works.

The immediate surroundings are commercial and recreational uses, which form part of the Linmere strategic development. To the south-east lies the recently constructed Lidl Distribution Centre. Adjoining the site to the south is a community centre, 'The Farmstead' and a Lidl superstore, whilst to the east is a public open space, Linmere Park. Residential development approved as part of the OPP is currently being constructed further to the west of the site (adjoining Linmere Park).

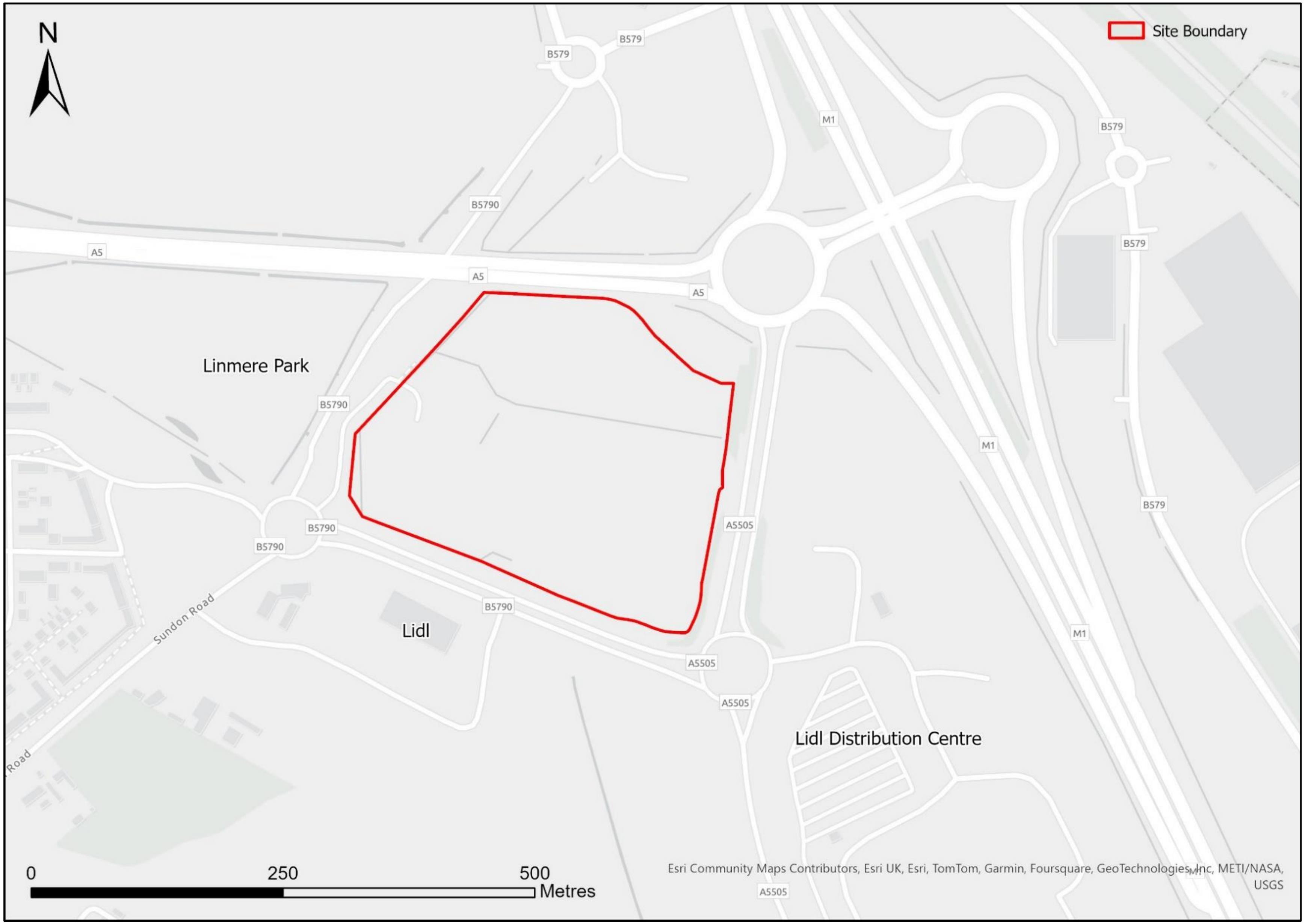
The location of the Proposed Development is shown in Figure 1.

1.3 Purpose and Structure

The Proposed Development includes a Data Centre and will include 42 emergency back-up diesel generators for emergency use, four of which are secondary back-ups ('catcher') and one is a smaller ('house') generator to cover non-critical loads (e.g., office lights, office fire system) during an emergency. All will be run individually for maintenance tests and will exhaust through individual flues. The backup generators will use Hydrogenated Vegetable Oil (HVO) as a fuel to achieve a reduction in NO_x, PM_{10} and $PM_{2.5}$; however, the assessment has considered diesel fuel to provide a worst-case scenario.

This report assesses the likely significant effects of the Proposed Development on the environment with respect to air quality. Air quality studies are concerned with the presence of airborne pollutants in the atmosphere. The main pollutants of concern for local air quality are oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Sulphur dioxide (SO_2) is not considered to be a human health concern in the area but has been assessed with regards to potential ecological impacts. No significant effects are anticipated for carbon monoxide (CO); therefore, CO has not been considered further in this assessment.

Figure 1: Site location



2. Legislation, Policy and Guidance

2.1 Legislation

2.1.1 Environment Act 2021

The Environment Bill became an Act[1] (law) in November 2021. The Environment Act 2021 amends the Environment Act 1995[2]. It also amends the Clean Air Act 1993[3] to give local authorities more power at reducing local pollution, particularly that from domestic burning. It also amends the Environmental Protection Act 1990[4] to reduce smoke from residential chimneys by extending the system of statutory nuisance to private dwellings.

The following sections of the Environment Act 1995 have been transposed into the Environment Act 2021:

- For the Secretary of State to develop, implement and maintain an Air Quality Strategy. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare an Air Quality Management Area (AQMA) where pollutant concentrations exceed the national air quality objectives. Where an AQMA is declared, the local authority needs to produce an Air Quality Action Plan (AQAP) which outlines the strategy for improving air quality in these areas.

The Act will implement key parts of the governments Clean Air Strategy and includes targets for tackling air pollution in the UK.

The following points are relevant to air quality[5]:

- For the Secretary of State to publish a report reviewing the Air Quality Strategy every five years;
- For the Office for Environmental Protection to be established[6] to substitute the watchdog function previously exercised by the European Commission;
- For local authorities' powers to be extended under the current Local Air Quality Management framework, including responsibilities to improve local air quality and to reduce public exposure to excessive levels of air pollution;
- For "air quality partners" to have a duty to share responsibility for dealing with local air pollution among public bodies; and
- Introduces a new power for the government to compel vehicle manufacturers to recall vehicles and non-road mobile machinery if they are found not to comply with the environmental standards that they are legally required to meet.

2.1.2 Air Quality Standards Regulations 2010 (amended in 2020) (England)

The Air Quality Standards Regulations 2010 (amended in 2020)[7] defines the policy framework for 12 air pollutants known to have harmful effects on human health or the natural environment. The Secretary of State

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[1] Environment Act 2021, SI 2021/30

[2] Environment Act 1995, Chapter 25, Part IV Air Quality

[3] Clean Air Act 1993. Available at: https://www.legislation.gov.uk/ukpga/1993/11/contents. [Accessed June 2024]

[4] Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents. [Accessed June 2024]

[5] Environment Act 2021. Part 4: Air Quality and Environmental Recall.

[6] Environment Act 2021. Chapter 2: The Office for Environmental Protection.

[7] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020

for the Environment has the duty of ensuring compliance with the air quality limit values (pollutant concentrations not to be exceeded by a certain date).

Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment, i.e. effects occur after a prolonged period of exposure to elevated concentrations. Other pollutants have standards expressed as 24-hour, 1-hour or 15-minute average concentrations due to the acute way in which they affect health or the natural environment, i.e. after a relatively short period of exposure. Some pollutants have standards expressed in terms of both long and short-term concentrations. Air quality limit values and objectives are quality standards for clean air. Therefore, in this assessment, the term 'air quality standard' has been used to refer to the national limit values.

Following the UK exit from the European Union, the Air Quality Standards Regulations were retained EU-derived domestic legislation under S.2 of the European Union (Withdrawal) Act 2018[8]. Practical amendments to ensure air quality management would continue were made via the following statutory instruments:

- The Air Quality (Amendment of Domestic Regulation) (EU Exit) Regulations 2019[9];
- The Air Quality (Miscellaneous Amendment and Revocation of Retained Direct EU Legislation) (EU Exit) Regulations 2018[10]; and
- The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[7].

Table 1 sets out the national air quality standards and standards used in this air quality assessment.

Table 1: Air quality standards

Pollutant	Averaging Period	Limit value / standard
Nitrogen dioxide (NO_2)	Annual mean	40µg/m^3
	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.79th percentile)
Particulate matter (PM_{10})	Annual mean	40µg/m^3
	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year (90.41st percentile)
Fine particulate matter ($PM_{2.5}$)	Annual mean	20µg/m^3
		12µg/m^3 to be achieved by 2028 [1][2]
		10µg/m^3 to be achieved by 2040 [1]

Note:

[1] The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10 µg/m³ ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m³, to be achieved by 31 January 2028.

[2] For the purpose of this assessment, a limit value of 12µg/m³ for $PM_{2.5}$ has been used.

[8] European Union (Withdrawal) Act 2018 (c. 16)

[9] The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019, SI 2019/0074

[10] The Air Quality (Miscellaneous Amendment and Revocation of Retained Direct EU Legislation) (EU Exit) Regulations 2018, SI 2018/1407

[11] Defra, 2023. Chief Planners Newsletter. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1140170/03_Chief_Planners_Newsletter_March_2023.pdf [Accessed June 2024]

2.1.3 Ecological Legislation

European Council Directive 92/43/EEC[12] (Habitats Directive) requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations 2017[13] transposes the Directive into law in England and Wales, now amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019[14].

The Habitats Directive requires the competent authority first to evaluate whether operation of the site is likely to give rise to a significant effect on the European site (Habitats Regulation Assessment screening). Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the Project would adversely affect the integrity of the European site.

Critical Levels

There are specific objective pollutant concentrations for vegetation called 'critical levels', which are shown in Table 2. These are concentrations below which harmful effects are unlikely to occur. The critical levels apply to locations more than 20km from towns with more than 250,000 inhabitants or more than 5km from other built-up areas, industrial installations or motorways.

The objectives in the legislation are used to assess the potential impacts upon any sensitive ecosystems.

Table 2: Critical levels for the protection of ecosystems

Pollutant	Averaging Period	Critical Level
Oxides of nitrogen (NO_x as NO_2)	Annual mean	30µg/m^3
	Daily mean	75µg/m^3
SO_2 (for all other ecosystems)	Annual mean	20µg/m^3

2.1.4 Dust Nuisance

Dust is the generic term used in the British Standard document BS 6069 (Part Two)[15] to describe particulate matter in the size range 1–75µm in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions in the Environmental Protection Act 1990[16], dust nuisance is defined as a statutory nuisance.

There are currently no standards or guidelines for dust nuisance in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. In law, complaints about excessive dust deposition would have to be investigated by the local authority and any complaint upheld for a statutory nuisance to occur. However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

2.1.5 Medium Combustion Plant Directive (MCPD)

The amended EPR regulates and enacts both the IED and the MCPD in England and operators undertaking any of the activities identified under these regulations require an environmental permit to carry out these activities.

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[12] European Council Directive (92/43/EEC) of 21 May 1992, on the conservation of natural habitats and of wild fauna and flora

[13] The Conservation of Habitats and Species Regulations 2017, SI 2017/1012

[14] The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, SI 2019/579

[15] BS 6069-2:1994, ISO 4225:1994 Characterisation of air quality

[16] Environmental Protection Act 1990, Chapter 43, Part III: Statutory Nuisance and Clean Air

In November 2015, the European Commission published the MCPD 2015/2193[17] on the limitation of emissions of certain pollutants into the air from medium combustion plant.

The MCPD regulates pollutant emissions from the combustion of fuels in plants with a rated thermal input equal to, or greater than, 1 megawatt (MWth) and less than 50 MWth.

The MCPD regulates emissions of SO_2, NO_x and dust to the air only, with the aim of reducing those emissions and the risks to human health and the environment they may cause. It also lays down rules to monitor emissions of CO but does not set an ELV for CO.

For those Medium Combustion Plant which are emergency use and operate less than 500 hours per year as a rolling average over a period of five years, the ELVs set out in the MCPD can be exempt, however an environmental permit will still be required.

2.1.6 Industrial Emissions Directive (IED)

The Industrial Emissions Directive (IED) (2010/75/EU)[18] was transposed into UK law through the Pollution Prevention and Control (PPC) system defined in The Environmental Permitting (England and Wales) Regulations 2016 (EPR)[3]. It is the regulatory regime being followed by the Environment Agency (EA). The UK government has introduced secondary legislation under the EU Withdrawal Act 2018, and further legislation in the devolved administrations where required, to ensure the domestic legislation that implements the IED can continue to operate.

The IED regulates pollutant emissions of NO_x, dust, SO_2 and CO to the air from combustion of fuel in plants with an aggregated rated thermal input equal or greater than 50MWth.

IED emission limit value (ELVs) for liquid fuel combustion plants (e.g. diesel generators) are provided in Annex V, Part 1 of the IED. However, for each of those turbines and engines which are emergency use and operate due to testing or emergency for less than 500 hours per year, the emission limit values defined in the IED under 1.1A combustion Chapter III Annex V do not apply.

The total aggregated capacity of the generators proposed is above 50 MWth and will therefore be permitted under the IED. However, because the individual combustion is below 15 MWth the installation will be permitted as an IED Chapter II installation but not a Chapter III (Large Combustion Plant) installation. This means the installation will not be required to meet the Best Available Technique (BAT) Conclusions for the Large Combustion plant. The permit will therefore follow the guidelines set out under the Medium Combustion Plant Directive (MCPD).

A.1.1 US Acute Exposure Guideline Levels (AEGLs)

In the United States, the Superfund Amendments and Reauthorization Act[19] (SARA) of 1986 required the US Environmental Protection Agency (EPA) to identify Extremely Hazardous Substances (EHSs) and, to provide guidance for conducting health hazard assessments for the development of emergency response plans for sites where EHSs are produced, stored, transported, or used. The Agency for Toxic Substances and Disease Registry (ATSDR) were also required to determine whether chemical substances identified either at hazardous waste sites or in the environment could present a public health concern.

Subsequently, Standard Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Substances[20] was published in 2001, providing updated procedures, methodologies, and other guidelines used by the National Advisory Committee (NAC) on Acute Exposure Guideline Levels for Hazardous Substances and the Committee on Acute Exposure Guideline Levels (AEGLs) in developing the AEGL values. There are now AEGLs for more than 270 extremely hazardous substances, which were

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[17] Directive (EU) 2015/2193 of the European Parliament and the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

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

[19] USEPA (1986) The Superfund Amendments and Reauthorization Act

[20] National Academies (2001) Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals

developed using the 2001 report and input from members of EPA, various governmental organisations and sectors, the chemical industry, academia and the private sector.

AEGLs represent threshold exposure limits (exposure levels below which adverse health effects are not likely to occur) for the general public and are applicable to emergency exposures ranging from 10 minutes to 8 hours.

There are three levels of AEGL, which are defined as follows:

- "AEGL-1 is the airborne concentration (expressed as ppm [parts per million] or mg/m^3 [milligrams per cubic meter]) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
- AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death."

The EA makes reference in the Data Centre Draft Industry Guidance (detailed in Section 2.3.3) to including a comparison of NO_2 with the AEGLs, for consideration of the potential impact from any emergency operation scenarios. Therefore, these AEGLs have been considered in the assessment. The AEGLs for NO_2 are provided in Table 3 below for hourly mean NO_2, 30-minute mean NO_2 and 10-minute mean NO_2.

Table 3: AEGLs 1-3 for NO_2

AEGL	10-minute mean	30-minute mean	Hourly mean
ppm			
AEGL 1	0.5	0.5	0.5
AEGL 2	20	15	12
AEGL 3	34	25	20
µg/m^3			
AEGL 1	956.3	956.3	956.3
AEGL 2	38,250	28,687.5	22,950
AEGL 3	65,025	47,812.5	38,250
Note: the AEGLs were converted from ppm to µg/m^3 using the Defra conversion factor for NO_x			

2.2 Policy

The land-use planning process is a key means of improving air quality, particularly in the long term, through the strategic location and design of new developments. Any air quality consideration that relates to land-use and its development can be a material planning consideration in the determination of planning applications, dependent upon the details of the Proposed Development.

2.2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[21] was updated in December 2023 with the purpose of planning to achieve sustainable development. Paragraph 192 of the NPPF on air quality states that:

> *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality*

[21] Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework

Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

In addition, paragraph 109 states that:

"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making."

Paragraph 180 discusses how planning policies and decisions should contribute to and enhance the natural and local environment. In relation to air quality, NPPF notes that this can be achieved by:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."

2.2.2 Planning Practice Guidance

Planning Practice Guidance (PPG)[22] on various topics, including air quality was developed in order to support the NPPF[21]. The guidance was first published in 2019 and is updated on a regular basis. It provides a concise outline as to how air quality should be considered in order to comply with the NPPF and identifies the circumstances when air quality is considered relevant to a planning application. This includes factors such as changes in traffic volumes, vehicle speeds, congestion or traffic composition, the introduction of new point sources of air pollution, exposure of people to existing sources of air pollutants, and the potential to give rise to air quality impacts at nearby sensitive receptors.

2.2.3 Clean Air Strategy

The Department for Environment, Food and Rural Affairs (Defra) Clean Air Strategy[23] was published in 2019 and sets targets for improving air quality across the country. It includes actions for reducing emissions from various sources, such as transport, domestic activities, farming and industry. There is also a long-term target for reducing population exposure to $PM_{2.5}$ concentrations to meet the World Health Organisation's (WHO) target of 10µg/m^3 as an annual mean. In particular, the Clean Air Strategy states:

"New legislation will create a stronger and a more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanism."

[22] Department for Communities and Local Government (2019): 'Planning Practice Guidance: Air Quality'

[23] Defra (2019) Clean Air Strategy 2019.

2.3 Guidance

2.3.1 Local Air Quality Management Policy and Technical Guidance

The policy guidance note, LAQM.PG(22)[24] provides additional guidance on the links between transport and air quality and the links between air quality and the land use planning system. It summarises the main ways in which the land-use planning system can help deliver compliance with the air quality objectives. This is relevant to any external organisations who may wish to engage with the local authority to assist in the delivery of their statutory duties on managing air quality.

The technical guidance, LAQM.TG(22)[25] is designed to support local authorities in carrying out their duties to review and assess air quality in their area. It provides detailed guidance on how to assess the impact of measures using existing air quality tools. Where relevant, this guidance has been taken into account in this assessment.

2.3.2 Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance Note H1

The IPPC H1 guidance[26] was produced by the Environment Agency (EA) for England and Wales in collaboration with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment and Heritage Service (EHS). The IPPC is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. The purpose of the H1 guidance note is to provide supplementary information relevant to all sectors, for the appraisal of BAT and to carry out an appropriate environmental assessment of the overall impact of the emissions resulting from a proposed installation.

The EA revised the H1 guidance and has developed a web-based version[27], with the latest revision date being September 2023. The SEPA H1 guidance has been followed in the assessment and, where applicable, reference is also made to the EA air emissions risk assessment guidance. For convenience, the reference to 'H1' is retained. This guidance sets out the full process for assessing air quality for an environmental permit and has been followed in this assessment.

2.3.3 Data Centre Draft Industry Guidance

The EA have published a working draft guide[28] (also known as the Frequently Asked Questions (FAQs) note) on the approach to the permitting and regulatory aspects for Data Centre within the context of the Industrial Emissions Directive (IED) and Environmental Permitting Regulations for 1.1A Combustion Activities 'Chapter II' sites aggregated to >50MWth input.

The FAQs also have relevance for Data centres that come under the Medium Combustion Plant Directive (MCPD) specified generators. i.e. plant that is less than aggregated 50MWth but which falls under the Tranche A or Tranche B criteria for generating power (unless 'excluded generator' due to <50 hours testing per year).

The draft guide makes reference to primarily assessing the NO_2 hourly mean from an emergency scenario (grid outage). This has been considered in the assessment.

The document is not presently an official release but forms the basis for discussion of a common methodology and liaison with individual operators and their industry association. The document states that it must be recognised that it is not a legal document intending to create or modify the law as stated in statute.

[24] Defra (2022) Local Air Quality Management Policy Guidance PG(22)

[25] Defra (2022) Local Air Quality Management Technical Guidance TG(22)

[26] IPPC H1 (2003) Environmental Assessment and Appraisal of BAT

[27] EA (2023) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-faadfor-your-environmental-permit

[28] EA (2018) Data Centre FAQ Headline Approach. Available at: https://consult.environment-agency.gov.uk/psc/cr0-4td-digital-realty-uk-limited/supporting_documents/Data%20Centre%20FAQ.pdf

3. Assessment Methodology

The overall approach to the air quality assessment comprises:

- A review of the existing air quality conditions at, and in the vicinity of the Proposed Development;
- An assessment of the potential changes in air quality arising from the operation of the Proposed Development; and
- Formulation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

3.1 Methodology of Baseline Assessment

Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources. This baseline assessment uses a study area of 2km from the Proposed Development, which is considered to be suitable to cover sufficient data to assess baseline conditions. Although the Proposed Development is located within the CBC authority area, Luton Borough Council (LBC) sits within 2km of the Proposed Development so has therefore been considered as part of the baseline assessment.

A desk-based review of the following data sources has been undertaken to determine baseline conditions of air quality in this assessment:

- CBC Air Quality Annual Status Report (ASR)[29];
- Luton Borough Council (LBC) ASR[30];
- The Defra Local Air Quality Management Website[31];
- The UK Air Information Resource Website[32]; and
- The EA register on industrial installations[33] and pollution inventory[34].

3.2 Methodology for Operational Phase

3.2.1 Emergency Generators

The Proposed Development comprises 42 containerised standby backup generators for emergency purposes, four of which are secondary back-ups (‘catcher’) and one is a smaller (‘house’) generator to cover non-critical loads (e.g., office lights, office fire system) during an emergency. The catcher generators have been run at 100% load during the emergency scenario to represent a worst-case scenario. Each generator has an individual flue at 25m above ground, the locations of which are provided in Figure 2. The generator details are provided in Appendix B.

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[29] Central Bedfordshire Council (2023) Air Quality Annual Status Report. Available at: https://www.centralbedfordshire.gov.uk/info/52/types_of_pollution/292/air_quality/3 [Accessed June 2024]

[30] Luton Borough Council (2023) Air Quality Annual Status Report. Available at: https://www.airqualityengland.co.uk/assets/documents/Luton/Luton_2023_ASR_FINAL_Ed_2.pdf [Accessed June 2024]

[31] Defra, Local Air Quality Management website. Available at: http://laqm.defra.gov.uk/ [Accessed June 2024]

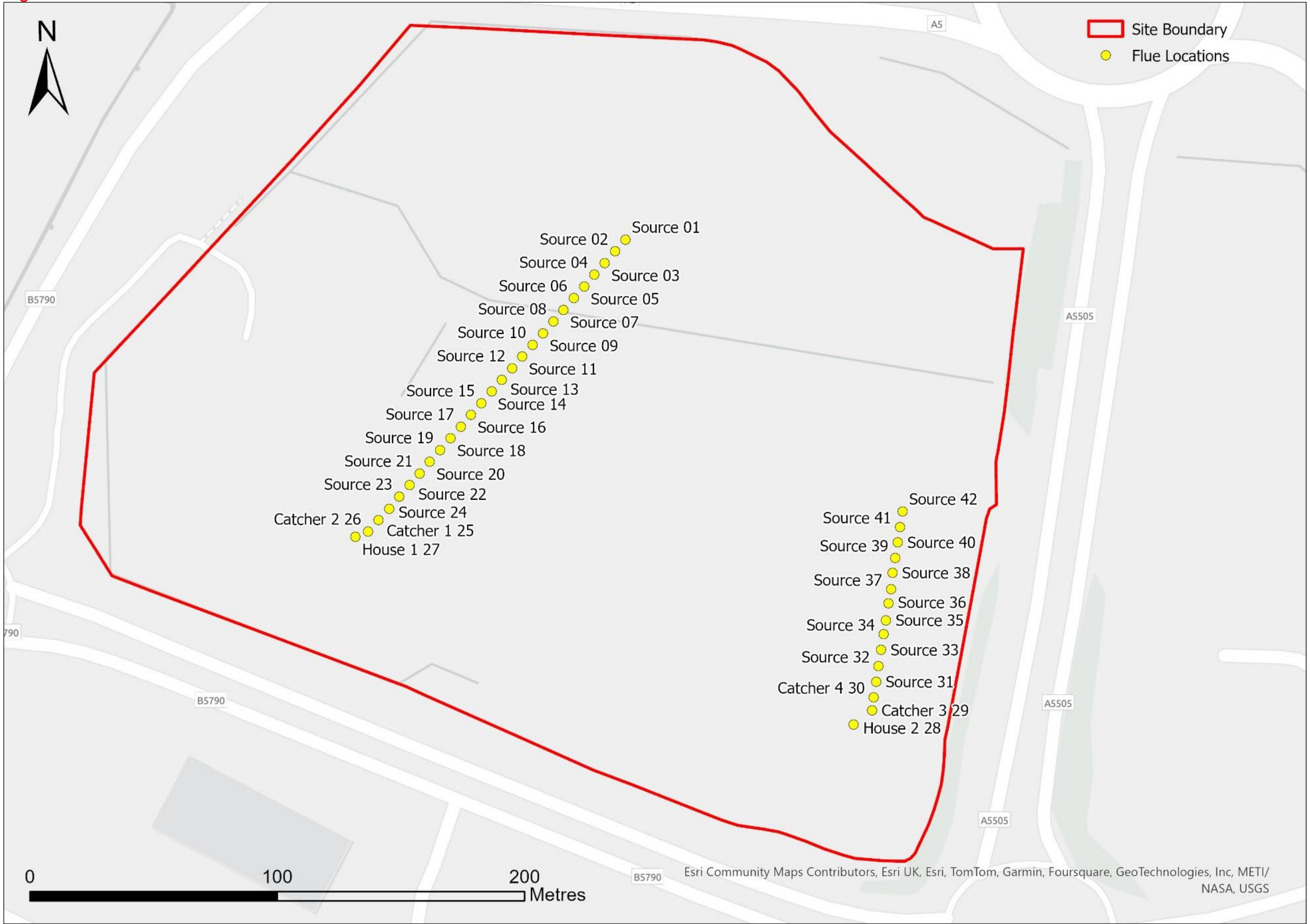
[32] Defra, Available at: https://uk-air.defra.gov.uk/ [Accessed June 2024]

[33] Environment Agency, Environmental Permitting Regulations – Installations. Available at: https://environment.data.gov.uk/public-register/view/search-industrial-installations [Accessed June 2024]

[34] Environment Agency, Pollution Inventory, https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory [Accessed June 2024]

There is also one generator in the substation compound, however it is a 150kW generator therefore not covered by MCP so is considered to be insignificant[17].

Figure 2: Generator flue locations



Assessment Scenarios

The scenarios detailed in Table 4 have been assessed, using information provided by Amazon Data Services UK Limited.

Table 4: Assessment scenarios

Scenarios	Operating profile	Description
Scenario 1: Biweekly	0.5 hour runs fortnightly = 13 hours per year	Each of the 42 generators to be tested, one at a time. Generators will be tested at 25% load (but conservatively modelled at 100%).
Scenario 2: Biannual	Up to 4 hours running, twice per year = 8 hours per year	Each of the 42 generators to be tested, one at a time. Generators will be tested at 100% load.
Scenario 3: Maintenance	10 hours of cumulative running over the course of the year	Each of the 42 generators to be tested, one at a time. Generators will be tested at 100% load.
Scenario 4: Emergency scenario (e.g., power utility outage)	A single (worst-case and rare) event of all generators running to simulate a power utility outage. The air quality modelling will establish the maximum emergency generator run hour availability.	A single event where 42 generators will operate simultaneously at 100% load, 8760 hours per year (in order to find the worst case hours for assessment against the hourly air quality standard for NO_2)

Although Scenario 1 is expected to run generators at 25% load, the modelling has assumed a 100% load for generator test runs as a conservative assumption to understand any potential operational constraints (100% load is expected to result in more emissions than 25% load).

Modelling long-term concentrations for testing scenarios (Scenario 1-3)

The long-term air quality standards are only relevant to planned operations (testing and maintenance). The resulting predicted annual mean concentrations were adjusted to the actual operating hours (e.g. for Scenario 1 the following factor was used to adjust the annual mean concentrations, 13 ÷ 8,760 = 0.0015) following EA guidance[35].

Modelling short-term concentrations for testing scenarios (Scenario 1-3)

There are short-term air quality standards for NO_2, and PM_{10}. The standards are given as a permitted annual number of exceedances of a threshold concentration, which can be expressed as an equivalent percentile. The NO_2 hourly mean standard (200µg/m^3), not to be exceeded more than 18 times a year, can be expressed at the 99.79th percentile of the hourly mean Predicted Environmental Concentration (PEC). PEC is the sum of the Process Contribution (PC) and the background concentration. The PM_{10} daily mean (50µg/m^3), not to be exceeded more than 35 times a year, can be expressed as the 90.41st percentile daily mean PEC.

Modelling short-term concentrations for emergency scenario (Scenario 4)

Modelling the generators for predicted short-term pollutant concentrations for the emergency scenario is complex as the timing of an emergency scenario cannot be predetermined. In order to estimate the absolute worst-case concentrations resulting from generators operating in an emergency, the modelling has assumed that 42 generators operate continuously throughout the year. This allows for the emissions to coincide with all meteorological conditions that occur throughout the year and then the short-term impacts are extracted from these predictions. This approach is very pessimistic as it is highly improbable that, in the case of the NO_2 hourly mean for instance, the generators will be operating during meteorological conditions that represent the 19 hours of the year that give rise to the highest concentrations for each receptor. Therefore, a further statistical analysis was carried out using the hypergeometric distribution to determine the probability of exceeding the NO_2 hourly mean standard.

[35] Environment Agency (2019) Specified generators: dispersion modelling assessment. Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment [Accessed June 2024]

Statistical analysis of the NO_2 hourly mean standard for Scenario 4 (emergency scenario)

The hypergeometric distribution has been used to assess the likelihood of NO_2 hourly mean exceedance hours coinciding with the estimated hours of emergency operation. This makes it possible to calculate the probability of exceeding the NO_2 hourly mean standard (not to be exceeded more than 18 times a year), taking into account the number of operating hours.

The probability of randomly selecting 19 or more exceedance hours (failures) from the operating hours (N) is the same as selecting a non-exceedance hour within the operating hours (successes, N – 19 hours). Based on this relationship, the hypergeometric analysis calculates the probability (P) of exceedance in a year (more than 18 exceedances of the $200 \mu g/m^3$ NO_2 hourly mean standard). The probability (P) is then multiplied by a safety factor of 2.5 following the EA guidance[35].

This study will determine the maximum generator run hour availability.

$$P = \sum_{i=0}^{N-19} \frac{\binom{K}{i}\binom{M-K}{N-i}}{\binom{M}{N}}$$

Where:

N= operating hours per year (maximum generator run hour availability determined in this study);

M= the operating envelope (i.e. the number of hours per year, 8,760 hours);

i= the number of sample successes required (i.e. the number of non-exceedance hours considering the total operating hours); and

K= The total number of non-exceedance hours in the operating envelope (i.e. 8,760 hours minus the number of hours that the limit in the model is expected to be exceeded).

3.2.2 Sensitive Receptors

Human Receptors

The assessment has been undertaken to assess the predicted concentrations in areas where the air quality standards apply for NO_2, PM_{10} and $PM_{2.5}$.

The long-term annual mean standard applies at locations where sensitive receptors are located, these would include residential properties, hospitals and schools. The short-term hourly mean standard applies at locations where members of the public may be expected to be present for more than an hour.

Pollutant concentrations have been predicted at existing and new sensitive receptors. Sensitive receptors include the properties around the Proposed Development. They include the most sensitive location of the residential area to the north and areas to the west and south, including a new residential property development directly to the west and south. These receptors have been modelled at the façades of nearby buildings (both existing and proposed), as these are closest to the pollutant sources, and have been included at 1.5m above ground level (corresponding to the average height of human exposure).

Additionally, a receptor has been added at Luton AQMA No. 1 as it sits within 2km of the Proposed Development.

Details of the assessed human receptors are given in

Table 5 below and their locations are shown in Figure 3.

Table 5: Assessed human receptors

ID	Receptor	National Grid Reference		Height (m)
		X	Y	
HR1	Chalton Heights	503208	226155	1.5
HR2	Unnamed Road 1	503613	226047	1.5
HR3	Sundon Road	504067	226163	1.5
HR4	Unnamed Road 2	503137	225364	1.5
HR5	The Chiltern School	503127	225129	1.5
HR6	Haughton Regis School	502849	225054	1.5
HR7	Sundon Road	502849	225199	1.5
HR8	Chalton Lower School	503208	226382	1.5
HR9	Priory Parkside Preschool	503022	224977	1.5
HR10	Houghton Park Road	503323	224959	1.5
HR11	New Receptor 1	503094	225708	1.5
HR12	New Receptor 2	503111	225606	1.5
HR13	New Receptor 3	503156	225460	1.5
HR14	New Receptor 4 – Thornhill Primary School	502690	225359	1.5
HR15	Sundon Feeder Station House	503777	226130	1.5
HR16	New Receptor 5	503601	225224	1.5
HR17	New Receptor 6	503482	225430	1.5
AQMA	Luton AQMA No. 1	504546	224620	1.5

Ecological Receptors

Ecological receptors have been reviewed within the vicinity of the Proposed Development, in accordance with EA guidance[35]:

- Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ramsar Sites and Sites of Special Scientific Interest (SSSI) within 10km; and
- Local Nature Sites (including ancient woodlands, Local Wildlife Sites (LWS), National and Local Nature Reserves (NNR and LNR) within 2km.

This review has identified that there are no SAC or SP within 10km of the Proposed Development.

There are two Sites of Special Scientific Interest (SSSI) within 2km of the Proposed Development, ER2 (Fancott Woods and Meadows) and ER1 and ER3 (Sundon Chalk Quarry). Two receptors have been placed an Sundon Chalk Quarry (ER1 and ER3) to take into account wind direction which is predominantly south-westerly (see Section 3.3.1 below). There is also an additional ancient woodland north-east of the Proposed Development (ER4) and a pocket of ancient woodland within Fancott Woods and Meadows (ER5).

Receptors were placed at the closest edge of the ecological designation to the proposed generator flues.

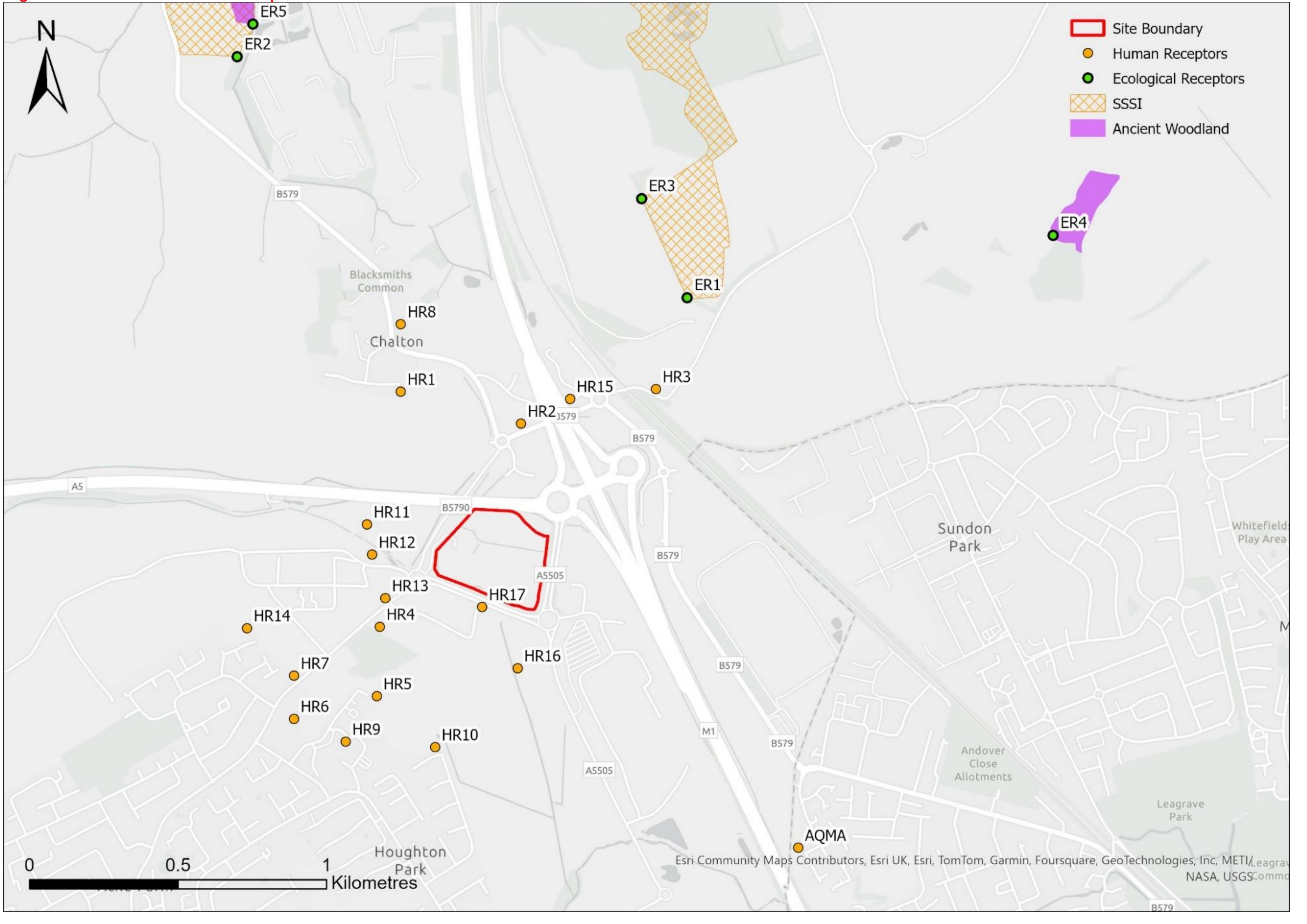
Ecological receptors have been modelled at a height of 0m, representative of ground level.

Ecological receptors are detailed in Table 6 and shown in Figure 3.

Table 6: Assessed ecological receptors

ID	Receptor	National Grid Reference		Height (m)
		X	Y	
ER1	Sundon Chalk Quarry (SSSI)	504307	226017	0
ER2	Fancott Woods and Meadows (SSSI)	502657	227281	0
ER3	Sundon Chalk Quarry (SSSI)	504018	226804	0
ER4	Ancient Woodland (AW) – unnamed	505404	226681	0
ER5	Fancott Woods and Meadows (AW)	502710	227391	0

Figure 3: Modelled sensitive receptors



3.3 Dispersion Model Setup

The ADMS 6 (version 6.0.0.1) was used for this assessment. The model has been widely validated for point sources and is accepted by the industry and the Environment Agency as 'fit for purpose' for air quality assessments of combustion plant and stack releases. The model incorporates the latest understanding of boundary layer meteorology and dispersion.

3.3.1 Meteorological Data

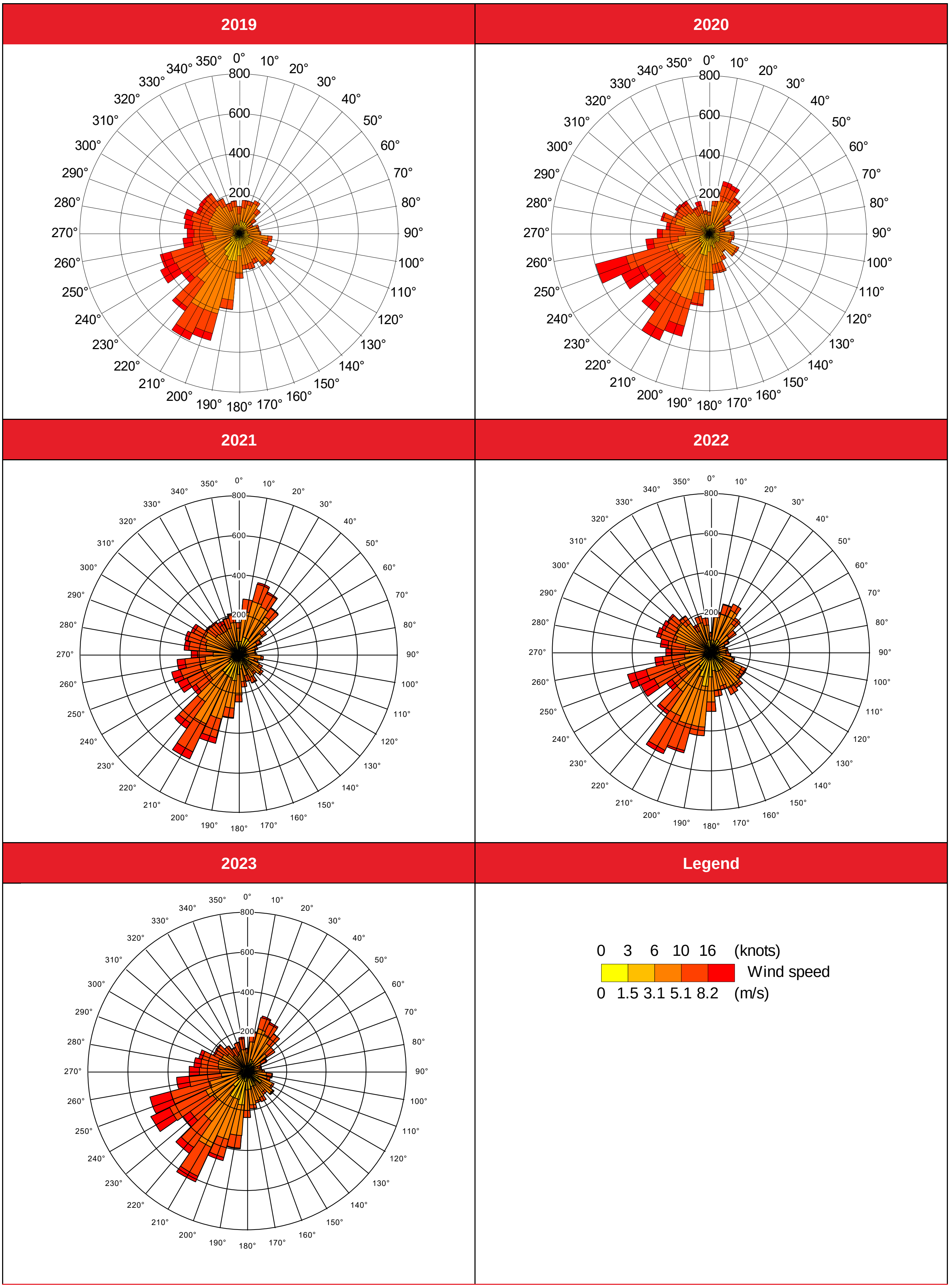
Meteorological data used in this assessment was measured at London Luton Airport meteorological station over the period 1st January 2019 to 31st December 2023 (inclusive). Five years of meteorological data have been used in the dispersion modelling to account for natural climatic variability. London Luton Airport is located approximately 9.2km south-east of the Proposed Development. This meteorological site was chosen due to its proximity to the Proposed Development.

In order for the modelling exercise to be representative of local conditions and to predict long-term averages, the dispersion model requires representative meteorological data. Most dispersion models cannot make predictions during calm wind conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. The default option within ADMS for treating calm conditions has been implemented, by setting the minimum wind speed to 0.75m/s. LAQM.TG22 guidance[25] recommends that the meteorological data file is tested within a dispersion model and the relevant output log file checked to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. The guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably 90%.

The datasets for 2019-2023 all had usable hours greater than 90% (2019: 99%; 2020: 100%; 2021: 98%; 2022: 100%; and 2023: 100%). The data therefore meet the requirements of the LAQM.TG22 guidance[25] and are considered to be adequate for use in dispersion modelling.

Figure 4 shows the wind roses for each year of data (2019 to 2023); the predominant wind direction is south-westerly.

Figure 4: Windroses for Luton Airport, 2019 to 2023



3.3.2 Buildings

Buildings can have a significant effect on the dispersion of pollutants and has been included within the model, particularly the two data centre halls and the substation. Building model input geometries are shown in Table 7 and Figure 5.- Building A will have the greatest effect on generator flues 1-27 and has therefore been set as the main building for these generators(see Figure 2). Building B will have the most effect on generator flues 28-42 and has therefore been set as the main building for these generators (see Figure 2). The complex building geometry has been simplified so as to be included within the model, which only accepts rectangular or circular building shapes. Additionally, due to the height of the noise barriers and landscaping bund, this has also been included in the model as it is likely to affect dispersion. Both have been modelled as buildings to enable them to be included.

Table 7: Modelled building parameters

Name	Building centre		Height (m)	Length (m)	Width (m)	Angle of building length to north (degrees)
	X centroid	Y centroid				
Building A	503446	225641	22.7	66.5	183.4	131.4
Building B	503592	225520	22.7	66.3	108.8	98.1
Substation	503506	225540	6.2	56.5	60.0	110.9
Landscaping bund	503614	225679	20.0	47.3	155.1	43.2
Noise barrier 1	503420	225542	5.0	25.0	0.001	40.0
Noise barrier 2	503490	225602	5.0	183.0	0.001	130.0
Noise barrier 3	503643	225470	5.0	26.8	0.001	189.0
Noise barrier 4	503661	225502	5.0	70.2	0.001	278.0

Assumptions and Limitations

The following assumptions and limitations have been applied to the modelling of buildings:

- The landscaping bund will be 20m at the highest point, with regrading creating more variation in gradients. It has been modelled at a single height as this will provide a worst-case scenario as well as simplifying geometry for input into ADMS 6.
- As ADMS 6 will only accept rectangular or circular building shapes, the noise barriers have been modelled in four separate sections. They have been modelled as buildings with the minimum allowed building width of 0.001m.

Figure 5: Modelled buildings

3.3.3 Other Input Parameters

The extent of mechanical turbulence (and hence, mixing) in the atmosphere is affected by the surface/ground over which the air is passing. Typical surface roughness values range from 0.0001m (for water or sandy deserts) to 1.5 (for cities, forests and industrial areas). In this assessment, the general land use in the Proposed Development can be described as "Cities, woodland" with a corresponding surface roughness of 1.0m. The surface roughness value used for the meteorological station site was also "Cities, woodland", which is considered representative.

The minimum Monin-Obukhov length is a model parameter which describes the extent to which the urban heat island effect limits stable atmospheric conditions. A Monin-Obukhov length of 30m has been used in this dispersion modelling study. It is suggested in ADMS-6 guidance that this length is suitable for "Cities and large towns". The same Monin-Obukhov length was used for the meteorological station site, which is considered representative.

3.3.4 NO_x to NO_2 Conversion

The model predicts nitrogen oxides (NO_x) concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NO_x is emitted from combustion processes, primarily as NO with a small percentage of NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form NO_2.

This assessment has followed the methodology set out by the EA[36], which states it should be assumed as a worst-case scenario that 70% of long-term and 35% of short-term NO_x concentrations will convert to NO_2[37].

3.3.5 Total Concentrations

To calculate the total concentration, the background concentrations are added to the impact of the generators at the receptors. For long-term concentrations, the annual average background concentration has been used. For the short-term concentrations (daily mean or hourly mean), twice the annual mean will be added to the model predictions, following EA H1 guidance[27].

The total concentrations at each receptor are calculated as follows:

- Long-term total concentration or predicted environmental concentration (PEC): long-term PC from the generators + annual mean background concentration.
- Short-term PEC: short-term PC + 2 x annual mean background concentration.

3.4 Significance Criteria

3.4.1 Human receptors

The EA H1 guidance[27] describes how insignificant process contributions can be screened out of further analysis.

Step 1: The process contribution (PC) can be considered insignificant and require no further investigation if:

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

Step 2: For those contributions not screened out, the PEC, which is the sum of background concentration and PC, must be tested. Concentrations are considered potentially significant if:

- The long-term PEC is greater than 70% of the long-term standard; or

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[36] Environment Agency (2024) Environmental permitting: air dispersion modelling reports. Available at: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports [Accessed June 2024]

[37] Environment Agency; Air Quality Modelling and Assessment Unit, Conversion ratios for NO_x and NO_2

- The short-term PC is greater than 20% of the short-term standard minus twice the annual mean background concentration.

3.4.2 Ecological receptors

Similarly, to the above process, the following criteria from the EA guidance[27] have been used in this assessment in respect to potential impacts at ecological sites:

- For SPAs, SACs, Ramsar sites or SSSIs:
  - The short-term PC is greater than 10% of the short-term environmental standard for protected conservation areas;
  - The long-term PC is less than 1% of the long-term environmental standard for protected conservation area but the PEC is less than 70% of the long-term environmental standards.

Predicted PC or PEC that meet the above criteria are deemed to be insignificant. When impacts cannot be screened out as being insignificant using the thresholds above, further evaluation of the significance requires advice from an ecologist.

3.4.3 Hypergeometric distribution

With regards to the probability from the hypergeometric distribution, the following criteria has been used following the EA guidance[35]. Where the probability is:

- 1% or less – exceedances are highly unlikely;
- less than 5% – exceedances are unlikely as long as the generator plant operational lifetime is no more than 20 years; and
- more than or equal to 5% – there is potential for exceedances and the regulator will consider if acceptable on a case-by-case basis.

Where probability is more than or equal to 5%, proposals to reduce the risk of exceedance of the hourly mean standard should be provided (i.e. reduction in the number of operating hours).

4. Baseline Assessment

A 2km study area is generally considered to be appropriate to determine baseline conditions. This section identifies the main sources of air pollution within 2km of the Proposed Development, the local air quality monitoring data for recent years and local background pollutant concentrations.

4.1 Air Pollution Sources

4.1.1 Industrial Processes

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A(1), A(2), Part B or Medium Combustion Plant (MCP) processes, and are regulated through the Pollution Prevention and Control (PPC) system[38,39]. The larger more polluting processes are regulated by the EA and the smaller less polluting ones by the local authorities. Local authorities regulate only for emissions to air, whereas the EA regulates emissions to air, water, and land.

There are no Part A(1) processes with releases to air within 2km of the Proposed Development, according to the EA website[33].

4.1.2 Road Traffic

In recent decades, atmospheric emissions from transport on a national basis have grown to match or exceed other sources in respect of many pollutants, particularly in urban areas. The local air quality around the Proposed Development is mainly influenced by vehicle emissions, notably the M1 (14,535 AADT[40] in 2023[41]) and the A5 (302,850 AADT in 2023[42,43]).

4.2 Local Air Quality

The Environment Act 2021[1] requires local authorities to review and assess air quality with respect to the standards for the pollutants specified in the National Air Quality Strategy. Where standards are not predicted to be met, local authorities must declare the area as an AQMA and then produce an Air Quality Action Plan (AQAP) which includes measures to improve air quality in the AQMA. Local authorities are also required to prepare an ASR to state the measures implemented to improve local air quality and report any progress achieved. Most AQMAs across the UK have been declared due to road traffic emissions.

The Proposed Development is located within the CBC authority area, which has three AQMAs, according to the Defra website[44]. However, these AQMAs are not within the 2km study area and the closest AQMA to the Proposed Development is the Luton Borough Council (LBC) Luton AQMA No. 1, which is located approximately 1.2km south-east of the Proposed Development. This AQMA was declared in 2003 for exceedances of the annual mean NO_2 air quality standards. The Luton AQMA No.2 is located approximately

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

[39] The Environmental Permitting (England and Wales) Regulations 2016, SI 2016/1154.

[40] Annual Average Daily Traffic (AADT)

[41] Department for Transport, Road traffic statistics, Site number 90071, Available at: https://roadtraffic.dft.gov.uk/manualcountpoints/90071 [Accessed June 2024]

[42] Estimation using previous years annua average daily flow.

[43] Department for Transport, Road traffic statistics, Site number 90065, Available at: https://roadtraffic.dft.gov.uk/manualcountpoints/90065 [Accessed June 2024]

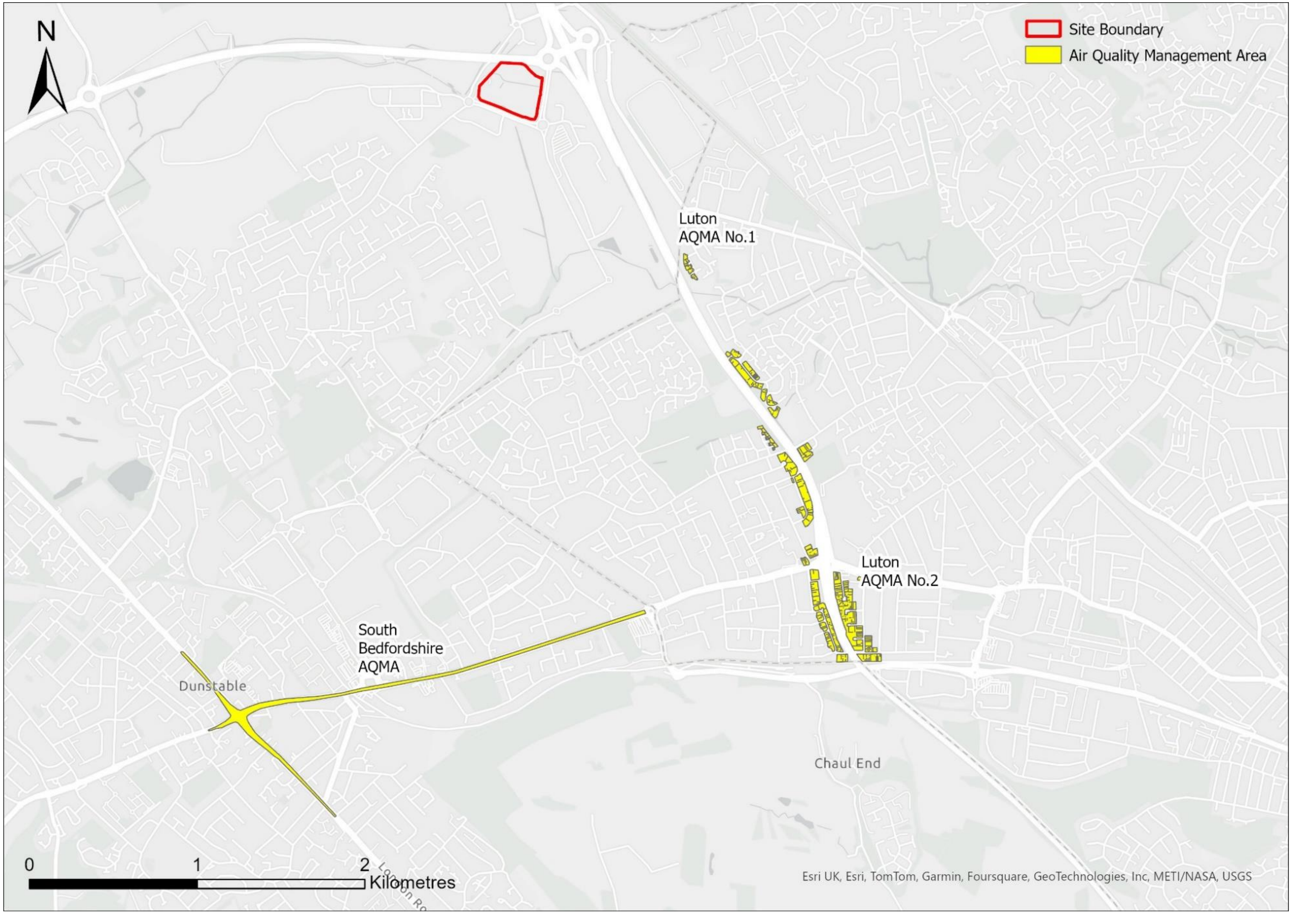
[44] Defra, List of Local Authorities with AQMAs. Available at: https://uk-air.defra.gov.uk/aqma/list [Accessed June 2024]

1.8km south-east of the Proposed Development and was declared in 2005 for exceedances of the annual mean for NO_2.

The nearest CBC AQMA is the South Bedfordshire AQMA, approximately 3km to the south of the Proposed Development. This AQMA was declared in 2005 for exceedances of the annual mean for NO_2.

The locations of these AQMAs are shown in Figure 6.

Figure 6: Air Quality Management Areas



4.3 Local Monitoring

A review of the existing air quality conditions in the area surrounding the Proposed Development has been undertaken using the 2023 CBC ASR[29] and the 2023 LBC ASR[30].

4.3.1 Automatic Monitoring

Automatic or continuous monitoring involves drawing air through an analyser continuously to obtain near real-time pollutant concentration data. A review of the most recent ASRs from CBC[29] and LBC[30] show that there are no automatic monitoring sites within 2km of the Proposed Development.

There is therefore no PM_{10} or $PM_{2.5}$ monitoring within 2km of the Proposed Development.

4.3.2 Diffusion Tube Monitoring

According to the CBC ASR, there are no diffusion tube locations within 2km of the Proposed Development. However, there is one diffusion tube located within 2km of the Proposed Development from LBC. The diffusion tube is approximately 1.2km south-east of the Proposed Development and lies within the Luton AQMA No.1. Details of the monitoring site is presented in Table 8 and its location shown in Figure 7.

Table 8: Details of diffusion tube monitoring sites within 2km of the Proposed Development

Local Authority	Site ID	Site Name	Site Type	OS Grid Ref (m)	
				X	Y
LBC	LN82	11 Withy Close	Suburban	504828	223999

NO_2 Monitored Concentrations

Table 9 shows the monitoring results for NO_2 from 2019 to 2023, which are the most recent years of available monitoring data. There were no exceedances of the annual mean air quality standard for NO_2, which is 40µg/m^3. The data show concentrations were well below the air quality standard for the period 2019 to 2022.

Table 9: Diffusion tube monitoring results for annual mean NO_2 from 2019 to 2023

Site ID	Site Name	Annual Mean NO_2 Concentration (µg/m^3)				
		2019	2020	2021	2022	2023
LN82	11 Withy Close	27.6	20.9	19.7	19.9	-

Notes:
"-" indicates no data was available for this year.

Data for 2020 and 2021 is not considered to be representative of typical conditions due to the Covid-19 pandemic, however the data is included for completeness.

4.4 Background Concentrations

Defra publishes background pollutant mapping[45] for every 1km x 1km Ordnance Survey (OS) grid square across the UK for NO_2, NO_x, PM_{10}, $PM_{2.5}$.

Table 10 show the estimated Defra background concentrations for the OS grid square containing the Proposed Development (503500, 225500) for 2023. All estimated background pollutant concentrations outlined in Table 10 are below their relevant standards (Table 1).

[45] Defra, Background Pollutant Mapping, Available at: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html; [Accessed: 23 June 2024].

Table 10: Defra background pollutant concentrations for 2023

Description	X, Y	Average Annual Mean Concentrations (µg/m^3)			
		NO_2	NO_x	PM_{10}	$PM_{2.5}$
Proposed Development	503500, 225500	13.2	17.7	17.4	10.6

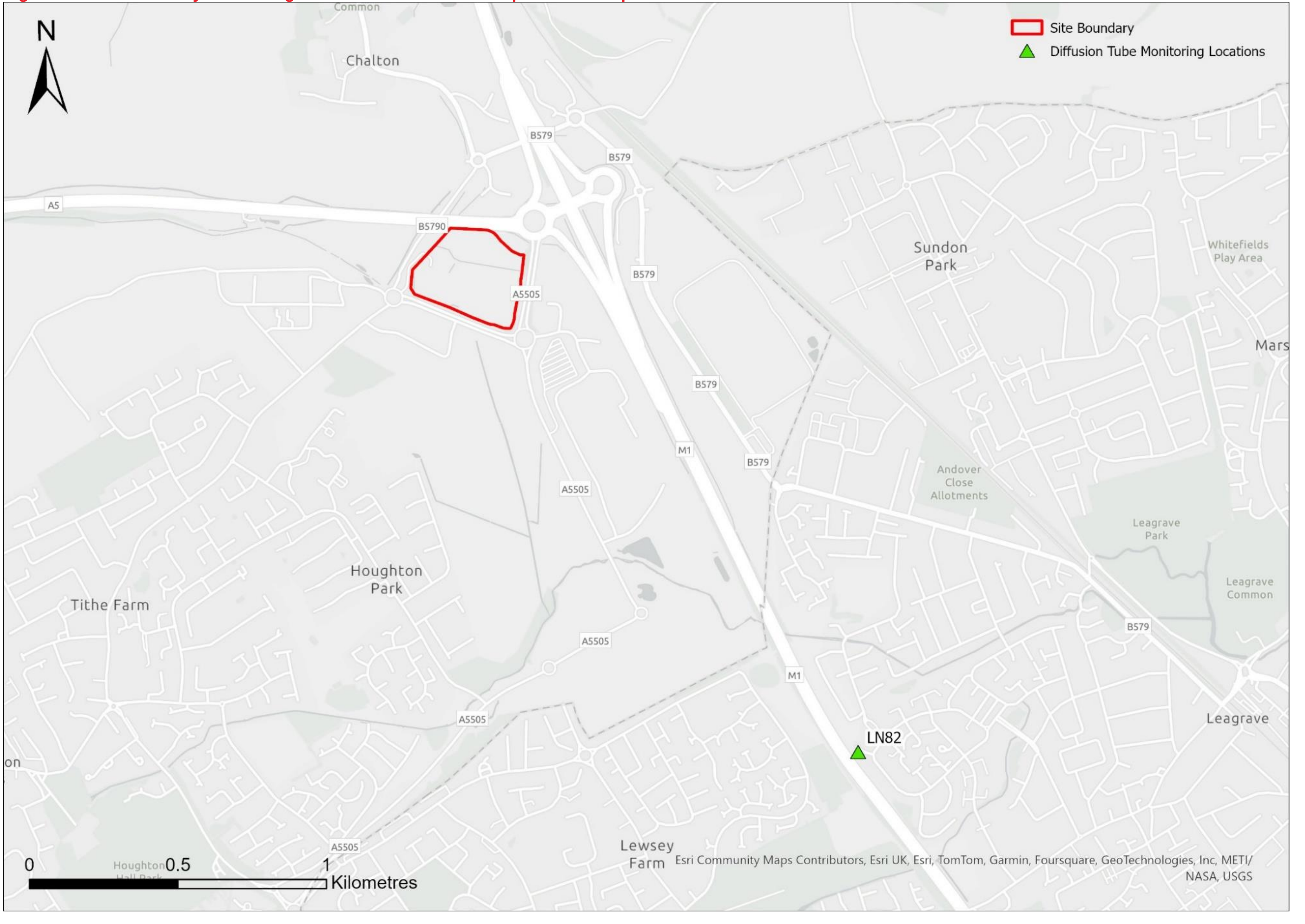
Although suburban locations can be considered representative of background conditions according to the LAQM.TG(22) guidance[25], monitoring site LN82 is not considered to be representative of background air quality conditions at the Proposed Development as it is likely to be influenced by local emission sources since it is approximately 40m east of the M1.

The nearest urban background monitor is approximately 3.2km from the Proposed Development and is too far to be considered representative. As there are no urban background monitoring locations within 2km of the Proposed Development, the Defra background concentrations for NO_2 have been used in this air quality assessment.

For PM_{10} and $PM_{2.5}$, in the absence of relevant monitoring results, Defra predicted backgrounds have been used for these pollutants too.

Defra background concentrations specific to the receptor locations have been used in the assessment. Concentrations are shown in results tables in Appendix C.

Figure 7: Local Authority monitoring sites within 2km of the Proposed Development



4.5 Baseline Summary

There is one AQMA within 2km of the Proposed Development, which is the LBC Luton AQMA No. 1, located approximately 1.2km south-east of the Proposed Development. This AQMA was declared in 2003 for exceedances of the annual mean NO_2 air quality standard.

CBC does not undertake any air quality monitoring within 2km of the Proposed Development. The nearest monitoring location to the Proposed Development, LN82, is operated by LBC and recorded an annual mean of 19.9µg/m^3 in 2022, which is well below the annual mean air quality standard.

Defra NO_2 annual mean background concentrations at the Proposed Development is 13.2µg/m^3 in 2023. No relevant background monitoring data for NO_2, PM_{10} and $PM_{2.5}$ is available within the study area; therefore, the 2023 Defra prediction background concentrations have been used in this assessment.

In summary, baseline concentrations at the Proposed Development are likely to be well below the air quality standards.

5. Best Available Techniques (BAT)

5.1 Overview

This section contains the findings and background of the appraisal of BAT and reports the findings of various alterations that have been made to the system of generators to minimise air quality impacts. BAT is explained in detail in the *EA guidance 'Best Available Techniques: Environmental Permits*[46]. The term 'technique' encompasses the technology used and the way the system is designed, built and operated.

The following section outlines the initial model setup prior to understanding the alterations that would be required to achieve BAT, and subsequently outlines the various scenarios that have been assessed to improve air quality concentrations.

In order to determine BAT for the Proposed Development, the following steps were taken:

- The project team compared initial air quality emission rates from an array of generators available, to identify the most acceptable generators that could be taken forward;
- The model inputs were further refined by comparing parameters with the noise team to ensure consistency and agree a generator specification suitable for both air quality and noise;
- A stack height assessment was undertaken in preliminary air quality modelling. More information of the stack height assessment is outlined below.

5.2 Stack Height Assessment

A stack height assessment was undertaken in preliminary air quality modelling to determine a suitable height of the proposed generator.

The stack height assessment was undertaken using a preliminary test fit, which comprised of a reduced number of 38 generators in the same layout as the final test fit design (see Figure 2).

Emissions of short-term NO_2 for Scenario 4 were identified early in the design development as the likely worse case and therefore this stack height assessment focussed on the predicted short-term NO_2 concentrations for the emergency scenario only.

When considering the stack height of 22m originally assessed was found to be suitable for the preliminary test fit design, as the final assessment and design has considered an increased stack height of 25m, this is also considered suitable for the Proposed Development.

[46] Environment Agency, 2016. Best Available Techniques: environmental permits. Available at: https://www.gov.uk/guidance/best-available-techniques-environmental-permits [Accessed July 2024]

6. Operational Phase Assessment

6.1 Assessment of Back-up Generator Emissions

The concentrations of pollutants as a result of generator emissions have been predicted for five meteorological years (2019, 2020, 2021, 2022, 2023) at each of the identified nearby sensitive receptors. The following section provides a summary of the highest modelling results predicted from the five years of meteorological data used. The detailed results are provided in Appendix C.

Table 11 outlines a summary of the significance of effects from Scenarios 1-4 (See Table 4 for information on the scenarios) for the assessment of generator emissions on human receptors. No significant effects were identified for testing or emergency scenarios.

Table 11: Human receptor assessment summary of significance for testing and emergency scenarios

Scenario	NO_2 annual mean	PM_{10} annual mean	$PM_{2.5}$ annual mean	NO_2 hourly mean	PM_{10} daily mean
Scenario 1 (biweekly test)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Scenario 2 (biannual test)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Scenario 3 (maintenance test)	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Scenario 4 emergency	-	-	-	Insignificant	Insignificant
"-"denotes that as this scenario would only run for a limited period and is not a regularly scheduled test, no annual averages have been calculated					

Table 12 outlines a summary of the significance of effects from Scenarios 1-4 on ecological receptors. No significant effects were identified for the testing scenarios. Although the critical level for NO_x daily mean is exceeded in the emergency scenario (Scenario 4), the chances of this scenario occurring are considered to be unlikely. After discussion with an ecologist, it was concluded that the NO_2 daily mean and can therefore be considered to be insignificant.

Table 12: Ecological assessment summary of significance for testing and emergency scenarios

Scenario	NO_x annual mean	SO_2 annual mean	NO_x daily mean
Scenario 1 (biweekly test)	Insignificant	Insignificant	Insignificant
Scenario 2 (biannual test)	Insignificant	Insignificant	Insignificant
Scenario 3 (maintenance test)	Insignificant	Insignificant	Insignificant
Scenario 4 emergency	-	-	Not significant [1]
"-"denotes that as this scenario would only run in the event of an emergency and is not a regularly scheduled test, no annual averages have been calculated. [1] Whilst the impacts on the NO_x daily mean from the generators during the emergency scenario are potentially significant, it should be noted that the chances of this scenario occurring are considered to be unlikely, based on the reliability of the electrical distribution network and the inbuilt design resilience.			

More detailed descriptions of the results on human receptors are provided in Table 13-Table 17 below for each Scenario, and full results are provided in Appendix C for testing and emergency Scenarios (see Table 4 for information on Scenarios).

Hypergeometric distribution analysis was undertaken to determine the maximum emergency running envelope for the emergency scenario (Scenario 4). Results for the hypergeometric distribution analysis are summarised in Table 17.

Table 18 provides the outcome of the assessment of the Scenario 4 emergency impacts against the AEGLs in keeping with EA requirements. There is an exceedance of AEGL 1 for each of the three time periods assessed (10 minute, 30-minute and 1 hour). The AEGLs guidance states that effects of exposure to AEGL 1 are “not disabling and are transient and reversible upon cessation of exposure”. Additionally, the risk of this emergency scenario occurring is very unlikely based on electrical grid reliability for the area and inbuilt design resilience. The exceedances are detailed below:

- For the 10-minute, 30-minute and 1-hour limits for AEGL 1, there is one exceedance at HR17, a residential receptor (New Receptor 6).

There are no exceedances of AEGL 2 and AEGL 3 for any of the three time periods assessed.

6.1.1 Scenario 1 – biweekly test

Table 13: Assessment of generator emissions on human receptors - Scenario 1 (biweekly test) results

Pollutant & period	Air quality standard	Largest PC	Location of largest PC (receptor)	PC as % of air quality standard	Largest PEC	Location of largest PEC (receptor)	PEC compared to air quality standard	Impact
NO_2 annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	15.2µg/m^3	AQMA	Well below the air quality standard	Insignificant
PM_{10} annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	17.4µg/m^3	HR17 (New Receptor 6)	Well below the air quality standard	Insignificant
$PM_{2.5}$ annual mean concentration	12µg/m^3 [1]	<0.01µg/m^3	HR2	Less than 1%	11.0µg/m^3	AQMA	Below the limit value	Insignificant
NO_2 hourly mean concentration (99.79th percentile)	200µg/m^3	52.1µg/m^3	HR17	More than 10% More than 20% of the short-term minus twice the annual mean background concentration (step 2 of the H1 criteria)[27]	78.4µg/m^3	HR17	Well below the air quality standard	Insignificant [2]
PM_{10} daily mean concentration (90.41st percentile)	50µg/m^3	0.2µg/m^3	HR2	Less than 10%	35.5µg/m^3	HR17	Well below the air quality standard	Insignificant

Notes:

[1] The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m³ ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m³, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[2] Although impacts cannot be screened out at receptor HR17 using the EA criteria, the air quality standard is not exceeded; overall the potential impacts are considered to be insignificant.

6.1.2 Scenario 2 – biannual test

Table 14: Assessment of generator emissions on human receptors - Scenario 2 (biannual test) results

Pollutant & period	Air quality standard	Largest PC	Location of largest PC (receptor)	PC as % of air quality standard	Largest PEC	Location of largest PEC (receptor)	PEC compared to air quality standard	Impact
NO_2 annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	15.2µg/m^3	AQMA	Well below the air quality standard	Insignificant
PM_{10} annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	17.4µg/m^3	HR17 (New Receptor 6)	Well below the air quality standard	Insignificant
$PM_{2.5}$ annual mean concentration	12µg/m^3 [1]	<0.01µg/m^3	HR2	Less than 1%	11.0µg/m^3	AQMA	Below the limit value	Insignificant
NO_2 hourly mean concentration (99.79th percentile)	200µg/m^3	52.1µg/m^3	HR17	More than 10% More than 20% of the short-term minus twice the annual mean background concentration (step 2 of the H1 criteria)[27]	78.4µg/m^3	HR17	Well below the air quality standard	Insignificant [2]
PM_{10} daily mean concentration (90.41st percentile)	50µg/m^3	0.2µg/m^3	HR2	Less than 10%	35.3µg/m^3	HR17	Well below the air quality standard	Insignificant

Notes:

[1] The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m^3 ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m^3, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[2] Although impacts cannot be screened out at receptor HR17 using the EA criteria, the air quality standard is not exceeded; overall the potential impacts are considered to be insignificant.

6.1.3 Scenario 3 – maintenance test

Table 15: Assessment of generator emissions on human receptors - Scenario 3 (maintenance test) results

Pollutant & period	Air quality standard	Largest PC	Location of largest PC (receptor)	PC as % of air quality standard	Largest PEC	Location of largest PEC (receptor)	PEC compared to air quality standard	Impact
NO_2 annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	15.2µg/m^3	AQMA	Well below the air quality standard	Insignificant
PM_{10} annual mean concentration	40µg/m^3	<0.01µg/m^3	HR2 (Unnamed Road 1)	Less than 1%	17.4µg/m^3	HR17 (New Receptor 6)	Well below the air quality standard	Insignificant
$PM_{2.5}$ annual mean concentration	12µg/m^3 [1]	<0.01µg/m^3	HR2	Less than 1%	11.0µg/m^3	AQMA	Below the limit value	Insignificant
NO_2 hourly mean concentration (99.79th percentile)	200µg/m^3	52.1µg/m^3	HR17	More than 10% More than 20% of the short-term minus twice the annual mean background concentration (step 2 of the H1 criteria)[27]	78.4µg/m^3	HR17	Well below the air quality standard	Insignificant [2]
PM_{10} daily mean concentration (90.41st percentile)	50µg/m^3	0.2µg/m^3	HR2	Less than 10%	35.3µg/m^3	HR17	Well below the air quality standard	Insignificant

Notes:

[1] The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m³ ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m³, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[2] Although impacts cannot be screened out at receptor HR17 using the EA criteria, the air quality standard is not exceeded; overall the potential impacts are considered to be insignificant.

6.1.4 Scenario 4 – emergency scenario

Table 16: Assessment of generator emissions on human receptors - Scenario 4 (emergency scenario) results

Pollutant & period	Air quality standard	Largest PC	Location of largest PC (receptor)	PC as % of air quality standard	Largest PEC	Location of largest PEC (receptor)	PEC compared to air quality standard	Impact
NO_2 hourly mean concentration	200µg/m^3	637µg/m^3	HR11 (New Receptor 1)	More than 10% More than 20% of the short-term minus twice the annual mean background concentration (step 2 of the H1 criteria)[27]	954µg/m^3	HR17 (New Receptor 6)	Exceeds the air quality standard	Insignificant[1]
PM_{10} daily mean concentration (90.41st percentile)	50µg/m^3	14.5µg/m^3	HR17	Less than 10% More than 20% of the short-term minus twice the annual mean background concentration (step 2 of the H1 criteria)[27]	49.3µg/m^3	HR17	Below the air quality standard	Insignificant[2]

Notes:

[1] As there is an exceedance of the air quality standard of 200µg/m^3, the next step required is the statistical analysis using the hypergeometric distribution. See Table 17 for hypergeometric distribution analysis results.

[2] Although impacts cannot be screened out at receptors using the EA criteria, as there are no exceedances of the air quality standard, and as this scenario would only occur in the unlikely event of a grid power outage, this is considered to be insignificant.

Table 17: Hypergeometric distribution analysis - Scenario 4 (emergency scenario) results

Pollutant & period	Air quality standard	Maximum number of exceedances	Location of maximum exceedances (receptor)	Envelope (hours of operation)	Probability of exceedance	Impact
NO_2 hourly mean concentration	200µg/m^3	1,906	HR17 (New Receptor 6)	55	4.95%	Unlikely[1], [2]
				48	0.97%	Highly Unlikely

Notes:

[1] HR17 is the only receptor with an exceedance greater than 1% with an envelope of 55 hours.

[2] Exceedances are unlikely as long as the generator plant operational lifetime is no more than 20 years.

Table 18: Assessment of Generator Emissions - Scenario 4 (emergency scenario) AEGL results

Pollutant & period	AEGL Limit Values (µg/m³)			Largest PC (µg/m³)	Location of largest PC (receptor)	Largest PEC (µg/m³)	Location of largest PEC (receptor)	PC as % of AEGL Limit Value	PC compared to AEGL Limit Value	Impact
	AEGL 1	AEGL 2	AEGL 3							
NO_x hourly mean concentration	956.3	22,950.0	38,250.0	1012	HR17 (New Receptor 6)	1038	HR17	106% of AEGL 1 [1]	Exceeds AEGL 1	Insignificant [2]
NO_x 30-minute mean concentration	956.3	28,867.5	47,812.5	1051	HR17	1077	HR17	110% of AEGL 1 [1]	Exceeds AEGL 1	Insignificant [2]
NO_x 10-minute mean concentration	956.3	38,250.0	65,025.0	1080	HR17	1106	HR17	113% of AEGL 1 [1]	Exceeds AEGL 1	Insignificant [2]

Notes

[1] There are no exceedances of AEGLs 2 and 3 therefore these have not been assessed further.

[2] Although there is an exceedance of AEGL 1, as this scenario would only occur in the unlikely event of a grid power outage, this is considered to be insignificant.

The impact of the Proposed Development on ecological receptors has been assessed against the relevant air quality standards for each scenario. Detailed descriptions of the results at ecological receptors are provided in Table 19-Table 22 below for each Scenario, and results are provided in Appendix C for testing and emergency Scenarios (see Table 4 for information on Scenarios).

APIS acidity plots for determining exceedances of the critical load are also provided in Appendix D.

6.1.5 Scenario 1 – biweekly test

Table 19: Assessment of generator emissions on ecological receptors - Scenario 1 (biweekly test) results

Pollutant & period	Critical level	Largest PC	Location of largest PC (receptor)	PC as % of critical level	Largest PEC	Location of largest PEC (receptor)	PEC compared to critical level	Impact
NO_x annual mean concentration	30µg/m^3	<0.01µg/m^3	ER1 (Sundon Chalk Quarry, SSSI)	Less than 1%	14.7µg/m^3	ER1	Below the critical level	Insignificant
SO_2 annual mean	20µg/m^3	<0.01µg/m^3	ER1	Less than 1%	3.5µg/m^3	ER4 (Ancient Woodland – unnamed)	Below the critical level	Insignificant
NO_x daily mean	75µg/m^3	9.85µg/m^3	ER1	More than 10%	39.2µg/m^3	ER1	Below the critical level	Insignificant

6.1.6 Scenario 2 – biannual test

Table 20: Assessment of generator emissions on ecological receptors - Scenario 2 (biannual test) results

Pollutant & period	Critical level	Largest PC	Location of largest PC (receptor)	PC as % of critical level	Largest PEC	Location of largest PEC (receptor)	PEC compared to critical level	Impact
NO_x annual mean concentration	30µg/m^3	<0.01µg/m3	ER1 (Sundon Chalk Quarry, SSSI)	Less than 1%	14.7µg/m3	ER1	Below the critical level	Insignificant
SO_2 annual mean	20µg/m^3	<0.01µg/m3	ER1	Less than 1%	3.5µg/m^3	ER4 (Ancient Woodland – unnamed)	Below the critical level	Insignificant
NO_x daily mean	75µg/m^3	9.85µg/m^3	ER1	More than 10%	39.2µg/m^3	ER1	Below the critical level	Insignificant

6.1.7 Scenario 3 –maintenance test

Table 21: Assessment of generator emissions on ecological receptors - Scenario 3 (maintenance test) results

Pollutant & period	Critical level	Largest PC	Location of largest PC (receptor)	PC as % of critical level	Largest PEC	Location of largest PEC (receptor)	PEC compared to critical level	Impact
NO_x annual mean concentration	30µg/m^3	<0.01µg/m3	ER1 (Sundon Chalk Quarry, SSSI)	Less than 1%	14.7µg/m3	ER1	Below the critical level	Insignificant
SO_2 annual mean	20µg/m^3	<0.01µg/m3	ER1	Less than 1%	3.5µg/m^3	ER4 (Ancient Woodland – unnamed)	Below the critical level	Insignificant

Pollutant & period	Critical level	Largest PC	Location of largest PC (receptor)	PC as % of critical level	Largest PEC	Location of largest PEC (receptor)	PEC compared to critical level	Impact
NO_x daily mean	75µg/m^3	9.85µg/m^3	ER1	More than 10%	39.2µg/m^3	ER1	Below the critical level	Insignificant

6.1.8 Scenario 4 – emergency scenario

Table 22: Assessment of generator emissions on ecological receptors - Scenario 4 (emergency scenario) results

Pollutant & period	Critical level	Largest PC	Location of largest PC (receptor)	PC as % of critical level	Largest PEC	Location of largest PEC (receptor)	PEC compared to critical level	Impact
NO_x daily mean	75µg/m^3	348µg/m^3	ER1 (Sundon Chalk Quarry, SSSI)	More than 10%	377µg/m^3	ER1	Above the critical level	Not significant[1]

Note:
[1] Whilst the critical level of NO_x daily mean from the generators during the emergency scenario is exceeded, it should be noted that the chances of this scenario occurring are considered to be unlikely, based on the reliability of the electrical distribution network and inbuilt design resilience.

In addition to reviewing the results for ecological receptors against the relevant critical levels, nitrogen and acid deposition have also been considered for Scenarios 1-3. Scenario 4 has not been considered as it will only be run in the event of an emergency and has therefore only considered short-term effects.

Receptors ER1, ER3-ER5 do not have critical loads assigned according to APIS, and therefore have not been assessed with regard to nitrogen or acid deposition. Only receptor ER2 is assessed below.

6.1.9 Scenario 1-3

Nitrogen deposition

For nitrogen deposition, the impact of the PC at receptor ER2 is predicted to be less than 1% of the relevant critical load. The impacts during Scenario 1-3 are therefore considered to be insignificant.

Acid deposition

For acid deposition, the PC for receptor ER2 was less than the critical load and no exceedances of the critical load function were recorded using the APIS critical load function tool. As such, the impacts of acid deposition during Scenario 1-3 can be considered insignificant.

Acidity plots recorded using the APIS critical load tool are provided in Appendix D, Figure 8-Figure 10.

7. Mitigation

7.1 Operational

Embedded Mitigation

Mitigation has been embedded into the design for the Proposed Development. This has resulted in no significant effects in the assessment. These embedded measures include:

- Determining an appropriate stack height for the generator exhausts at an earlier design stage, which was found to be 25m based on air quality modelling; and
- The choice of high market generators and flue design (parameters affecting exit velocity and temperature which influence dispersion). Further information is provided below.

As part of the air quality assessment (AQA), consideration has also been given to the design of the plant, equipment and infrastructure, particularly in how to demonstrate relevant Best Available Techniques (BAT) will be used. This includes consideration for the MCPD.

A comprehensive BAT assessment is contained within the Summary Technical Report (30231-ARP-XX-XX-RP-Z-1003) which forms part of this Environmental Permit Application In relation to emissions to air (and the AQA) however, the below responses to the quoted Environment Agency text provide a summary to demonstrate that the engines are specified to be BAT. This is for 2 standby backup diesel generators for emergency use with a net rated thermal input above 1 MW, which are exempted from MCPD emission limits because they operate for less than 500 hours per year.

- “Emissions optimised engines specified to TA-Luft 2g, or US EPA Tier 2 standard or equivalent NO_x emission levels in the range of 2000 mg/m^3 of NO_x at 5% oxygen and reference conditions”

Response – the assessment has been based on back-up emergency generators specified to US EPA Teir 2 standard.

- “Dispersion of flue gases optimised through vertical stacks, no caps and cowls impediments”;

Response – Individual 25m vertical stacks, clear of impediments, are proposed to be installed at the Proposed Development. A stack height assessment was undertaken in preliminary air quality monitoring to determine the optimised height of the stack.

- “Maintenance testing minimised and kept to less than 50 hours per year”;

Response - Maintenance testing will be kept to less than 50 hours per year – see Table 4.

- “Provision of flue gases sampling ports to allow for monitoring of NO_x and Carbon Monoxide in line with web guidance ‘Monitoring stack emissions: low risk MCPs and specified generators’”.

Response – Sampling ports will be included for flue gas monitoring.

Further Mitigation

Given no significant effects have been identified in the assessment, no further mitigation is required. This is further evidenced given the likelihood of a complete grid failure for a continuous 55-hour period is considered to be highly unlikely, based on in-built electrical design resilience measures at the Proposed Development, together with published grid reliability data for the National Grid Network.

8. Conclusions

This report considered and assessed the likely significant effects of the Proposed Development on local air quality.

A review of current legislation and planning policy and a baseline assessment describing the current air quality conditions in the vicinity of the Proposed Development has been undertaken.

Monitoring data within 2km of the Proposed Development showed that there are no exceedances of the annual mean NO_2 air quality standard (40µg/m^3). Defra background concentrations for the OS grid square containing the Proposed Development are below their relevant standards for annual mean NO_2, annual mean PM_{10} (40µg/m^3) and annual mean $PM_{2.5}$ (20µg/m^3). The interim $PM_{2.5}$ target of 12µg/m^3 was not exceeded.

The operational effects from the generator emissions were assessed for planned testing scenarios, which would be under normal operation of the Proposed Development. The generator and flue design found no significant impacts with regards to the NO_2, PM_{10}, $PM_{2.5}$ standards for all testing Scenarios (1-3) for human receptors. Additionally, there were no significant impacts with regards to the NO_x and SO_2 critical levels for all testing Scenarios (1-2) for ecological receptors.

An emergency scenario (Scenario 4) was assessed assuming all generators would be operating in the unlikely event of a grid failure. For Scenario 4, potential exceedances of the NO_2 hourly mean standard and NO_x daily mean critical level are predicted. A statistical analysis (hypergeometric distribution) was used to determine the significance for hourly NO_2 and to maximum emergency running envelope for the emergency scenario. This showed that an exceedance of the NO_2 hourly mean standard would be unlikely (<5% probability) for an operating window of 55 hours for receptor HR17 (all other modelled receptors have a probability <1%). The probability of exceedance is very unlikely (<1% probability) for an operating window of 48 hours for all receptors. While there is a predicted exceedance of the NO_x daily mean critical level, it should also be noted that the likelihood of this emergency scenario occurring is very unlikely based on electrical grid reliability for the area and inbuilt design resilience. After discussion with an ecologist, it can therefore be considered to be not significant.

Exceedances of the AEGL 1 limit are predicted under the emergency scenario. The effects of exposure to AEGL 1 are not disabling and are reversible upon cessation of exposure. Additionally, the likelihood of this scenario occurring us very unlikely based on electrical grid reliability for the area and inbuilt design resilience.

No significant impacts were found with regards to the SO_2 critical level.

Overall, it can be concluded that there are no significant effects from the Proposed Development on air quality.

Appendix B

Generator Parameters

The Proposed Development comprises 42 generators (including four catcher generators and two smaller house generators) with the parameters detailed in Table 23.

The emission rates used are taken for the more conservative generator options provided by Amazon Data Services UK Limited.

The generators are proposed to have individual flue exhausts. The coordinates of the flue for the generators are detailed in Table 24.

Table 23: Generator stack exhaust parameters

Description	Units	Main generators and redundancy generators at 100% load	House generator
Generator	-	CAT 3516E	CAT C32
Power capacity	MWe	2.8	0.72
NO_x Concentration	Mg/Nm^3	2,232	1,938
NO_x emission rate	g/s	5.66	1.47
PM_{10} emission rate	g/s	0.068	0.011
SO_2 emission rate [1]	g/s	0.0042	0.0013
Exit diameter	m	0.6	0.6
Exit temperature	°C	489.6	509.2
Efflux velocity	m/s	38.3	12.2

Notes:
[1] The SO_2 emission rate for the generators was calculated using USEPA AP-42 methodology[47], assuming the Sulphur content of heavy oil is 1% following EU directive[48].

Table 24: Generator flue locations

Source ID	X (m)	Y (m)	Height above ground (m)
Source 01	503542	225672	25
Source 02	503538	225668	25
Source 03	503534	225663	25
Source 04	503530	225658	25
Source 05	503526	225653	25
Source 06	503522	225649	25
Source 07	503517	225644	25
Source 08	503513	225639	25
Source 09	503509	225635	25
Source 10	503505	225630	25
Source 11	503501	225625	25
Source 12	503497	225620	25

[47] US Environmental Protection Agency (1996) AP 42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines. [Accessed June 2024] Available at: AP 42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources | US EPA

[48] Ricardo-AEA (2012) Implementation of the EC Sulphur Content of Liquid Fuels Directive 1999/32/EC (as amended by 2005/33/EC) in the UK

Source ID	X (m)	Y (m)	Height above ground (m)
Source 13	503492	225616	25
Source 14	503488	225611	25
Source 15	503484	225606	25
Source 16	503480	225602	25
Source 17	503476	225597	25
Source 18	503472	225592	25
Source 19	503468	225587	25
Source 20	503463	225583	25
Source 21	503459	225578	25
Source 22	503455	225573	25
Source 23	503451	225569	25
Source 24	503447	225564	25
Catcher 1 25	503443	225559	25
Catcher 2 26	503438	225554	25
House 1 27	503433	225552	25
House 2 28	503635	225476	25
Catcher 3 29	503642	225482	25
Catcher 4 30	503643	225487	25
Source 31	503644	225494	25
Source 32	503645	225500	25
Source 33	503646	225507	25
Source 34	503647	225513	25
Source 35	503648	225519	25
Source 36	503649	225526	25
Source 37	503650	225531	25
Source 38	503650	225538	25
Source 39	503651	225544	25
Source 40	503653	225550	25
Source 41	503653	225556	25
Source 42	503654	225563	25

Appendix C

Modelling Results

C.1 Scenario 1 (biweekly test)

C.1.1 NO_2 results for Scenario 1 (biweekly test)

Table 25: NO_2 annual mean results (µg/m^3)

Receptor	X	Y	Long term NO_2 background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR2	503613	226047	14.8	2022	<0.01	0.01%	14.8	37%	Insignificant
HR3	504067	226163	11.1	2019	<0.01	<0.01%	11.1	28%	Insignificant
HR4	503137	225364	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR5	503127	225129	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR6	502849	225054	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR7	502849	225199	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR8	503208	226382	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR9	503022	224977	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR10	503323	224959	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR11	503094	225708	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR12	503111	225606	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR13	503156	225460	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR14	502690	225359	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR15	503777	226130	14.8	2019	<0.01	0.01%	14.8	37%	Insignificant
HR16	503601	225224	13.2	2021	<0.01	0.01%	13.2	33%	Insignificant
HR17	503482	225430	13.2	2021	0.01	0.03%	13.2	33%	Insignificant
AQMA	504546	224619	15.2	2022	<0.01	<0.01%	15.2	38%	Insignificant

AQS: 40µg/m^3

[1] Results are to 2d.p.

Table 26: NO_2 hourly mean results (µg/m³)

Receptor	X	Y	Short term NO_2 background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	29.7	2022	14.4	7%	44.1	22%	Insignificant
HR2	503613	226047	29.7	2020	20.0	10%	49.7	25%	Insignificant
HR3	504067	226163	22.2	2021	14.6	7%	36.7	18%	Insignificant
HR4	503137	225364	26.3	2021	19.6	10%	45.9	23%	Insignificant
HR5	503127	225129	26.3	2021	13.8	7%	40.2	20%	Insignificant
HR6	502849	225054	18.3	2019	10.1	5%	28.4	14%	Insignificant
HR7	502849	225199	18.3	2021	10.0	5%	28.3	14%	Insignificant
HR8	503208	226382	29.7	2022	12.8	6%	42.4	21%	Insignificant
HR9	503022	224977	21.7	2019	11.8	6%	33.5	17%	Insignificant
HR10	503323	224959	21.7	2019	15.6	8%	37.3	19%	Insignificant
HR11	503094	225708	26.3	2019	20.6	10%	46.9	23%	Insignificant
HR12	503111	225606	26.3	2019	22.9	11%	49.3	25%	Insignificant
HR13	503156	225460	26.3	2021	24.2	12%	50.5	25%	Insignificant
HR14	502690	225359	18.3	2022	9.4	5%	27.7	14%	Insignificant
HR15	503777	226130	29.7	2021	14.6	7%	44.2	22%	Insignificant
HR16	503601	225224	26.3	2022	24.9	12%	51.3	26%	Insignificant
HR17	503482	225430	26.3	2022	52.1	26%	78.4	39%	Insignificant [1]
AQMA	504546	224619	30.4	2020	7.3	4%	37.7	19%	Insignificant

AQS: 200µg/m³

[1] Although impacts cannot be screened out using the EA criteria, Scenario 1 would include 546 hours of total generator run time over the course of a year, which equates to 6% of the year (546/8760); overall the potential impacts are considered to be insignificant.

C.1.2 PM_{10} results for Scenario 1 (biweekly test)

Table 27: PM_{10} annual mean results (μg/m^3)

Receptor	X	Y	Long term PM_{10} background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR2	503613	226047	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR3	504067	226163	14.9	2019	<0.01	<0.01%	14.9	37%	Insignificant
HR4	503137	225364	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR5	503127	225129	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR6	502849	225054	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR7	502849	225199	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR8	503208	226382	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR9	503022	224977	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR10	503323	224959	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR11	503094	225708	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR12	503111	225606	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR13	503156	225460	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR14	502690	225359	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR15	503777	226130	16.8	2019	<0.01	<0.01%	16.8	42%	Insignificant
HR16	503601	225224	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR17	503482	225430	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
AQMA	504546	224619	17.4	2022	<0.01	<0.01%	17.4	43%	Insignificant

AQS: 40μg/m^3

[1] Results are to 2d.p.

Table 28: PM_{10} daily mean results (µg/m^3)

Receptor	X	Y	Short term PM_{10} background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	33.6	2022	0.08	0.17%	33.7	67%	Insignificant
HR2	503613	226047	33.6	2022	0.20	0.39%	33.8	68%	Insignificant
HR3	504067	226163	29.8	2021	0.10	0.20%	29.9	60%	Insignificant
HR4	503137	225364	34.8	2021	0.13	0.26%	34.9	70%	Insignificant
HR5	503127	225129	34.8	2021	0.14	0.27%	35.0	70%	Insignificant
HR6	502849	225054	30.0	2021	0.05	0.11%	30.0	60%	Insignificant
HR7	502849	225199	30.0	2021	0.05	0.10%	30.0	60%	Insignificant
HR8	503208	226382	33.6	2022	0.06	0.12%	33.7	67%	Insignificant
HR9	503022	224977	29.5	2021	0.09	0.18%	29.6	59%	Insignificant
HR10	503323	224959	29.5	2021	0.10	0.21%	29.6	59%	Insignificant
HR11	503094	225708	34.8	2019	0.13	0.26%	34.9	70%	Insignificant
HR12	503111	225606	34.8	2019	0.12	0.24%	34.9	70%	Insignificant
HR13	503156	225460	34.8	2021	0.13	0.25%	34.9	70%	Insignificant
HR14	502690	225359	30.0	2021	0.03	0.07%	30.0	60%	Insignificant
HR15	503777	226130	33.6	2022	0.17	0.35%	33.8	68%	Insignificant
HR16	503601	225224	34.8	2021	0.25	0.50%	35.1	70%	Insignificant
HR17	503482	225430	34.8	2021	0.47	0.93%	35.3	71%	Insignificant
AQMA	504546	224619	34.7	2019	0.03	0.06%	34.8	70%	Insignificant

AQS: 50µg/m^3

[1] Results are to 2d.p.

C.1.3 $PM_{2.5}$ results for Scenario 1 (biweekly test)

Table 29: $PM_{2.5}$ annual mean results (µg/m^3)

Receptor	X	Y	Long term $PM_{2.5}$ background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	10.4	2022	<0.01	<0.01%	10.4	87%	Insignificant
HR2	503613	226047	10.4	2022	<0.01	<0.01%	10.4	87%	Insignificant
HR3	504067	226163	9.5	2019	<0.01	<0.01%	9.5	79%	Insignificant
HR4	503137	225364	10.6	2021	<0.01	<0.01%	10.6	88%	Insignificant
HR5	503127	225129	10.6	2021	<0.01	<0.01%	10.6	88%	Insignificant
HR6	502849	225054	9.3	2021	<0.01	<0.01%	9.3	77%	Insignificant
HR7	502849	225199	9.3	2021	<0.01	<0.01%	9.3	77%	Insignificant
HR8	503208	226382	10.4	2022	<0.01	<0.01%	10.4	87%	Insignificant
HR9	503022	224977	9.7	2021	<0.01	<0.01%	9.7	81%	Insignificant
HR10	503323	224959	9.7	2021	<0.01	<0.01%	9.7	81%	Insignificant
HR11	503094	225708	10.6	2019	<0.01	<0.01%	10.6	88%	Insignificant
HR12	503111	225606	10.6	2019	<0.01	<0.01%	10.6	88%	Insignificant
HR13	503156	225460	10.6	2021	<0.01	<0.01%	10.6	88%	Insignificant
HR14	502690	225359	9.3	2021	<0.01	<0.01%	9.3	77%	Insignificant
HR15	503777	226130	10.4	2019	<0.01	<0.01%	10.4	87%	Insignificant
HR16	503601	225224	10.6	2021	<0.01	<0.01%	10.6	88%	Insignificant
HR17	503482	225430	10.6	2021	<0.01	<0.01%	10.6	88%	Insignificant
AQMA	504546	224619	11.0	2022	<0.01	<0.01%	11.0	92%	Insignificant

AQS: 12µg/m^3. The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m^3 ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m^3, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[1] Results are to 2dp.

C.1.4 Ecological Results for Scenario 1 (biweekly test)

Table 30: NO_x annual mean results (µg/m³)

Receptor	X	Y	Long term NO_x background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER2	502658	227281	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant
ER3	504018	226804	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER4	505404	226681	14.1	2023	<0.01	<0.01%	14.1	47%	Insignificant
ER5	502711	227391	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant

Critical Level: 30µg/m³

[1] Results are to 2d.p.

Table 31: NO_x daily mean results (µg/m³)

Receptor	X	Y	Short term NO_x background	Maximum Year	Maximum modelled PC	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	29.4	2021	9.85	13%	39.2	52%	Insignificant
ER2	502658	227281	24.5	2019	5.78	8%	30.3	40%	Insignificant
ER3	504018	226804	29.4	2022	8.93	12%	38.3	51%	Insignificant
ER4	505404	226681	28.3	2020	3.93	5%	32.2	43%	Insignificant
ER5	502711	227391	24.5	2021	4.96	7%	29.4	39%	Insignificant

Critical Level: 75µg/m³

Table 32: SO_2 annual mean results (µg/m³)

Receptor	X	Y	Long term SO_2 background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER2	502658	227281	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant
ER3	504018	226804	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER4	505404	226681	3.5	2023	<0.01	<0.01%	3.5	17%	Insignificant
ER5	502711	227391	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant

Critical Level: 20µg/m³

[1] Results are to 2d.p.

Table 33: Nutrient nitrogen deposition results

Ecological receptor ID	Critical load (CL) min	Background Nitrogen deposition	Annual mean NO_2 PC (µg/m^3)	Dry deposition (kg N/ha/yr)	Proportion of PC to CL (%) Min	Proportion of PEC to CL (%) Min
ER1 (Calcareous Grassland)	10	15.2	0.0018	0.00025	0.0025	152.2
ER1 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0018	0.00051	0.0051	281.0
ER2	10	9.7	0.0004	0.00006	0.0006	97.4
ER3 (Calcareous Grassland)	10	15.2	0.0014	0.00020	0.0020	152.2
ER3 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0014	0.00040	0.0040	281.0
ER4	No critical load has been assigned for this feature					
ER5	No critical load has been assigned for this feature					

Table 34: Acid deposition results

Ecological receptor ID	Critical Load (CL) max Sulphur (kg S/ha/yr)	CL min Nitrogen (kg N/ha/yr)	CL max Nitrogen (kg N/ha/yr)	Background Nitrogen deposition (kg N/ha/yr)	Background Sulphur deposition (kg S/ha/yr)	PC Nitrogen (keq N/ha/yr)	PC Sulphur (keq S/ha/yr)	Exceedance
ER1 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000002	0.000018	PC < CL No exceedance
ER1 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000004	0.000036	PC < CL No exceedance
ER2	4	0.928	4.928	1.17	0.16	0.0000001	0.000004	PC < CL No exceedance
ER3 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000002	0.000014	PC < CL No exceedance
ER3 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000003	0.000029	PC < CL No exceedance
ER4	Not available for this feature							
ER5	Not available for this feature							

C.2 Scenario 2 (biannual test)

C.2.1 NO_2 results for Scenario 2 (biannual test)

Table 35: NO_2 annual mean results (µg/m^3)

Receptor	X	Y	Long term NO_2 background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR2	503613	226047	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR3	504067	226163	11.1	2019	<0.01	<0.01%	11.1	28%	Insignificant
HR4	503137	225364	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR5	503127	225129	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR6	502849	225054	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR7	502849	225199	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR8	503208	226382	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR9	503022	224977	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR10	503323	224959	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR11	503094	225708	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR12	503111	225606	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR13	503156	225460	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR14	502690	225359	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR15	503777	226130	14.8	2019	<0.01	<0.01%	14.8	37%	Insignificant
HR16	503601	225224	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR17	503482	225430	13.2	2021	<0.01	0.02%	13.2	33%	Insignificant
AQMA	504546	224619	15.2	2022	<0.01	<0.01%	15.2	38%	Insignificant

AQS: 40µg/m^3

[1] Results are to 2d.p.

Table 36: NO_2 hourly mean results (µg/m³)

Receptor	X	Y	Short term NO_2 background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	29.7	2022	14.4	7%	44.1	22%	Insignificant
HR2	503613	226047	29.7	2020	20.0	10%	49.7	25%	Insignificant
HR3	504067	226163	22.2	2021	14.6	7%	36.7	18%	Insignificant
HR4	503137	225364	26.3	2021	19.6	10%	45.9	23%	Insignificant
HR5	503127	225129	26.3	2021	13.8	7%	40.2	20%	Insignificant
HR6	502849	225054	18.3	2019	10.1	5%	28.4	14%	Insignificant
HR7	502849	225199	18.3	2021	10.0	5%	28.3	14%	Insignificant
HR8	503208	226382	29.7	2022	12.8	6%	42.4	21%	Insignificant
HR9	503022	224977	21.7	2019	11.8	6%	33.5	17%	Insignificant
HR10	503323	224959	21.7	2019	15.6	8%	37.3	19%	Insignificant
HR11	503094	225708	26.3	2019	20.6	10%	46.9	23%	Insignificant
HR12	503111	225606	26.3	2019	22.9	11%	49.3	25%	Insignificant
HR13	503156	225460	26.3	2021	24.2	12%	50.5	25%	Insignificant
HR14	502690	225359	18.3	2022	9.4	5%	27.7	14%	Insignificant
HR15	503777	226130	29.7	2021	14.6	7%	44.2	22%	Insignificant
HR16	503601	225224	26.3	2022	24.9	12%	51.3	26%	Insignificant
HR17	503482	225430	26.3	2022	52.1	26%	78.4	39%	Insignificant [1]
AQMA	504546	224619	30.4	2020	7.3	4%	37.7	19%	Insignificant

AQS: 200µg/m³

[1] Although impacts cannot be screened out using the EA criteria, Scenario 2 would include 336 hours of total generator run time over the course of a year, which equates to 4% of the year (336/8760); overall the potential impacts are considered to be insignificant.

C.2.2 PM_{10} results for Scenario 2 (biannual test)

Table 37: PM_{10} annual mean results (µg/m^3)

Receptor	X	Y	Long term PM_{10} background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR2	503613	226047	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR3	504067	226163	14.9	2019	<0.01	<0.01%	14.9	37%	Insignificant
HR4	503137	225364	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR5	503127	225129	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR6	502849	225054	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR7	502849	225199	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR8	503208	226382	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR9	503022	224977	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR10	503323	224959	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR11	503094	225708	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR12	503111	225606	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR13	503156	225460	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR14	502690	225359	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR15	503777	226130	16.8	2019	<0.01	<0.01%	16.8	42%	Insignificant
HR16	503601	225224	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR17	503482	225430	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
AQMA	504546	224619	17.4	2022	<0.01	<0.01%	17.4	43%	Insignificant

AQS: 40µg/m^3

[1] Results are to 2d.p.

Table 38: PM_{10} daily mean results (µg/m³)

Receptor	X	Y	Short term PM_{10} background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	33.6	2022	0.08	0.17%	33.7	67%	Insignificant
HR2	503613	226047	33.6	2022	0.20	0.39%	33.8	68%	Insignificant
HR3	504067	226163	29.8	2021	0.10	0.20%	29.9	60%	Insignificant
HR4	503137	225364	34.8	2021	0.13	0.26%	34.9	70%	Insignificant
HR5	503127	225129	34.8	2021	0.14	0.27%	35.0	70%	Insignificant
HR6	502849	225054	30.0	2021	0.05	0.11%	30.0	60%	Insignificant
HR7	502849	225199	30.0	2021	0.05	0.10%	30.0	60%	Insignificant
HR8	503208	226382	33.6	2022	0.06	0.12%	33.7	67%	Insignificant
HR9	503022	224977	29.5	2021	0.09	0.18%	29.6	59%	Insignificant
HR10	503323	224959	29.5	2021	0.10	0.21%	29.6	59%	Insignificant
HR11	503094	225708	34.8	2019	0.13	0.26%	34.9	70%	Insignificant
HR12	503111	225606	34.8	2019	0.12	0.24%	34.9	70%	Insignificant
HR13	503156	225460	34.8	2021	0.13	0.25%	34.9	70%	Insignificant
HR14	502690	225359	30.0	2021	0.03	0.07%	30.0	60%	Insignificant
HR15	503777	226130	33.6	2022	0.17	0.35%	33.8	68%	Insignificant
HR16	503601	225224	34.8	2021	0.25	0.50%	35.1	70%	Insignificant
HR17	503482	225430	34.8	2021	0.47	0.93%	35.3	71%	Insignificant
AQMA	504546	224619	34.7	2019	0.03	0.06%	34.8	70%	Insignificant
AQS: 50µg/m³									

C.2.3 $PM_{2.5}$ results for Scenario 2 (biannual test)

Table 39: $PM_{2.5}$ annual mean results (µg/m^3)

Receptor	X	Y	Long term $PM_{2.5}$ background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR2	503613	226047	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR3	504067	226163	9.5	2019	<0.01	<0.01%	9.5	48%	Insignificant
HR4	503137	225364	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR5	503127	225129	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR6	502849	225054	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR7	502849	225199	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR8	503208	226382	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR9	503022	224977	9.7	2021	<0.01	<0.01%	9.7	48%	Insignificant
HR10	503323	224959	9.7	2021	<0.01	<0.01%	9.7	48%	Insignificant
HR11	503094	225708	10.6	2019	<0.01	<0.01%	10.6	53%	Insignificant
HR12	503111	225606	10.6	2019	<0.01	<0.01%	10.6	53%	Insignificant
HR13	503156	225460	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR14	502690	225359	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR15	503777	226130	10.4	2019	<0.01	<0.01%	10.4	52%	Insignificant
HR16	503601	225224	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR17	503482	225430	10.6	2021	<0.01	0.01%	10.6	53%	Insignificant
AQMA	504546	224619	11.0	2022	<0.01	<0.01%	11.0	55%	Insignificant

AQS: 12µg/m^3. The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m^3 ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m^3, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[1] Results are to 2d.p.

C.2.4 Ecological Results for Scenario 2 (biannual test)

Table 40: NO_x annual mean results (µg/m^3)

Receptor	X	Y	Long term NO_x background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER2	502658	227281	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant
ER3	504018	226804	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER4	505404	226681	14.1	2023	<0.01	<0.01%	14.1	47%	Insignificant
ER5	502711	227391	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant

Critical Level: 30µg/m^3

[1] Results are to 2d.p.

Table 41: NO_x daily mean results (µg/m^3)

Receptor	X	Y	Short term NO_x background	Maximum Year	Maximum modelled PC	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	29.4	2021	9.85	13%	39.2	52%	Insignificant
ER2	502658	227281	24.5	2019	5.78	8%	30.3	40%	Insignificant
ER3	504018	226804	29.4	2022	8.93	12%	38.3	51%	Insignificant
ER4	505404	226681	28.3	2020	3.93	5%	32.2	43%	Insignificant
ER5	502711	227391	24.5	2021	4.96	7%	29.4	39%	Insignificant

Critical Level: 75µg/m^3

Table 42: SO_2 annual mean results (µg/m^3)

Receptor	X	Y	Long term SO_2 background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER2	502658	227281	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant
ER3	504018	226804	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER4	505404	226681	3.5	2023	<0.01	<0.01%	3.5	17%	Insignificant
ER5	502711	227391	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant

Critical Level: 20µg/m^3

[1] Results are to 2d.p.

Table 43: Nutrient nitrogen deposition results

Ecological receptor ID	Critical load (CL) min	Background Nitrogen deposition	Annual mean NO_2 PC (µg/m³)	Dry deposition (kg N/ha/yr)	Proportion of PC to CL (%) Min	Proportion of PEC to CL (%) Min
ER1 (Calcareous Grassland)	10	15.2	0.0014	0.00020	0.0020	152.2
ER1 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0014	0.00039	0.0039	281.0
ER2	10	9.7	0.0003	0.00005	0.0005	97.4
ER3 (Calcareous Grassland)	10	15.2	0.0011	0.00015	0.0015	152.2
ER3 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0011	0.00031	0.0031	281.0
ER4	No critical load has been assigned for this feature					
ER5	No critical load has been assigned for this feature					

Table 44: Acid deposition results

Ecological receptor ID	Critical Load (CL) max Sulphur (kg S/ha/yr)	CL min Nitrogen (kg N/ha/yr)	CL max Nitrogen (kg N/ha/yr)	Background Nitrogen deposition (kg N/ha/yr)	Background Sulphur deposition (kg S/ha/yr)	PC Nitrogen (keq N/ha/yr)	PC Sulphur (keq S/ha/yr)	Exceedance
ER1 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000002	0.000014	PC < CL No exceedance
ER1 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000003	0.000028	PC < CL No exceedance
ER2	4	0.928	4.928	1.17	0.16	0.00000004	0.000003	PC < CL No exceedance
ER3 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000001	0.000011	PC < CL No exceedance
ER3 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000003	0.000022	PC < CL No exceedance
ER4	Not available for this feature							
ER5	Not available for this feature							

C.3 Scenario 3 (maintenance test)

C.3.1 NO_2 results for Scenario 3 (maintenance test)

Table 45: NO_2 annual mean results (µg/m^3)

Receptor	X	Y	Long term NO_2 background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR2	503613	226047	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR3	504067	226163	11.1	2019	<0.01	<0.01%	11.1	28%	Insignificant
HR4	503137	225364	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR5	503127	225129	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR6	502849	225054	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR7	502849	225199	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR8	503208	226382	14.8	2022	<0.01	<0.01%	14.8	37%	Insignificant
HR9	503022	224977	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR10	503323	224959	10.8	2021	<0.01	<0.01%	10.8	27%	Insignificant
HR11	503094	225708	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR12	503111	225606	13.2	2019	<0.01	<0.01%	13.2	33%	Insignificant
HR13	503156	225460	13.2	2021	<0.01	<0.01%	13.2	33%	Insignificant
HR14	502690	225359	9.2	2021	<0.01	<0.01%	9.2	23%	Insignificant
HR15	503777	226130	14.8	2019	<0.01	<0.01%	14.8	37%	Insignificant
HR16	503601	225224	13.2	2021	<0.01	0.01%	13.2	33%	Insignificant
HR17	503482	225430	13.2	2021	<0.01	0.02%	13.2	33%	Insignificant
AQMA	504546	224619	15.2	2022	<0.01	<0.01%	15.2	38%	Insignificant

AQS: 40µg/m^3

[1] Results are to 2d.p.

Table 46: NO_2 hourly mean results (µg/m³)

Receptor	X	Y	Short term NO_2 background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	29.7	2022	14.4	7%	44.1	22%	Insignificant
HR2	503613	226047	29.7	2020	20.0	10%	49.7	25%	Insignificant
HR3	504067	226163	22.2	2021	14.6	7%	36.7	18%	Insignificant
HR4	503137	225364	26.3	2021	19.6	10%	45.9	23%	Insignificant
HR5	503127	225129	26.3	2021	13.8	7%	40.2	20%	Insignificant
HR6	502849	225054	18.3	2019	10.1	5%	28.4	14%	Insignificant
HR7	502849	225199	18.3	2021	10.0	5%	28.3	14%	Insignificant
HR8	503208	226382	29.7	2022	12.8	6%	42.4	21%	Insignificant
HR9	503022	224977	21.7	2019	11.8	6%	33.5	17%	Insignificant
HR10	503323	224959	21.7	2019	15.6	8%	37.3	19%	Insignificant
HR11	503094	225708	26.3	2019	20.6	10%	46.9	23%	Insignificant
HR12	503111	225606	26.3	2019	22.9	11%	49.3	25%	Insignificant
HR13	503156	225460	26.3	2021	24.2	12%	50.5	25%	Insignificant
HR14	502690	225359	18.3	2022	9.4	5%	27.7	14%	Insignificant
HR15	503777	226130	29.7	2021	14.6	7%	44.2	22%	Insignificant
HR16	503601	225224	26.3	2022	24.9	12%	51.3	26%	Insignificant
HR17	503482	225430	26.3	2022	52.1	26%	78.4	39%	Insignificant [1]
AQMA	504546	224619	30.4	2020	7.3	4%	37.7	19%	Insignificant

AQS: 200µg/m³

[1] Although impacts cannot be screened out using the EA criteria, Scenario 3 would include 420 hours of total generator run time over the course of a year, which equates to 5% of the year (420/8760); overall the potential impacts are considered to be insignificant.

C.3.2 PM_{10} results for Scenario 3 (maintenance test)

Table 47: PM_{10} annual mean results (µg/m^3)

Receptor	X	Y	Long term PM_{10} background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR2	503613	226047	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR3	504067	226163	14.9	2019	<0.01	<0.01%	14.9	37%	Insignificant
HR4	503137	225364	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR5	503127	225129	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR6	502849	225054	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR7	502849	225199	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR8	503208	226382	16.8	2022	<0.01	<0.01%	16.8	42%	Insignificant
HR9	503022	224977	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR10	503323	224959	14.8	2021	<0.01	<0.01%	14.8	37%	Insignificant
HR11	503094	225708	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR12	503111	225606	17.4	2019	<0.01	<0.01%	17.4	44%	Insignificant
HR13	503156	225460	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR14	502690	225359	15.0	2021	<0.01	<0.01%	15.0	37%	Insignificant
HR15	503777	226130	16.8	2019	<0.01	<0.01%	16.8	42%	Insignificant
HR16	503601	225224	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
HR17	503482	225430	17.4	2021	<0.01	<0.01%	17.4	44%	Insignificant
AQMA	504546	224619	17.4	2022	<0.01	<0.01%	17.4	43%	Insignificant

AQS: 40µg/m^3

[1] Results are to 2d.p.

Table 48: PM_{10} daily mean results (µg/m^3)

Receptor	X	Y	Short term PM_{10} background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	33.6	2022	0.08	0.17%	33.7	67%	Insignificant
HR2	503613	226047	33.6	2022	0.20	0.39%	33.8	68%	Insignificant
HR3	504067	226163	29.8	2021	0.10	0.20%	29.9	60%	Insignificant
HR4	503137	225364	34.8	2021	0.13	0.26%	34.9	70%	Insignificant
HR5	503127	225129	34.8	2021	0.14	0.27%	35.0	70%	Insignificant
HR6	502849	225054	30.0	2021	0.05	0.11%	30.0	60%	Insignificant
HR7	502849	225199	30.0	2021	0.05	0.10%	30.0	60%	Insignificant
HR8	503208	226382	33.6	2022	0.06	0.12%	33.7	67%	Insignificant
HR9	503022	224977	29.5	2021	0.09	0.18%	29.6	59%	Insignificant
HR10	503323	224959	29.5	2021	0.10	0.21%	29.6	59%	Insignificant
HR11	503094	225708	34.8	2019	0.13	0.26%	34.9	70%	Insignificant
HR12	503111	225606	34.8	2019	0.12	0.24%	34.9	70%	Insignificant
HR13	503156	225460	34.8	2021	0.13	0.25%	34.9	70%	Insignificant
HR14	502690	225359	30.0	2021	0.03	0.07%	30.0	60%	Insignificant
HR15	503777	226130	33.6	2022	0.17	0.35%	33.8	68%	Insignificant
HR16	503601	225224	34.8	2021	0.25	0.50%	35.1	70%	Insignificant
HR17	503482	225430	34.8	2021	0.47	0.93%	35.3	71%	Insignificant
AQMA	504546	224619	34.7	2019	0.03	0.06%	34.8	70%	Insignificant

AQS: 50µg/m^3

[1] Results are to 2d.p.

C.3.3 $PM_{2.5}$ results for Scenario 3 (maintenance test)

Table 49: $PM_{2.5}$ annual mean results (µg/m^3)

Receptor	X	Y	Long term $PM_{2.5}$ background	Maximum Year	Maximum modelled PC [1]	% of standard	PEC	% of standard	Significance
HR1	503208	226155	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR2	503613	226047	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR3	504067	226163	9.5	2019	<0.01	<0.01%	9.5	48%	Insignificant
HR4	503137	225364	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR5	503127	225129	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR6	502849	225054	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR7	502849	225199	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR8	503208	226382	10.4	2022	<0.01	<0.01%	10.4	52%	Insignificant
HR9	503022	224977	9.7	2021	<0.01	<0.01%	9.7	48%	Insignificant
HR10	503323	224959	9.7	2021	<0.01	<0.01%	9.7	48%	Insignificant
HR11	503094	225708	10.6	2019	<0.01	<0.01%	10.6	53%	Insignificant
HR12	503111	225606	10.6	2019	<0.01	<0.01%	10.6	53%	Insignificant
HR13	503156	225460	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR14	502690	225359	9.3	2021	<0.01	<0.01%	9.3	46%	Insignificant
HR15	503777	226130	10.4	2019	<0.01	<0.01%	10.4	52%	Insignificant
HR16	503601	225224	10.6	2021	<0.01	<0.01%	10.6	53%	Insignificant
HR17	503482	225430	10.6	2021	<0.01	0.01%	10.6	53%	Insignificant
AQMA	504546	224619	11.0	2022	<0.01	<0.01%	11.0	55%	Insignificant

AQS: 12µg/m^3. The Environmental Targets (Fine Particular Matter) (England) Regulations 2023 updated in 2023, to state that the "the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m^3 ("the target level")" by 31st December 2040[11]. The Environmental Improvement Plan (2023) sets an interim target of 12µg/m^3, to be achieved by 31 January 2028. For the purpose of this assessment, a limit value of 12µg/m^3 for $PM_{2.5}$ has been used.

[1] Results are to 2d.p.

C.3.4 Ecological Results for Scenario 3 (maintenance test)

Table 50: NO_x annual mean results (µg/m^3)

Receptor	X	Y	Long term NO_x background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER2	502658	227281	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant
ER3	504018	226804	14.7	2019	<0.01	<0.01%	14.7	49%	Insignificant
ER4	505404	226681	14.1	2023	<0.01	<0.01%	14.1	47%	Insignificant
ER5	502711	227391	12.2	2022	<0.01	<0.01%	12.2	41%	Insignificant

Critical Level: 30µg/m^3

[1] Results are to 2d.p.

Table 51: NO_x daily mean results (µg/m^3)

Receptor	X	Y	Short term NO_x background	Maximum Year	Maximum modelled PC	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	29.4	2021	9.85	13%	39.2	52%	Insignificant
ER2	502658	227281	24.5	2019	5.78	8%	30.3	40%	Insignificant
ER3	504018	226804	29.4	2022	8.93	12%	38.3	51%	Insignificant
ER4	505404	226681	28.3	2020	3.93	5%	32.2	43%	Insignificant
ER5	502711	227391	24.5	2021	4.96	7%	29.4	39%	Insignificant

Critical Level: 75µg/m^3

Table 52: SO_2 annual mean results (µg/m^3)

Receptor	X	Y	Long term SO_2 background	Maximum Year	Maximum modelled PC [1]	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER2	502658	227281	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant
ER3	504018	226804	3.4	2019	<0.01	<0.01%	3.4	17%	Insignificant
ER4	505404	226681	3.5	2023	<0.01	<0.01%	3.5	17%	Insignificant
ER5	502711	227391	3.2	2022	<0.01	<0.01%	3.2	16%	Insignificant

Critical Level: 20µg/m^3

[1] Results are to 2d.p.

Table 53: Nutrient nitrogen deposition results

Ecological receptor ID	Critical load (CL) min	Background Nitrogen deposition	Annual mean NO_2 PC ($\mu g/m^3$)	Dry deposition (kg N/ha/yr)	Proportion of PC to CL (%) Min	Proportion of PEC to CL (%) Min
ER1 (Calcareous Grassland)	10	15.2	0.0011	0.00016	0.0016	152.2
ER1 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0011	0.00031	0.0031	281.0
ER2	10	9.7	0.0003	0.00004	0.0004	97.4
ER3 (Calcareous Grassland)	10	15.2	0.0009	0.00012	0.0012	152.2
ER3 (Broadleaved, Mixed and Yew Woodland)	10	28.1	0.0009	0.00025	0.0025	281.0
ER4	No critical load has been assigned for this feature					
ER5	No critical load has been assigned for this feature					

Table 54: Acid deposition results

Ecological receptor ID	Critical Load (CL) max Sulphur (kg S/ha/yr)	CL min Nitrogen (kg N/ha/yr)	CL max Nitrogen (kg N/ha/yr)	Background Nitrogen deposition (kg N/ha/yr)	Background Sulphur deposition (kg S/ha/yr)	PC Nitrogen (keq N/ha/yr)	PC Sulphur (keq S/ha/yr)	Exceedance
ER1 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000001	0.000011	PC < CL No exceedance
ER1 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000003	0.000022	PC < CL No exceedance
ER2	4	0.928	4.928	1.17	0.16	0.00000003	0.000003	PC < CL No exceedance
ER3 (Calcareous Grassland)	4	0.856	4.856	1.09	0.16	0.0000001	0.000009	PC < CL No exceedance
ER3 (Broadleaved, Mixed and Yew Woodland)	10.717	0.142	10.859	2.01	0.21	0.0000002	0.000018	PC < CL No exceedance
ER4	Not available for this feature							
ER5	Not available for this feature							

C.4 Scenario 4 (emergency scenario)

C.4.1 NO_2 results for Scenario 4 (emergency scenario)

Table 55: NO_2 hourly mean results (µg/m^3)

Receptor	X	Y	Short term NO_2 background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	29.7	2022	437.5	219%	467.2	234%	Insignificant [1]
HR2	503613	226047	29.7	2020	500.5	250%	530.2	265%	Insignificant [1]
HR3	504067	226163	22.2	2023	338.4	169%	360.5	180%	Insignificant [1]
HR4	503137	225364	26.3	2021	535.5	268%	561.8	281%	Insignificant [1]
HR5	503127	225129	26.3	2021	371.0	186%	397.3	199%	Insignificant [1]
HR6	502849	225054	18.3	2019	314.3	157%	332.6	166%	Insignificant [1]
HR7	502849	225199	18.3	2023	317.6	159%	335.9	168%	Insignificant [1]
HR8	503208	226382	29.7	2022	388.5	194%	418.2	209%	Insignificant [1]
HR9	503022	224977	21.7	2019	299.3	150%	320.9	160%	Insignificant [1]
HR10	503323	224959	21.7	2019	328.3	164%	350.0	175%	Insignificant [1]
HR11	503094	225708	26.3	2021	637.0	319%	663.3	332%	Insignificant [1]
HR12	503111	225606	26.3	2020	675.5	338%	701.8	351%	Insignificant [1]
HR13	503156	225460	26.3	2019	644.0	322%	670.3	335%	Insignificant [1]
HR14	502690	225359	18.3	2019	308.0	154%	326.3	163%	Insignificant [1]
HR15	503777	226130	29.7	2021	374.5	187%	404.2	202%	Insignificant [1]
HR16	503601	225224	26.3	2022	598.5	299%	624.8	312%	Insignificant [1]
HR17	503482	225430	26.3	2021	927.5	464%	953.8	477%	Insignificant [1]
AQMA	504546	224619	30.4	2020	231.0	116%	261.4	131%	Insignificant [1]

AQS: 200µg/m^3

[1] Statistical analysis using the hypergeometric distribution was used to assess the probability of exceeding the NO_2 hourly mean s**tandard** and this indicated that an exceedance would be highly unlikely with a run time of 48 hours (<1% probability). The risk of this scenario occurring is also very unlikely based on electrical grid reliability data for the area and inbuilt design resilience.

Table 56: NO_2 hourly mean hypergeometric distribution analysis (48 hours)

Receptor	N	P	Likelihood of exceedance
HR1	48	<0.01%	Highly unlikely
HR2	48	<0.01%	Highly unlikely
HR3	48	<0.01%	Highly unlikely
HR4	48	<0.01%	Highly unlikely
HR5	48	<0.01%	Highly unlikely
HR6	48	<0.01%	Highly unlikely
HR7	48	<0.01%	Highly unlikely
HR8	48	<0.01%	Highly unlikely
HR9	48	<0.01%	Highly unlikely
HR10	48	<0.01%	Highly unlikely
HR11	48	<0.01%	Highly unlikely
HR12	48	<0.01%	Highly unlikely
HR13	48	<0.01%	Highly unlikely
HR14	48	<0.01%	Highly unlikely
HR15	48	<0.01%	Highly unlikely
HR16	48	<0.01%	Highly unlikely
HR17	48	0.97%	Highly unlikely
AQMA	48	<0.01%	Highly unlikely
N= operating hours per year; P = Probability of exceedance of the standard.			

Table 57: NO_2 hourly mean hypergeometric distribution analysis (55 hours)

Receptor	N	P	Likelihood of exceedance
HR1	55	<0.01%	Highly unlikely
HR2	55	0.05%	Highly unlikely
HR3	55	<0.01%	Highly unlikely
HR4	55	<0.01%	Highly unlikely
HR5	55	<0.01%	Highly unlikely
HR6	55	<0.01%	Highly unlikely
HR7	55	<0.01%	Highly unlikely
HR8	55	<0.01%	Highly unlikely
HR9	55	<0.01%	Highly unlikely
HR10	55	<0.01%	Highly unlikely

Receptor	N	P	Likelihood of exceedance
HR11	55	<0.01%	Highly unlikely
HR12	55	<0.01%	Highly unlikely
HR13	55	<0.01%	Highly unlikely
HR14	55	<0.01%	Highly unlikely
HR15	55	0.03%	Highly unlikely
HR16	55	<0.01%	Highly unlikely
HR17	55	4.95%	Unlikely
AQMA	55	<0.01%	Highly unlikely
N= operating hours per year; P = Probability of exceedance of the standard.			

Table 58: NO_2 10-minute mean results (AEGLs) ($\mu g/m^3$)

Receptor	X	Y	Year of Max PC	Max NOx PC	Max NO_2 PC	AEGL 1 (% of standard)	AEGL 2 (% of standard)	AEGL 3 (% of standard)
HR1	503208	226155	2020	1638	573	60%	1.5%	0.9%
HR2	503613	226047	2021	1909	668	70%	1.7%	1.0%
HR3	504067	226163	2020	1273	446	47%	1.2%	0.7%
HR4	503137	225364	2021	1855	649	68%	1.7%	1.0%
HR5	503127	225129	2023	1328	465	49%	1.2%	0.7%
HR6	502849	225054	2019	1352	473	49%	1.2%	0.7%
HR7	502849	225199	2019	1439	504	53%	1.3%	0.8%
HR8	503208	226382	2019	1557	545	57%	1.4%	0.8%
HR9	503022	224977	2021	1375	481	50%	1.3%	0.7%
HR10	503323	224959	2022	1304	456	48%	1.2%	0.7%
HR11	503094	225708	2019	2487	870	91%	2.3%	1.3%
HR12	503111	225606	2023	2324	813	85%	2.1%	1.3%
HR13	503156	225460	2022	2157	755	79%	2.0%	1.2%
HR14	502690	225359	2022	2354	824	86%	2.2%	1.3%
HR15	503777	226130	2019	1929	675	71%	1.8%	1.0%
HR16	503601	225224	2021	1858	650	68%	1.7%	1.0%
HR17	503482	225430	2022	3085	1080	113%	2.8%	1.7%
AQMA	504546	224619	2021	1529	535	56%	1.4%	0.8%

Table 59: NO_2 30-minute mean results (AEGLs) (µg/m³)

Receptor	X	Y	Year of Max PC	Max NOx PC	Max NO_2 PC	AEGL 1 (% of standard)	AEGL 2 (% of standard)	AEGL 3 (% of standard)
HR1	503208	226155	2020	1513	530	55%	1.8%	1.1%
HR2	503613	226047	2021	1841	644	67%	2.2%	1.3%
HR3	504067	226163	2020	1248	437	46%	1.5%	0.9%
HR4	503137	225364	2021	1754	614	64%	2.1%	1.3%
HR5	503127	225129	2022	1258	440	46%	1.5%	0.9%
HR6	502849	225054	2020	1273	446	47%	1.6%	0.9%
HR7	502849	225199	2019	1346	471	49%	1.6%	1.0%
HR8	503208	226382	2022	1359	476	50%	1.7%	1.0%
HR9	503022	224977	2021	1232	431	45%	1.5%	0.9%
HR10	503323	224959	2021	1253	438	46%	1.5%	0.9%
HR11	503094	225708	2019	2290	802	84%	2.8%	1.7%
HR12	503111	225606	2023	2225	779	81%	2.7%	1.6%
HR13	503156	225460	2022	2109	738	77%	2.6%	1.5%
HR14	502690	225359	2022	2013	704	74%	2.5%	1.5%
HR15	503777	226130	2019	1740	609	64%	2.1%	1.3%
HR16	503601	225224	2021	1859	651	68%	2.3%	1.4%
HR17	503482	225430	2022	3002	1051	110%	3.7%	2.2%
AQMA	504546	224619	2019	1292	452	47%	1.6%	0.9%

Table 60: NO_2 1-hour mean results (AEGLs) (µg/m³)

Receptor	X	Y	Year of Max PC	Max NOx PC	Max NO_2 PC	AEGL 1 (% of standard)	AEGL 2 (% of standard)	AEGL 3 (% of standard)
HR1	503208	226155	2020	1638	573	60%	1.5%	0.9%
HR2	503613	226047	2021	1909	668	70%	1.7%	1.0%
HR3	504067	226163	2020	1273	446	47%	1.2%	0.7%
HR4	503137	225364	2021	1855	649	68%	1.7%	1.0%
HR5	503127	225129	2023	1328	465	49%	1.2%	0.7%
HR6	502849	225054	2019	1352	473	49%	1.2%	0.7%
HR7	502849	225199	2019	1439	504	53%	1.3%	0.8%
HR8	503208	226382	2019	1557	545	57%	1.4%	0.8%
HR9	503022	224977	2021	1375	481	50%	1.3%	0.7%
HR10	503323	224959	2022	1304	456	48%	1.2%	0.7%
HR11	503094	225708	2019	2487	870	91%	2.3%	1.3%
HR12	503111	225606	2023	2324	813	85%	2.1%	1.3%
HR13	503156	225460	2022	2157	755	79%	2.0%	1.2%
HR14	502690	225359	2022	2354	824	86%	2.2%	1.3%

Receptor	X	Y	Year of Max PC	Max NOx PC	Max NO_2 PC	AEGL 1 (% of standard)	AEGL 2 (% of standard)	AEGL 3 (% of standard)
HR15	503777	226130	2019	1929	675	71%	1.8%	1.0%
HR16	503601	225224	2021	1858	650	68%	1.7%	1.0%
HR17	503482	225430	2022	3085	1080	113%	2.8%	1.7%
AQMA	504546	224619	2021	1529	535	56%	1.4%	0.8%

C.4.2 PM_{10} results for Scenario 4 (emergency scenario)

Table 61: PM_{10} daily mean results ($\mu g/m^3$)

Receptor	X	Y	Short term PM_{10} background	Maximum Year	Maximum modelled PC	% of standard	PEC	% of standard	Significance
HR1	503208	226155	33.6	2022	1.38	2.76%	35.0	70%	Insignificant
HR2	503613	226047	33.6	2022	9.17	18.34%	42.8	86%	Insignificant [1]
HR3	504067	226163	29.8	2019	4.97	9.94%	34.8	70%	Insignificant [1]
HR4	503137	225364	34.8	2021	1.80	3.60%	36.6	73%	Insignificant
HR5	503127	225129	34.8	2021	4.48	8.96%	39.3	79%	Insignificant [1]
HR6	502849	225054	30.0	2021	0.83	1.66%	30.8	62%	Insignificant
HR7	502849	225199	30.0	2021	0.36	0.72%	30.3	61%	Insignificant
HR8	503208	226382	33.6	2022	1.02	2.04%	34.7	69%	Insignificant
HR9	503022	224977	29.5	2021	2.89	5.78%	32.4	65%	Insignificant
HR10	503323	224959	29.5	2021	4.87	9.74%	34.4	69%	Insignificant [1]
HR11	503094	225708	34.8	2019	0.55	1.11%	35.4	71%	Insignificant
HR12	503111	225606	34.8	2019	0.24	0.47%	35.1	70%	Insignificant
HR13	503156	225460	34.8	2021	0.58	1.17%	35.4	71%	Insignificant
HR14	502690	225359	30.0	2021	0.02	0.04%	30.0	60%	Insignificant
HR15	503777	226130	33.6	2019	7.52	15.04%	41.2	82%	Insignificant [1]
HR16	503601	225224	34.8	2021	7.72	15.44%	42.5	85%	Insignificant [1]
HR17	503482	225430	34.8	2021	14.50	29.00%	49.3	99%	Insignificant [1]
AQMA	504546	224619	34.7	2022	0.51	1.02%	35.3	71%	Insignificant

AQS: 50µg/m^3

[1] Although concentrations at these receptors cannot be screened out as they do not meet the EA criteria, they do not exceed the air quality s**tandard**s and the process is not continuously operating and only occurs in the unlikely event of an emergency, so this is considered to be insignificant.

C.4.3 Ecological Results for Scenario 4 (emergency scenario)

Table 62: NO_x daily mean results (µg/m^3)

Receptor	X	Y	Short term NO_x background	Maximum Year	Maximum modelled PC	% of critical level	PEC	% of critical level	Significance
ER1	504172	226471	29.4	2021	348	464%	377	503%	Insignificant [1]
ER2	502658	227281	24.5	2021	206	275%	231	307%	Insignificant [1]
ER3	504018	226804	29.4	2022	285	380%	314	419%	Insignificant [1]
ER4	505404	226681	28.3	2020	135	180%	163	218%	Insignificant [1]
ER5	502711	227391	24.5	2021	183	244%	208	277%	Insignificant [1]

Critical Level: 75µg/m^3

[1] Although the critical level for the NO_x daily mean is exceeded, it should be noted that the chances of this scenario occurring are considered to be unlikely, based on the reliability of the electrical distribution network and the inbuilt design resilience therefore this can be considered insignificant.

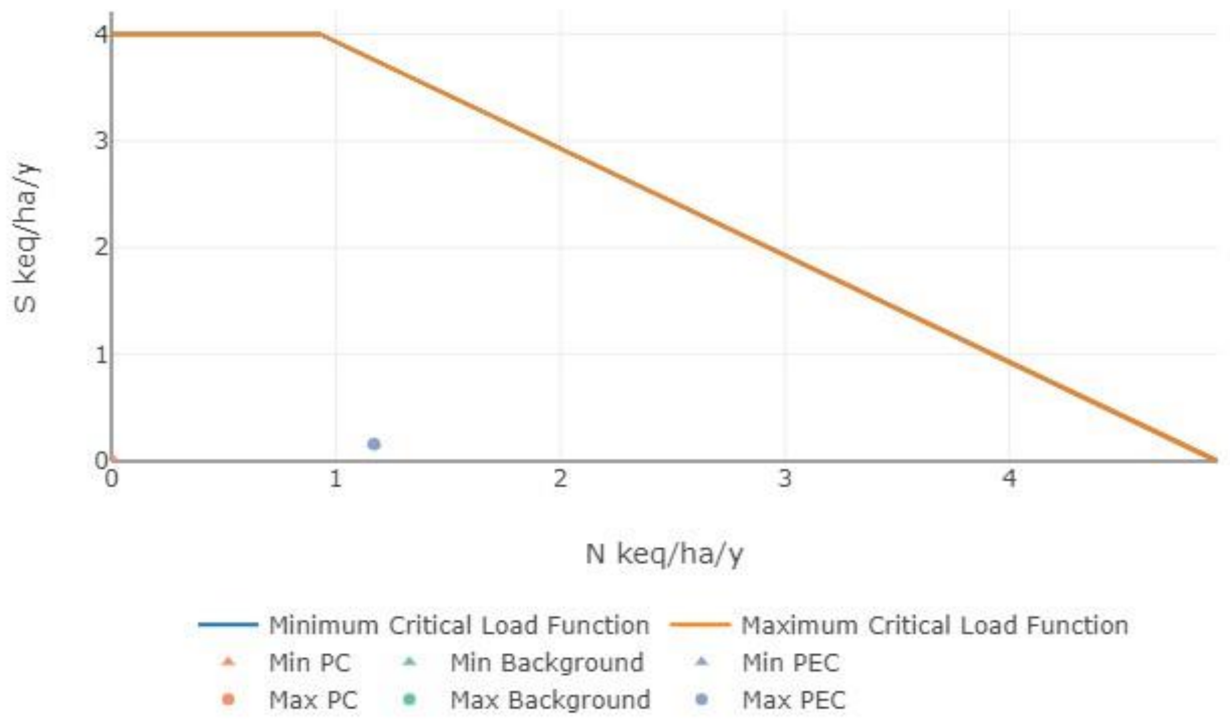
Appendix D

APIS Critical Load Acidity Plots

This section provides the acidity plots and the APIS acid critical load function tool for each testing Scenario. There are no acidity plots available for receptors ER1, ER3-ER5.

Scenario 1 – biweekly test

Figure 8: Acidity plot and critical load function tool for ER2 – Scenario 1 (biweekly test)



Initial screening: acid deposition as a proportion of the Minimum CL Function (keq/ha/yr)

Minimum acid CL values feature **Cynosurus Cristatus - Centaurea Nigra Grassland**

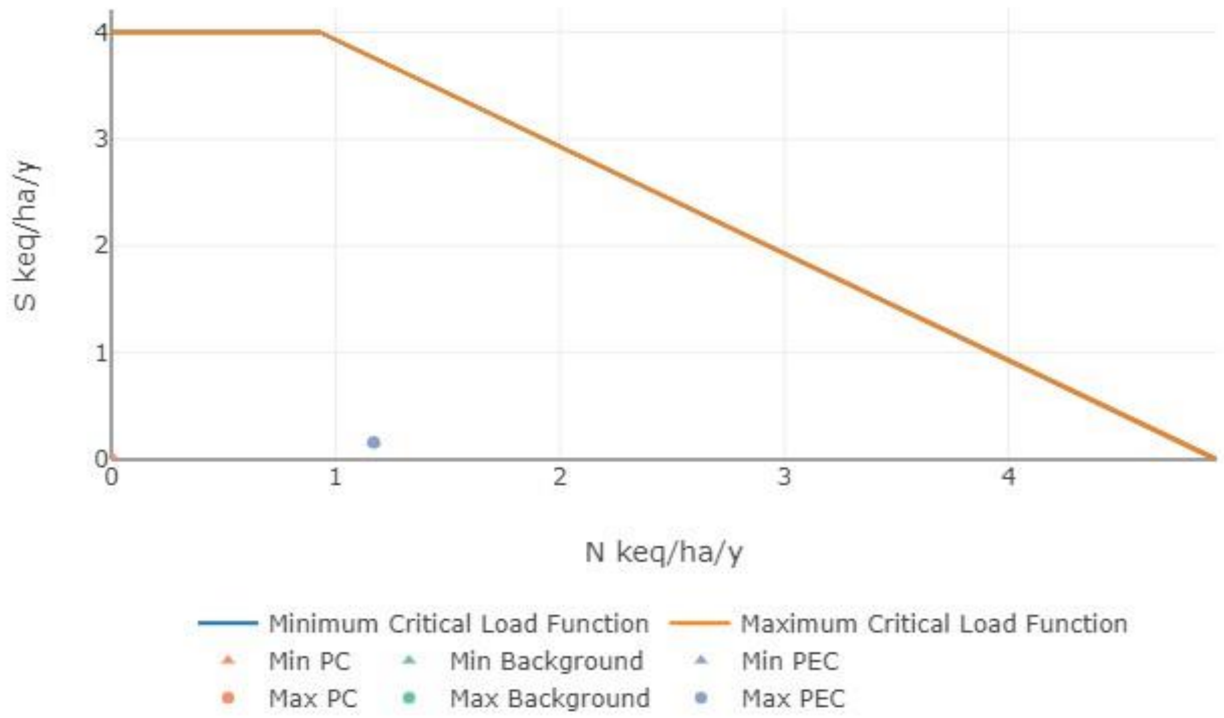
CLminN	CLmaxS	CLmaxN
0.928	4	4.928

Submit

Source	Sulphur deposition	Nitrogen deposition	Total acid deposition (S+N)	Acidity	% of CL function
Process contribution (PC)	0.0000001	0.000003	3.1e-06	No exceedance of CL function	0
Background **Moorland**	0.16	1.17	1.33	No exceedance of CL function	27
Predicted Environmental Concentration (PEC)	0.1600001	1.170003	1.330003	No exceedance of CL function	27

Scenario 2 – biannual test

Figure 9: Acidity plot and critical load function tool for ER2 – Scenario 2 (biannual test)



Initial screening: acid deposition as a proportion of the Minimum CL Function (keq/ha/yr)

Minimum acid CL values feature **Cynosurus Cristatus - Centaurea Nigra Grassland**

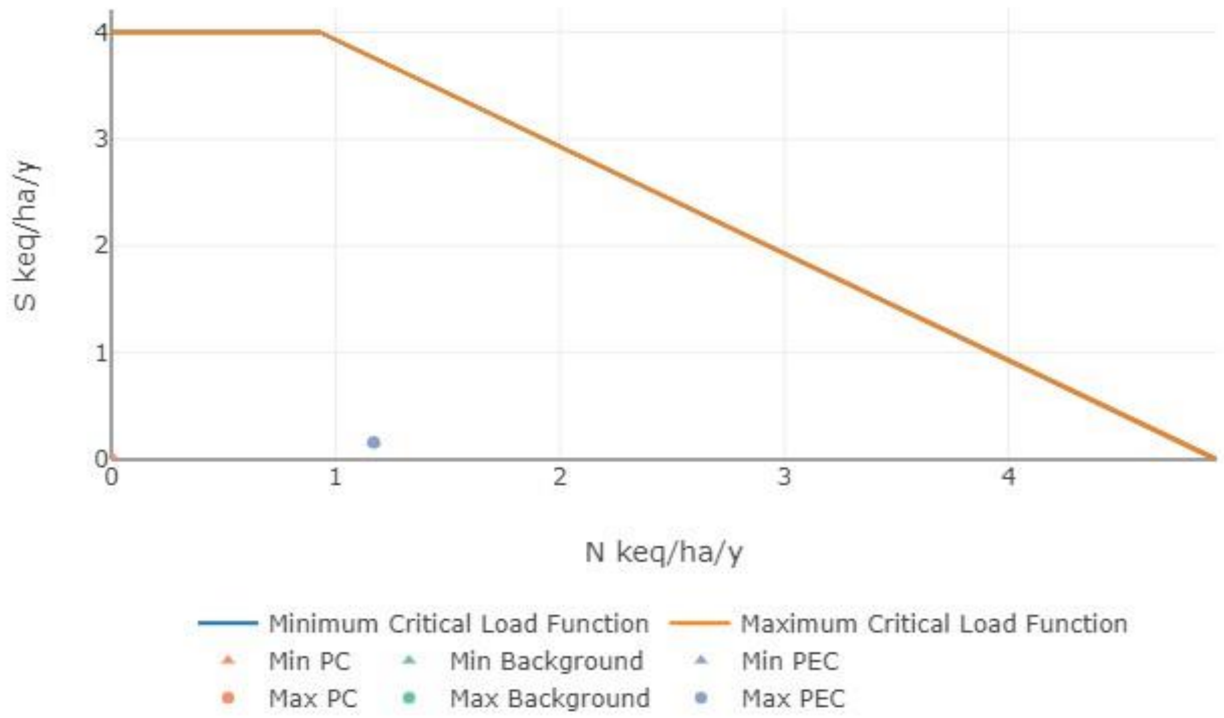
CLmaxS	CLminN	CLmaxN
4	0.928	4.928

Submit

Source	Sulphur deposition	Nitrogen deposition	Total acid deposition (S+N)	Acidity	% of CL function
Process contribution (PC)	0.00000003	0.000003	3.03e-06	No exceedance of CL function	0
Background **Moorland**	0.16	1.17	1.33	No exceedance of CL function	27
Predicted Environmental Concentration (PEC)	0.16	1.170003	1.330003	No exceedance of CL function	27

Scenario 3 – maintenance test

Figure 10: Acidity plot and critical load function tool for ER2 - Scenario 3 (maintenance test)



Initial screening: acid deposition as a proportion of the Minimum CL Function (keq/ha/yr)

Minimum acid CL values feature **Cynosurus Cristatus - Centaurea Nigra Grassland**

CLminN 0.928

CLmaxS 4 **CLmaxN** 4.928

Submit

Source	Sulphur deposition	Nitrogen deposition	Total acid deposition (S+N)	Acidity	% of CL function
Process contribution (PC)	0.00000004	0.000003	3.04e-06	No exceedance of CL function	0
Background **Moorland**	0.16	1.17	1.33	No exceedance of CL function	27
Predicted Environmental Concentration (PEC)	0.16	1.170003	1.330003	No exceedance of CL function	27