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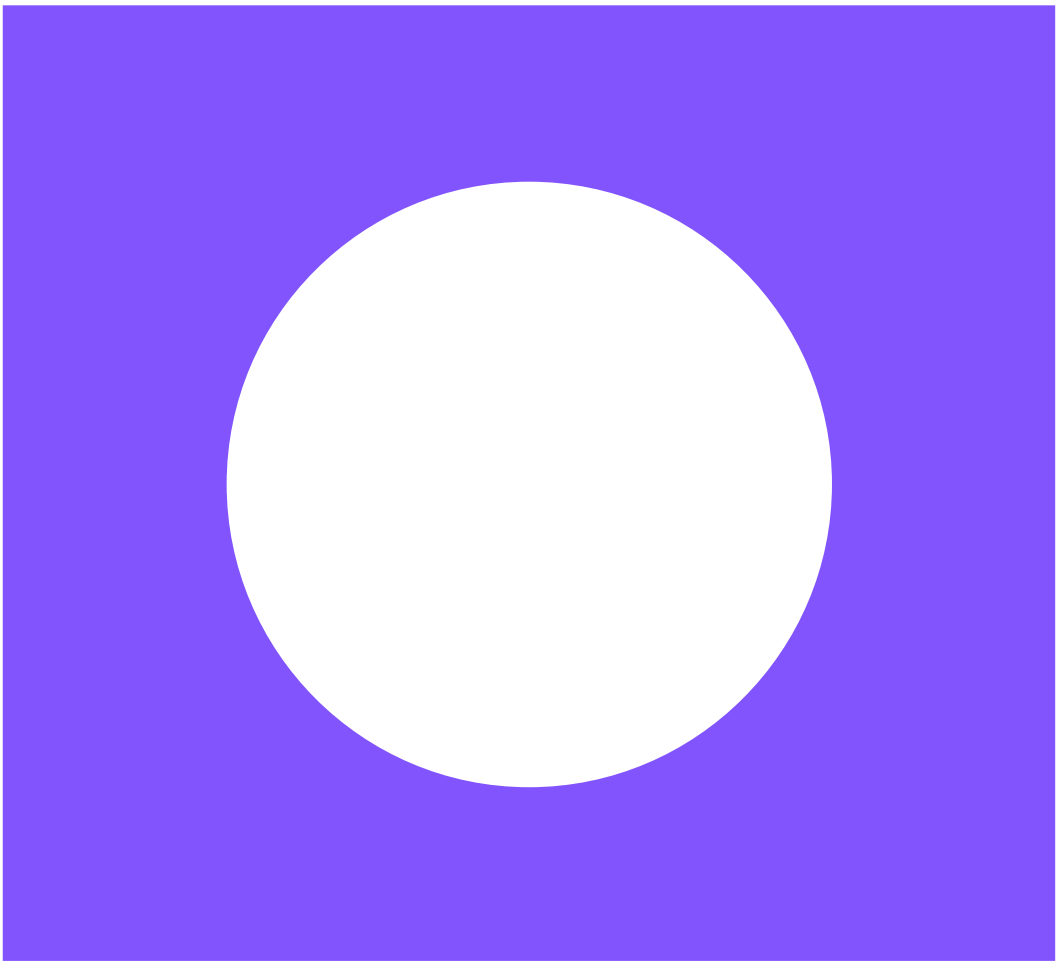

Main Supporting Document

Hindlip Lane permit application

September 2025

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Main Supporting Document

Hindlip Lane permit application

September 2025

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	September 2025	T. Malik-Agrawal	J. Brookes	C. Mills	Final for submission

Document reference: 100412074 | 53 | A

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1 Non-technical summary

1.1 Overview

ADV 001 Limited (ADV) is applying for a new Medium Combustion Plant/Specified Generator permit (MCP/SG) to allow operation of their proposed peaking plant site located at Hindlip Lane (hereafter referred to as “the Site”), which will consist of three natural gas, spark-ignition engines.

This document has been prepared to accompany the permit application for the Site. The application has been prepared by Mott MacDonald Limited on behalf of ADV. Mr Peter Ford (Project Manager at ADV), who is the principal contact for this application.

1.2 Summary of regulated facility

The Site will consist of three 5.96 megawatt thermal (MWth) input natural gas spark-ignition engines. These engines will provide balancing services to the National Grid, operating on a short-term basis to meet peak demand or shortfalls in generation within the electrical distribution network.

While the precise operating envelope of the Site is unknown, it is proposed that the Site be allowed to operate for up to 6,188 hours per year for each engine (assuming operation 17 hours a day, every day of the year). This is the maximum number of hours that the Site could operate in any given year. It is also requested that the hours of operation of the Site are not restricted within the permit.

1.3 Summary key technical standards

The Environmental Permitting Regulations (EPR)[1] require that combustion plants with a rated thermal input equal to or greater than 1 megawatt thermal (MWth) and less than 50MWth operate under an MCP/SG Environmental Permit. Individual generators are also subject to these regulations if multiple generators are at the same location and used for the same purpose and thus form a Specified Generator with an aggregated thermal input of greater than 1MWth.

Under the EPR, the engines at the Site are defined as new, “Tranche B generators” and therefore require a permit to operate and to comply with a standard emission limit for nitrogen oxides (NO_x) from the day they become operational. The Site in isolation should also not result in an exceedance of environmental quality standards as predicted environmental concentrations (PEC) at nearby sensitive human health or ecological receptors.

As the Site will consist of a peaking plant and it is proposed to operate the Site for more than 1,500 hours a year, it cannot be screened out as “low risk” using the Specified Generator Tranche B Screening tool. Therefore, an air quality risk assessment has been undertaken using atmospheric dispersion modelling to assess the level of environmental risk from proposed emissions to air from the Site. The risk assessment has been undertaken in accordance with Environment Agency best practice guidance.

[1] The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 No.110 implement the requirements of the Medium Combustion Plant Directive

1.4 Environmental Risk Assessment findings

The Site is located on Hindlip Lane, Worcester, WR3 8TJ, within the administrative area of Worcester City Council (WCC). The boundary for Wychavon District Council (WDC) is located approximately 55m north of the Site boundary.

The Site is surrounded primarily by agricultural and commercial land use. The A449 is located directly to the north of the Site. The Hereford-to-Birmingham train route is located directly to the east of the Site.

The nearest human health receptor to the Site is a residential property on Spring Bank, located approximately 115m to the west.

WCC has one declared city-wide Air Quality Management Area (AQMA) (Worcester City AQMA) within its administrative area for exceedances of the annual NO_2 objective. It was first declared in 2019 due to emissions from road traffic. The Site is located within Worcester City AQMA.

There are no conservation sites (SPAs, SACs, Ramsar or SSSI) within the applicable screening distance of 2500m.

1.5 Summary of control measures

Impacts on air quality are reduced to an acceptable level by controlling emissions at the source as well as by promoting proper dispersion through high exhaust gas temperatures and exit velocities.

Emissions monitoring of the Site exhaust gases will be undertaken in accordance with the conditions of the environmental permit for the Site and “M5: Monitoring of stack gas emissions from medium combustion plants and specified generators” to confirm the Site does not exceed the NOx emission limit specified in the permit. The number of operational hours will be recorded to confirm that the Site will not operate for more than the permitted number of hours per year.

An Environmental Management System (EMS) has also been developed in accordance with government guidance which will implement systems to manage activities on Site as per the Environmental Permit.

2 Introduction

2.1 Overview

This document has been prepared to accompany the application for an MCP/SG environmental permit for the Site at Hindlip Lane.

2.2 Contents of this Document

The following application forms have been completed to support the application:

- Part A: About You
- Part B2.5: Application for an environmental permit – New Medium Combustion Plant and/or Specified Generator bespoke permit
- Part F1: Charges and declarations

The main body of this document includes all the supplementary information required in response to relevant questions within the Part A and B2.5 application forms for which there was not enough space on the form to answer the questions in full.

Additional information to support the application is provided in the following Appendices:

- Appendix A – Environmental Risk Assessment (air quality dispersion modelling)
- Appendix B – Site Plan

3 Form A – About you

3.1 Supplementary information – details of directors

Table 3.1 below provides details of directors at ADV 001 Limited.

Table 3.1: Details of directors at ADV 001 Limited

Title	First name	Last name	Date of birth	Position
Mr	Pieter-Schalk	Krugel	[redacted]	Director
Mr	Andrew	Leach		Director
Mr	Stephen	Mason		Director
Mr	Noel	O'Keeffe		Director
Mr	Graham	White		Director

4 Form B2.5

4.1 Form B2.5, section 2f, Dispersion modelling

The dispersion modelling assessment undertaken to assess the risk to the environment from proposed emissions to air from the Site is presented in “Appendix A - Environmental Risk Assessment (air quality dispersion modelling)”. The Specified Generator Tranche B screening tool was not used as the Site is a peaking plant that would operate for more than 1,500 hours a year and therefore does not meet the criteria for the screening tool.

The modelling input files are provided separately as .APL files.

4.2 Form B2.5, section 5a, Non-technical summary

The non-technical summary is provided in the upfront section of this document.

Appendices

A. Environmental Risk Assessment (air quality assessment)

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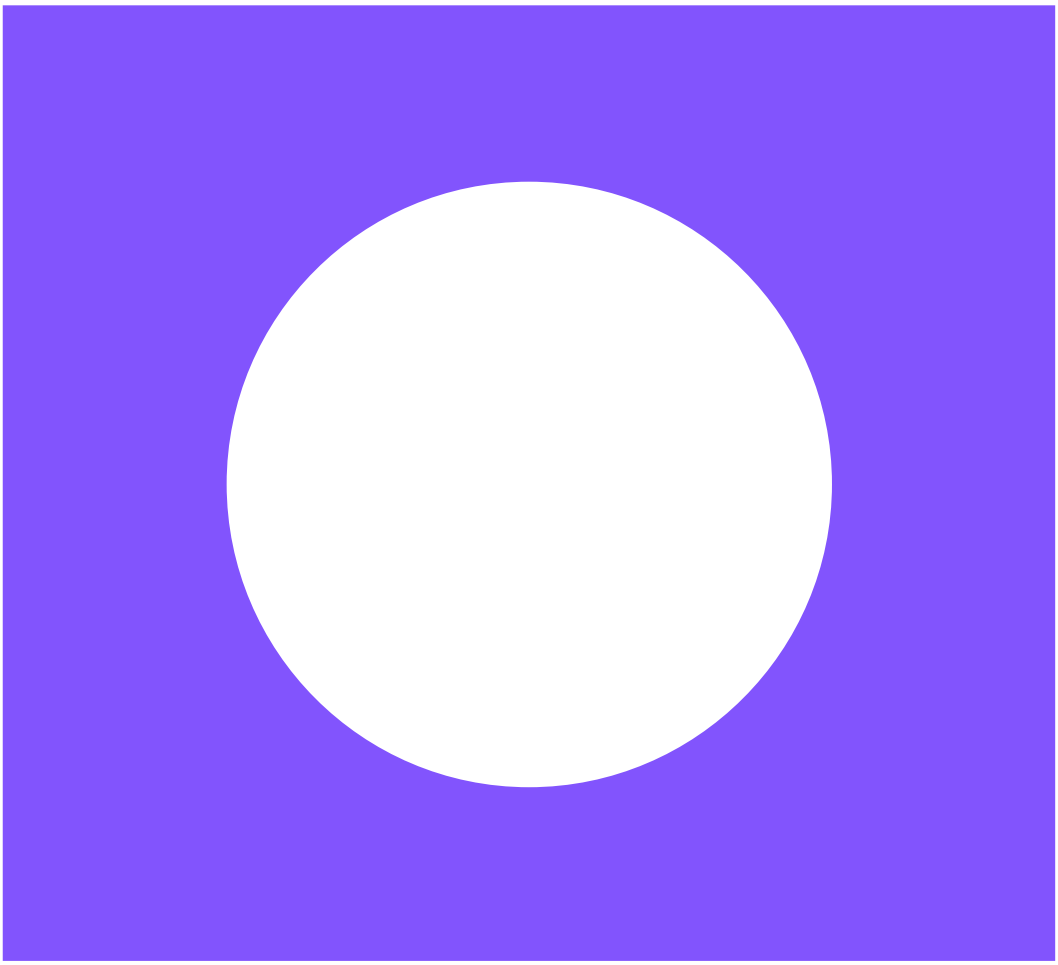

Hindlip Lane

Air quality assessment to accompany permit application

September 2025

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Hindlip Lane

Air quality assessment to accompany permit application

September 2025

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Tables

Figures

Tables – Appendices

1 Introduction

1.1 Overview

ADV 001 Limited (hereafter 'ADV') is applying for a new Medium Combustion Plant/Specified Generator permit (MCP/SG) to allow operation of their proposed peaking plant site on Hindlip Lane (hereafter referred to as "the Site"), which will consist of three natural gas, spark-ignition engines.

This report provides an assessment of the point source emissions to air, and subsequent air quality effects associated with the proposed operation of the Site. The assessment has been undertaken in accordance with current Environment Agency (EA) guidance.

1.2 Site description and operating envelope

The Site will consist of three 5.96 megawatt thermal (MWth) input natural gas spark-ignition engines. These engines will provide balancing services to the National Grid, operating on a short-term basis to meet peak demand or shortfalls in generation within the electrical distribution network.

The precise operating envelope of the Site is unknown; however, the Site is planned to operate between the hours of 6:00 to 23:00 Monday to Sunday. While the Site could theoretically operate continuously for up to 17 hours per day, the required duration of operation would normally be less.

It is proposed that the Site be allowed to operate for up to 6,188 hours per year for each engine (assuming operation 17 hours a day, every day of the year), which is the maximum number of operation hours possible for the Site. It is requested that the operation hours of the Site are not restricted within the permit application.

1.3 Site location

The Site is located on Hindlip Lane, Worcester, WR3 8TJ, within the administrative area of Worcester City Council (WCC). The boundary for Wychavon District Council (WDC) is located approximately 55m north of the Site boundary.

The Site is surrounded primarily by agricultural and commercial land use. The A449 is located directly to the north of the Site. The Hereford-to-Birmingham train route is located directly to the east of the Site.

The nearest human health receptor to the Site is a residential property on Spring Bank, located approximately 115m to the west.

WCC has one declared city-wide Air Quality Management Area (AQMA) (Worcester City AQMA) within its administrative area for exceedances of the annual NO_2 objective. It was first declared in 2019 due to emissions from road traffic. The Site is therefore located within Worcester City AQMA.

The location of the Site and the AQMA are displayed in Figure 1.1.

Figure 1.1: Site location

1.4 Summary of key pollutants – oxides of nitrogen

The assessment considers concentrations of oxides of nitrogen (NOx) as this is the key pollutant of concern, given that the engines will operate on natural gas.

NOx is a term used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2). These are primarily formed from atmospheric and fuel nitrogen as a result of high temperature combustion; the main sources of which being road traffic and power generation in the UK.

During the process of combustion, atmospheric and fuel nitrogen is partially oxidised via a series of complex reactions to NO. The process is dependent on the temperature, pressure, oxygen concentration and residence time of the combustion gases in the combustion zone. Most NO_X exhausting from a combustion process is in the form of NO, which is a colourless and tasteless gas. It is readily oxidised to NO_2, a more harmful form of NO_X, by chemical reactions with ozone and other chemicals in the atmosphere. NO_2 is a yellowish-orange to reddish-brown gas with a pungent, irritating odour and is a strong oxidant.

2 Legislation context

2.1 Overview

This section summarises the relevant international and national legislation, policy and planning guidance in relation to air quality for the Site.

2.2 England

The Air Quality Standards Regulations 2010[1], Air Quality Standards (amendment) Regulations 2016[2], Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019[3] and Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[4] implement the EU's Directive 2008/50/EC on ambient air quality.

Part IV of the Environment Act 1995[5] (as amended in Schedule 11 of the Environment Act 2021[6]) requires that every local authority shall carry out a review of air quality within its designated area. Local authorities have to consider and assess whether current and forecasted air quality levels in their areas are likely to exceed the objectives set out in the Air Quality (England) Regulations 2000[7] and the Air Quality (England) (Amendment) Regulations 2002[8]. The objectives that are set out in these regulations are, in most cases, numerically synonymous with the limit values specified within the legislation, although compliance dates differ. Where an area exceeds an air quality objective, an Air Quality Management Area (AQMA) must be declared, and an Air Quality Action Plan (AQAP) must be prepared to specify and implement measures to improve air quality.

The Environment Act 1995 requires the UK Government to produce a national 'Air Quality Strategy' (AQS). The AQS establishes the UK framework for air quality improvements. Measures agreed at the national and international level are the foundations on which the strategy is based. The first Air Quality Strategy was adopted in 1997.

The UK Government revised its national Air Quality Strategy[9] in 2023. This revision replaces the 2007 strategy and compliments the Clean Air Strategy 2019 (CAS). The 2023 revision sets out the actions the government expects local authorities in England to take in support of achieving the Government's long-term air quality goals.

Although the CAS does not set legally binding objectives, the CAS instead has targets for reducing total UK emissions of NOx from sectors such as road transport, domestic sources and industry.

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[1] Statutory Instrument. (2010), 'The Environmental Permitting (England and Wales) Regulations', Queen's Printer of Acts of Parliament.

[2] Statutory Instrument (2016) The Air Quality Standards (Amendment) Regulations, No. 1184.

[3] Statutory Instrument (2019) Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations., No. 74.

[4] Statutory Instrument. (2020) Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, No. 1313.

[5] Department for Environment Food and Rural Affairs. (2009). Part IV of the Environment Act 1995 Local Air Quality Management Policy Guidance (PG09). London: Defra.

[6] Statutory Instrument. (2021) Chapter 30, Schedule 11 Local Air Quality Management Framework of Environment Act 2021

[7] Statutory Instrument. (2000), 'Air Quality (England) Regulations', No. 928. UK statutory instrument

[8] Statutory Instrument. (2002), 'Air Quality (England) (Amendment) Regulations', No. 3043. UK statutory instrument

[9] Draft revised Air Quality Strategy available at https://consult.defra.gov.uk/air-quality-strategy-review-team/consultation-on-the-draft-revised-air-quality-stra/ [last accessed 21st April 2023]

2.3 Permitting requirements and associated guidance

2.3.1 Overview

The Medium Combustion Plant Directive (MCPD) (Directive 2015/2193) [10] regulates emissions of NOx into the air from combustion plants with a rated thermal input equal to or greater than 1 MWth and less than 50 MWth. Schedules 25A and 25B of the Environmental Permitting (Amendment) Regulations 2018[11] implements this directive while also including additional provisions for generators. Generators are subject to the Environmental Permitting (EP) regulations if they:

- Have a capacity agreement or an agreement to provide balancing services; or,
- They form part of a specified generator[12] (SG) with a total rated thermal input of 1-50MWth.

Specified generators are subject to more stringent requirements than the MCPD in that, depending on the type of generator, they may be required to have a permit by an earlier date than would be required under the MCPD.

Depending on the potential level of risk to air quality, the preparation of a permit application can include the requirement for an air quality assessment. Key guidance issued by the EA to assist with undertaking an air quality assessment for an environmental permit includes:

- Air emissions risk assessment for your environmental permit[13]
- Environmental permitting: air dispersion modelling reports[14]
- Specified generators: dispersion modelling assessment guidance[15]
- Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air[16]

2.3.2 Permitting requirements at the Site

ADV are applying for a new MCP/SG permit for the Site. The engines have not yet been commissioned and therefore would be classified as 'new' under the MCPD. The engines would also be classified as Tranche B specified generators so would be required to meet the requirements associated with generators under Schedule 25B of the EP (Amendment) Regulations 2018. This is in addition to the emission limits set out in the MCPD, as the Site is proposed to be operating for more than 500 hours a year.

The Site will meet a NOx emission limit of 95mg/Nm^3 (standard conditions[17], dry @ 15% O_2). The engines will only operate on natural gas, so there are no applicable emission limits for SO_2 or dust/PM_{10}.

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

[11] The Environmental Permitting (England and Wales) Regulations 2016 No.1154

[12] Specified generator = Individual or multiple generators at the same location or site, operated by the same Operator and for the same purpose

[13] Environment Agency. (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

[14] Environment Agency. (2014) Environmental permitting: air dispersion modelling reports. Available at: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

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

[16] Environment Agency. (2006) Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air: Habitats Directive 2004 (AQTAG 06).

[17] At a temperature of 273.15K, pressure of 101.3kPa

2.3.3 Assessment criteria

The following section presents the relevant air quality standards that are applicable to the Site and that the Site will be assessed against. These are collectively described as the Environmental Quality Standards (EQS).

The EA's risk assessment guidance[18] provides guidelines on Ambient Air Directive (AAD) limit values, UK air quality objectives and environmental assessment levels (EALs) that the impact should be compared against. Further EQS to assess the potential impact at designated sites are available from the Air Pollution Information System[19] (APIS).

2.3.3.1 Air quality limit values and objectives

Table 2.1 summarises the AAD limit values and air quality objectives for the pollutants relevant to this assessment.

Table 2.1: Summary of relevant air quality objectives and AAD limit values

Pollutant	Averaging period	Objective / limit value (µg/m³)	Allowance
For the protection of human health			
Nitrogen dioxide (NO_2)	1-hour	200	18 times pcy
	Annual	40	–
For the protection of vegetation and ecosystems			
Nitrogen oxides (NO_X)	Annual	30	–

Note: pcy = per calendar year

The limit values apply everywhere with the exception of:

a) Any locations situated within areas where members of the public do not have access and there is no fixed habitation
b) In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply
c) On the carriageway of roads, and
d) On the central reservations of roads except where there is normally pedestrian access to the central reservation.

Table 2.2 provides examples of the locations where the UK air quality objectives apply for the protection of human health. This has been used to define where the AAD limit values and air quality objectives should apply within the assessment.

Table 2.2: Locations where air quality objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.

[18] Environment Agency. (2016) 'Air Emissions Risk Assessment for your Environmental Permit'.

[19] UK Air Pollution Information System (APIS) www.apis.ac.uk [last accessed 09/07/2019]

Averaging period	Objectives should apply at:	Objectives should not apply at:
24 hour	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
1 hour	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Specified generator guidance published by the EA[20] states that the annual and hourly NO_2 objectives should be considered at sensitive receptors where "there is relevant public exposure". Relevant public exposure is defined as a location where members of the public:

- Have access
- Are regularly present, and
- Can be exposed for a significant portion of the averaging time of the standard.

Consequently, the standards do not apply where health and safety at work provisions exist and where members of the public do not have access, such as within the Site boundary.

2.3.3.2 Environmental Assessment Levels

In addition to the AAD limit values and air quality objectives, the EA risk assessment guidance[21] provides further assessment criteria in the form of EALs. The EALs cover a wide range of pollutants and also specify target values for the protection of conservation areas. Any exceedances of these EALs may result in further action needing to be taken to reduce the impact on the environment. EALs applicable to the assessment (also referred to as critical levels in the context of designated sites) are presented in Table 2.3.

Table 2.3: Summary of relevant EALs/critical levels for the protection of conservation area

Pollutant	Averaging period	EAL/critical level (µg/m³)
Nitrogen oxides (NO_X)	24 hours	75
	Annual	30*

Note: * Numerically synonymous with the annual AAD limit value

In addition to these EALs, APIS provides targets for nitrogen and acid deposition for specific habitats and species. These EALs, also known as critical loads, are only available for Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSI).

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

[21] Environment Agency. (2016) 'Air Emissions Risk Assessment for your Environmental Permit'.

3 Methodology

3.1 Overview

In accordance with the EA risk assessment guidance[22], the approach to the air quality assessment has involved the following key elements:

- Calculation of the environmental concentration of pollutants released to the air (Process Contributions (PC) and Predicted Environmental Concentrations (PEC))
- Identification of whether the PCs and PECs have a significant environmental impact by comparing with the relevant EQS

PECs have been calculated by adding the PC to a representative value for the background concentration. Section 4 provides further details on the background concentrations used in this assessment.

As a complex bespoke permit is required, detailed modelling has been undertaken to calculate PCs and PECs to determine whether emissions from the Site are significant. A simple bespoke risk assessment cannot be undertaken using the Specified Generator Tranche B Screening tool as the Site consists of peaking plants which could be operating for more than 1,500 hours a year.

3.2 Modelling approach

3.2.1 Model selection

Commercially available dispersion models are accessible to predict ground level concentrations arising from emissions to air from elevated point sources.

ADMS is a “new generation” dispersion model, developed by Cambridge Environmental Research Consultants (CERC), which models a wide range of buoyant and passive releases to the atmosphere either individually or in combination. ADMS brings together the results of recent research on dispersion modelling. The model calculates the mean concentration over flat terrain, allowing for the effect of plume rise, complex terrain, buildings, radioactive decay and deposition. The model has been subject to extensive validation. ADMS comprises of a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. The latest version of the model, ADMS 6.0.2.1, has been used in this assessment.

3.2.2 Buildings

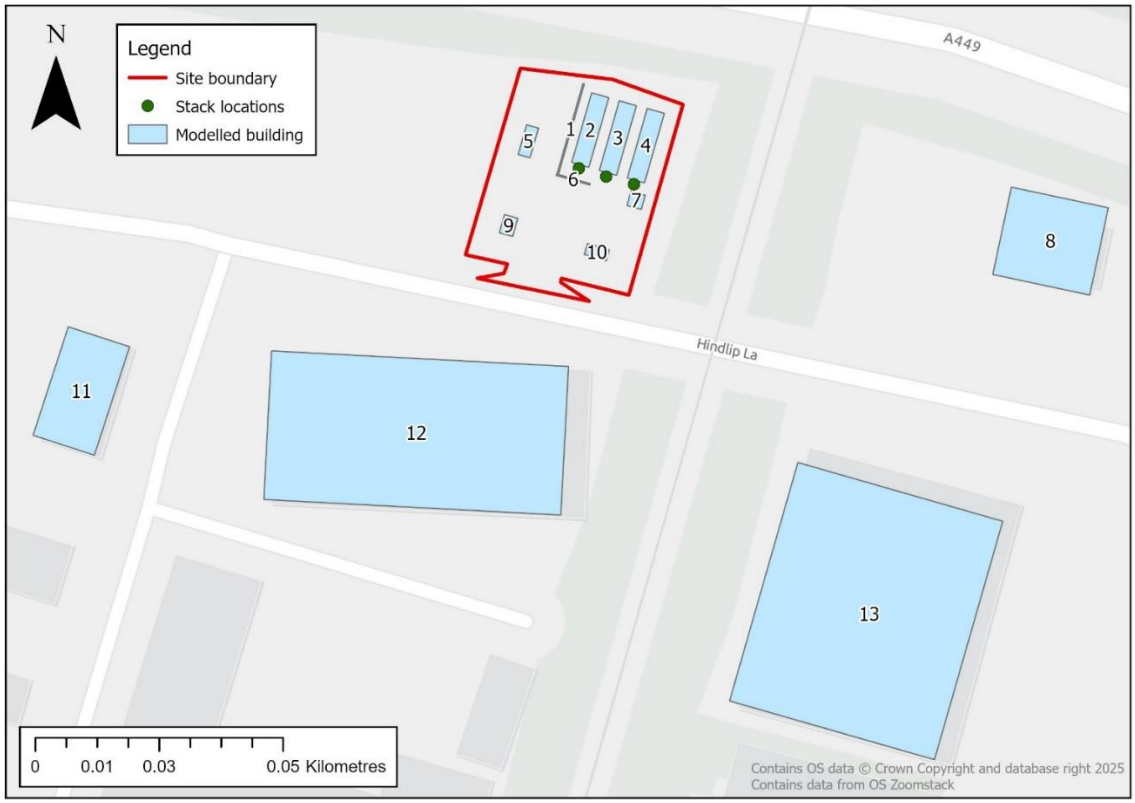
The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. ADMS includes a building effects module to calculate the dispersion of pollution from sources near large structures. The buildings likely to have a dominant effect (i.e. with the greatest dimensions likely to promote turbulence) which have been included within the model are listed in Table 3.1 and illustrated in Figure 3.1

[22] Environment Agency. (2016) ‘Air Emissions Risk Assessment for your Environmental Permit’.

Table 3.1: Building dimensions used within the assessment

No.	Name in ADMS	X (m)	Y (m)	Height (m)	Length (m)	Width (m)	Angle (°)
1	Acoustic fence 2	386621.3	258357.5	5.0	19.0	0.3	16
2	Engine 1	386625.3	258357.3	3.5	14.6	3.6	16
3	Engine 2	386630.8	258355.6	3.5	14.6	3.6	16
4	Engine 3	386636.5	258354.1	3.5	14.6	3.6	16
5	Switchroom	386612.8	258355.0	3.2	6.2	2.5	16
6	Acoustic fence 1	386621.8	258347.3	5.0	7.0	0.3	106
7	Oil store	386634.5	258343.1	2.0	3.0	3.0	16
8	Offsite building 4	386718.1	258334.9	7.0	20.0	18.0	102
9	DNO HV Kiosk	386608.8	258338.0	2.4	3.8	2.8	16
10	Gas kiosk	386626.6	258332.6	2.4	2.3	4.6	16
11	Offsite building 1	386522.6	258304.6	6.0	23.0	13.0	18
12	Offsite building 2	386590.1	258296.2	7.0	60.0	30.0	93
13	Offsite building 3	386680.9	258260.3	7.0	50.0	43.0	16

Figure 3.1: Modelled building locations



3.2.3 Meteorology

The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed.

- Wind speed affects the distance the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise.
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. ADMS uses a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

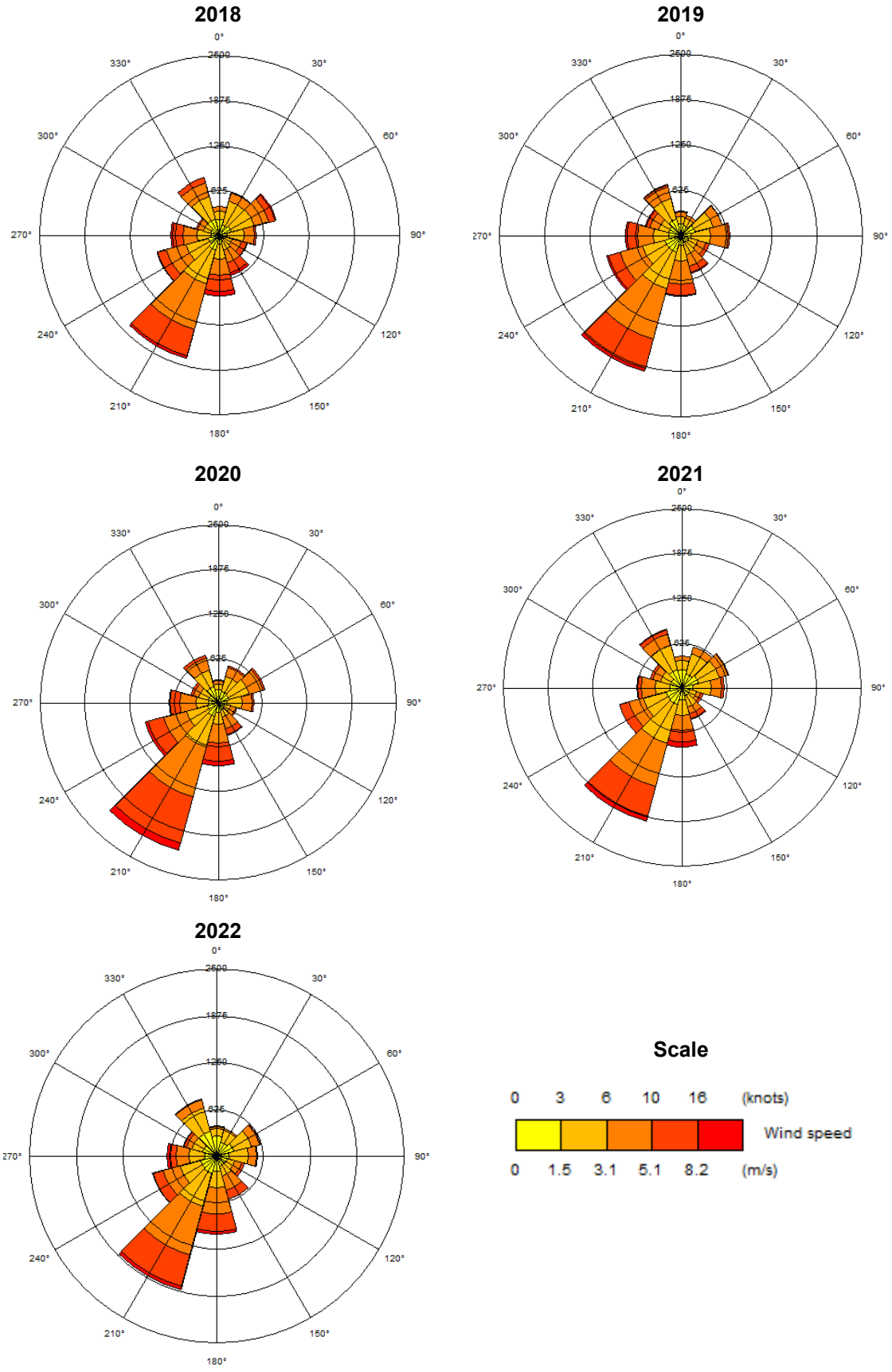
For meteorological data to be suitable for dispersion modelling purposes, parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. As recommended by the EA dispersion modelling guidance[23], modelling was undertaken using five years of data. Data from the Pershore meteorological station was used as this was considered the most representative station due to its proximity to the Site (approximately 13.8 kilometres to the southeast). Five years of data from 2018 to 2022 were used.

Wind roses have been constructed for each of the five years of meteorological data used in this assessment. The wind roses presented in Figure 3.2 illustrate that in most years there is dominance in winds from the southwest.

[23] Environment Agency. (2014) Environmental permitting: air dispersion modelling reports. Available at: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

Figure 3.2: Wind roses for Pershore Meteorological Station (2018 – 2022)



3.2.4 Terrain

The presence of elevated terrain can significantly affect ground level concentrations of pollutants emitted from elevated sources such as stacks by reducing the distance between the plume centre line and ground level and increasing turbulence and, hence, plume mixing.

Terrain in the study area (5km radius from the Site) includes some slopes with gradients more than 10%. Therefore, in accordance with EA specified generator guidance[24], terrain data has been included in the dispersion model.

3.2.5 Surface roughness

The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length. A surface roughness length of 0.5m has been assigned to the model domain while a surface roughness length of 0.2m has been assigned to the Pershore meteorological station, as recommended by CERC.

3.2.6 Emissions data

Emissions used in this assessment are based on a plant load of 100% (three engines at 5.96MWth input) and assumes that exhaust gases will contain the maximum concentration of pollutants permitted.

The NOx emissions modelled in this assessment are based on the emissions guaranteed by the engine manufacturer. These emission guarantees are compliant with the MCP ELVs within the MCPD and the specified generator ELV within the EP regulations.

Table 3.2 presents the emission parameters used in the dispersion modelling and is based on information provided by the engine supplier. Emission rates for NOx have been calculated using the equations presented below:

Emission rate = Plant emission limit x Normalised gas flow.

Correcting for water content:

Dry value = Measured value x 100 / (100 – H_2O measured concentrations [%]).

Correcting for oxygen content:

Corrected value = Measured value x (21 – O_2 Reference value [%] / 21 – O_2 Measured Value [%]).

Correcting for temperature:

Corrected value = Measured value x (Temperature of measured value [K] / 273 [K]).

Table 3.2: Stack emission parameters

Parameter	Units	Value per engine
Stack location	x,y	Engine 1: 386623.0, 258349.5 Engine 2: 386628.5, 258347.9 Engine 3: 386634.0, 258346.3
Stack height	m	6
Stack diameter	m	0.6

[24] Environment Agency, 2019. Specified generators: dispersion modelling assessment. Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

Parameter	Units	Value per engine
Exit temperature	°C	415
Efflux velocity (actual)	m/s	26.6
Volumetric flow rate (actual)	Am^3/s	7.5 [(a)]
Volumetric flow rate (normalised)	Nm^3/s	5.4 [(b)]
NO_x emission [(b)]	mg/Nm³	95
	g/s	0.51

Note: [(a)] Actual flue gas actual conditions = 7.5% O_2, 13.3% H_2O, 415ºC
[(b)] Normalised conditions = 15% O_2, 0ºC, 1013 mbar, dry air

3.3 Post processing of results

3.3.1 NOx to NO_2 relationship

The NOx emissions associated with combustion activities at the Site will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% NO_2 at source. As described previously, the NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal concern in terms of environmental health effects.

There are various techniques available for estimating the portion of the NOx that is converted to NO_2, which will increase with distance from the source. The EA's specified generator modelling guidance[25] identifies that a 70% conversion of NOx to NO_2 should be used for calculation of annual average concentrations and a 35% conversion of NOx to NO_2 should be used for calculation of short-term concentrations. The EA's recommended conversion rates have been used in this assessment.

3.3.2 Assessment of annual mean concentrations

The Site is expected to be operational between the hours of 06:00 to 23:00 Monday to Sunday. Therefore, the Site could theoretically operate for up to 6,188 hours per year, which is based on the Site operating for up to 17 hours per day, every day of the year (although the required duration of operation is likely to be much less than this).

As the model has been run assuming continuous operation all year, the annual mean process contributions (PCs) for the Site have been scaled down by a factor of 6188/8760 to account for the likely total hours of operation across the year. This has been undertaken so that the annual concentrations of pollutants at discrete receptors are a representative worst-case. The short-term (one hour) PCs have not been adjusted to account for all potential worst-case meteorological conditions.

3.3.3 Ambient concentrations

Background concentrations, or ambient concentrations (AC), are added to the PCs to determine the PEC at modelled receptors. EA dispersion modelling guidance[26] states that Defra background maps or local authority/Defra monitoring data can be used as a representative value for the background concentrations in the assessment. Ambient concentrations added to

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

[26] Environment Agency, 2014. Environmental permitting: air dispersion modelling reports. Available at: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

the modelled PC have been taken from the WDC monitored 2024 concentration from site 'BG' (see Section 4).

As the concentrations from the background maps are long-term (annual) average concentrations, short-term background concentrations have been estimated by doubling the long-term background concentrations. This is in accordance with the EA risk assessment guidance[27].

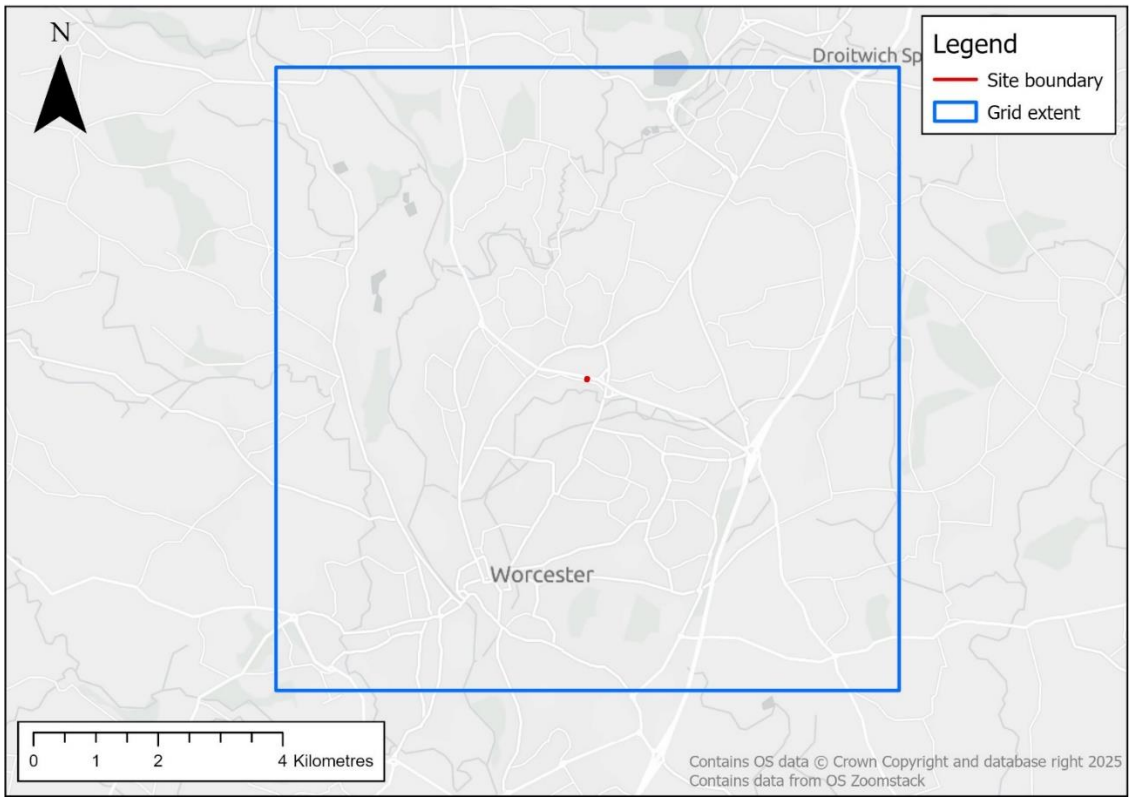
3.4 Sensitive receptors

Gridded receptors and discrete human health receptors have been considered within this assessment.

3.4.1 Gridded receptors

Pollutant concentrations have been modelled across a Cartesian grid with 20m spacing up to 1km from the Site and 100m spacing up to 5km from the Site. The extent of the grid has been presented in Figure 3.3. This assessment has not considered onsite concentrations as the EQSs would not apply at these locations as there is no relevant public exposure.

Figure 3.3: Gridded model extent



3.4.2 Human health

Nine discrete receptors representing the façades of the closest sensitive receptors (residential properties) have been included within the model so that a comparison against the EQS can be made. Both the hourly and annual NO_2 objectives apply to all receptors, except for R3 where

[27] Environment Agency. (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

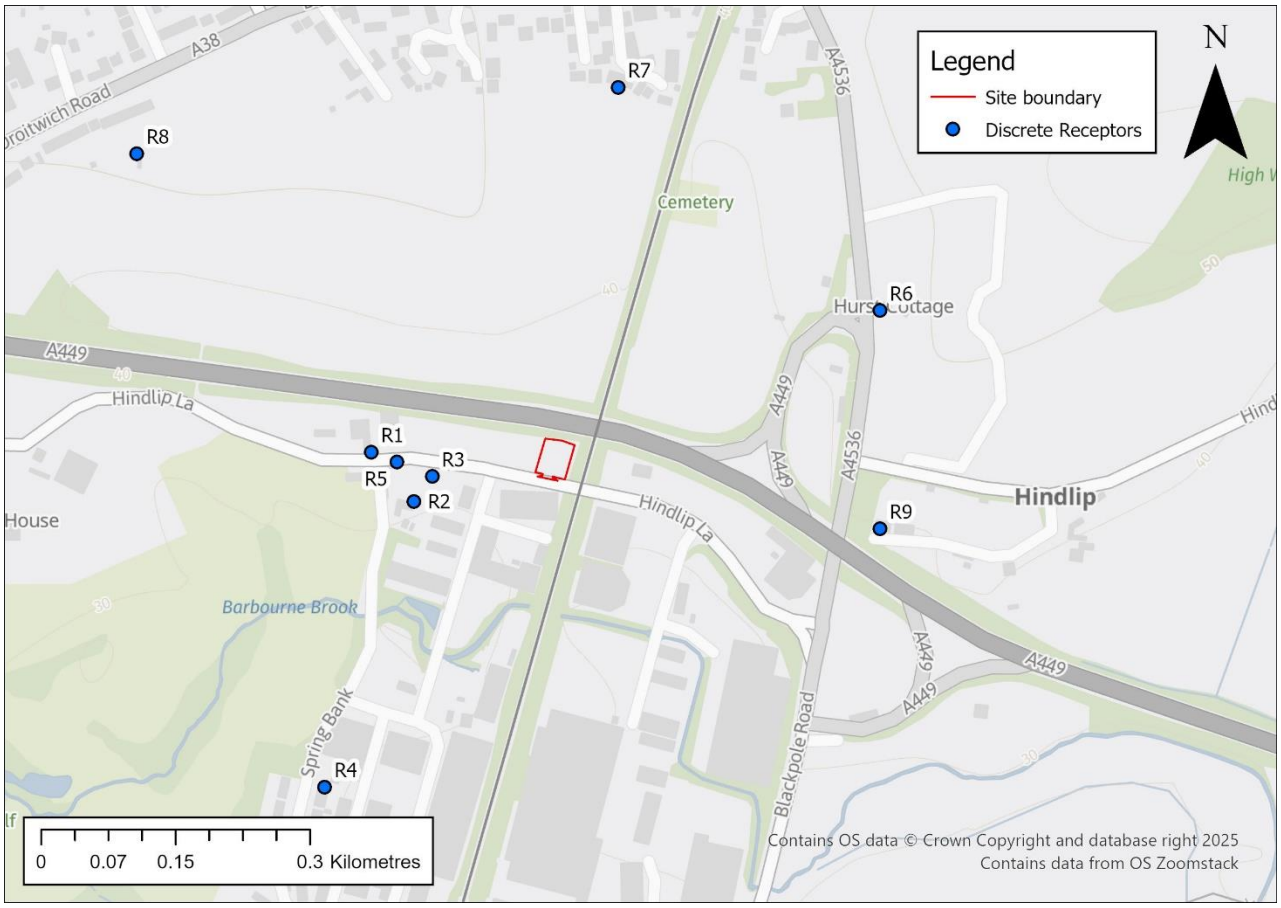
only the short-term NO_2 objective applies. Table 3.3 and Figure 3.4 show the locations of the discrete receptors considered within this assessment.

Table 3.3: Modelled human health receptors

Receptor ID	X	Y	Height (m)
R1	386417.0	258354.7	1.5
R2	386464.7	258299.4	1.5
R3 [(a)]	386484.9	258327.3	1.5
R4	386365.0	257981.1	1.5
R5	386445.8	258343.5	1.5
R6	386985.0	258512.5	1.5
R7	386692.4	258761.6	1.5
R8	386155.1	258687.6	1.5
R9	386984.6	258269.1	1.5

Note: (a) Short-term receptor, therefore annual NO_2 objectives do not apply.

Figure 3.4: Modelled human health receptors



3.4.3 Ecological receptors

The EA specified generator guidance[28] requires that specific sites designated for their ecological importance need only be considered where they fall within set distances from the assessment site in relation to the specified generator's rated thermal input and main fuel type.

The screening distance for a site operating a natural gas fired specified generator with a rated thermal input between 10 to 20MWth (the Site has three engines rated at 5.96MWth input) is 2000m for SSSIs and Marine Conservation Zones and 2500m for SPAs, SACs, and Ramsar sites.

There are no SSSIs and Marine Conservation Zones within 2000m and no SPAs, SACs, or Ramsar sites within the screening distance of 2500m and therefore the Site's effect on ecological receptors has not been considered further.

3.5 Significance criteria

A number of approaches can be used to determine whether the potential air quality effects of a development are significant. However, there remains no universally recognised definition of what constitutes 'significance' for air quality effects.

Guidance is available from a range of regulatory authorities and advisory bodies on how best to determine and present the significance of effects within an air quality assessment. It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Any description of an effect of a development is informed by numerical results. However, an element of professional judgement must also be involved.

Definitions of significance have been adopted from the EA's air dispersion modelling guidance[29]. Where the PCs do not meet the EA's description of 'insignificant', the PEC is compared against the relevant EQS to establish if this is exceeded, as per the EA risk assessment guidance[30]. Table 3.4 provides a summary of criteria used to screen out insignificant impacts.

Table 3.4: Summary of assessment criteria

Parameter	Long term standards	Short-term standards
Screen out insignificant emissions (PCs)	Emissions can be seen as insignificant where: PC long term <= 1% of standard	Emissions can be seen as insignificant where: PC short-term <= 10% of standard
Screening for SPAs, SACs, Ramsar and SSSIs	The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas	The short-term PC is less than 10% of the short-term environmental standard for protected conservation areas
Screen out insignificant PECs	Resulting PEC does not exceed the relevant EQS	

Note: PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Ambient Concentration, AC)

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

[29] Environment Agency. (2014) Environmental permitting: air dispersion modelling reports. Available at: https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

[30] Environment Agency. (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

4 Baseline conditions

4.1 Overview

Information on air quality within the UK can be obtained from a variety of sources including local authorities, national network monitoring sites and other published sources. The primary sources of data examined in this assessment are from WCC[31], WDC[32] and Defra[33]. The most recent full year of monitoring data available for WCC and WDC is 2024. Monitoring data from 2020 and 2021 may not be representative of the conditions around the Site due to the restrictions implemented during the COVID-19 pandemic.

4.2 Local Authority Review and Assessment

4.2.1 Automatic monitoring

WCC does not undertake any automatic monitoring within its administrative area.

WDC started automatic monitoring at one site in 2023 which recorded an annual mean concentration of 24.9µg/m^3 in 2024, well below the EQS of 40µg/m^3. It is located approximately 9km to the northeast of the Site, at a roadside location approximately 100m from the M5 motorway and in close proximity to the M5 Junction 5 roundabout. However, the monitoring results from this site have not been considered further as its location is not considered representative of the Site.

4.2.2 Diffusion tube monitoring

WCC undertook diffusion tube monitoring at 34 sites in 2024. The closest diffusion tube is located approximately 1.8km to the southwest of the Site. However, the diffusion tubes within WCC are not representative of air quality at the Site as they are located within the Worcester urban area and are representative of an urban environment. Therefore, the WCC diffusion tube monitoring has not been considered any further.

WDC undertook diffusion tube monitoring at 28 sites in 2024. Of these sites, diffusion tube 'BG'[34] is an urban background site located approximately 6km south of the Site adjacent to the A4440 Crookbarrow Way. This location is considered representative of the A449 which runs adjacent to the Site. Monitoring site BG recorded an annual mean NO_2 concentration of 16.4µg/m^3 in 2024.

4.3 Defra projected background concentrations

Defra provides estimates of background pollution concentrations for NO_X and NO_2 across the UK for each one kilometre grid square for every year from 2021 to 2040. Future year projections have been developed from the base year of the background maps, which is currently 2021. The maps include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2021 UK monitoring data.

[31] Worcester City Council (2025) 2025 Annual Status Report

[32] Wychavon District Council (2025) 2025 Annual Status Report

[33] Department for Environment, Food and Rural Affairs (2019), Monitoring networks. Available at: https://uk-air.defra.gov.uk/networks

[34] Located at 386297, 252150

The background concentrations for the grid square containing the Site for the current year of 2025 are presented in Table 4.1. The data shows background concentrations are all below the relevant EQS.

Table 4.1: Defra projected background concentrations for the Site in 2025 (µg/m^3)

1km Grid Square Location (OS Grid Reference)	NO_2	NO_x
386500, 258500	7.2	9.1

Source: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2021

4.4 Summary

Air quality monitoring undertaken by WCC and WDC recorded no exceedances of the annual or hourly NO_2 objectives in 2024 at locations expected to have higher pollutant concentrations than the Site. Defra projected background concentrations for 2025 at the Site also indicate that there a no exceedances of the annual mean NO_2 objectives and that background concentrations are low.

Given the presence of the A449 to the north of the site, the monitored concentration of 16.4µg/m^3 from WDC site 'BG' has been conservatively used to represent background concentrations at the Site for both the predicted maximum point of impact and at modelled discrete receptors. The BG monitored concentration is approximately double that of the Defra project background concentrations for the Site.

5 Potential Impacts

5.1 Overview

The results of modelling atmospheric emissions from the Site at gridded and human health receptors are summarised and interpreted below. The model results are presented in tabular form and as contour plots. The PCs and PECs have been compared against the EQSs and assessment criteria stated within EA's risk assessment guidance[35], as presented in Table 3.4, to assess the significance of the air quality impacts from the Site.

It is important to note that for the purpose of modelling, the engines have been assumed to be operating continuously all year in order to undertake a conservative assessment. However, it is proposed that the engines on Site will only operate for a maximum of 6,188 hours per year. Therefore, the annual mean PCs for the Site have been scaled down by a factor of 6188/8760 to more accurately reflect how they could operate.

The same method of scaling down cannot be applied to hourly means. As such, the results presented below for short-term PCs are much higher than they would be as they have assumed continuous operation all year and that operation would coincide with the worst-case meteorological conditions for dispersion.

5.2 Gridded receptors

Table 5.1 presents the maximum NO_2 PCs and PECs at offsite locations across the modelled grid.

The annual PC is greater than 1% of the long term EQS and the hourly PC is greater than 10% of the short term EQS and therefore cannot be screened out according to the EA significance criteria[36].

The maximum hourly NO_2 PEC, when assuming continuous operation all year, and the maximum annual NO_2 PEC are both below 100% of the EQS so can be screened out as insignificant in accordance with the EA significant criteria (see Section 3.5).

Table 5.1: Maximum NO_2 predicted environmental concentrations (µg/m³) – gridded receptors

Averaging period	EQS	Max PC	Max PC as % of EQS	AC	Max PEC	Max PEC as % of EQS
99.79 %'ile of hourly averages	200	98.7	**49.4**	32.8	131.5	65.8
Annual average	40	10.0	**25.0**	16.4	26.4	66.0

Note: Results rounded to 1 decimal place. AC = Ambient Concentration (WDC monitored 2024 concentration from site 'BG'); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); EQS = Environmental Quality Standard, equivalent to the ambient air quality objectives. Arithmetic discrepancies may occur due to rounding of results. The results in **bold** are those that cannot be screened out as insignificant according to EA criteria

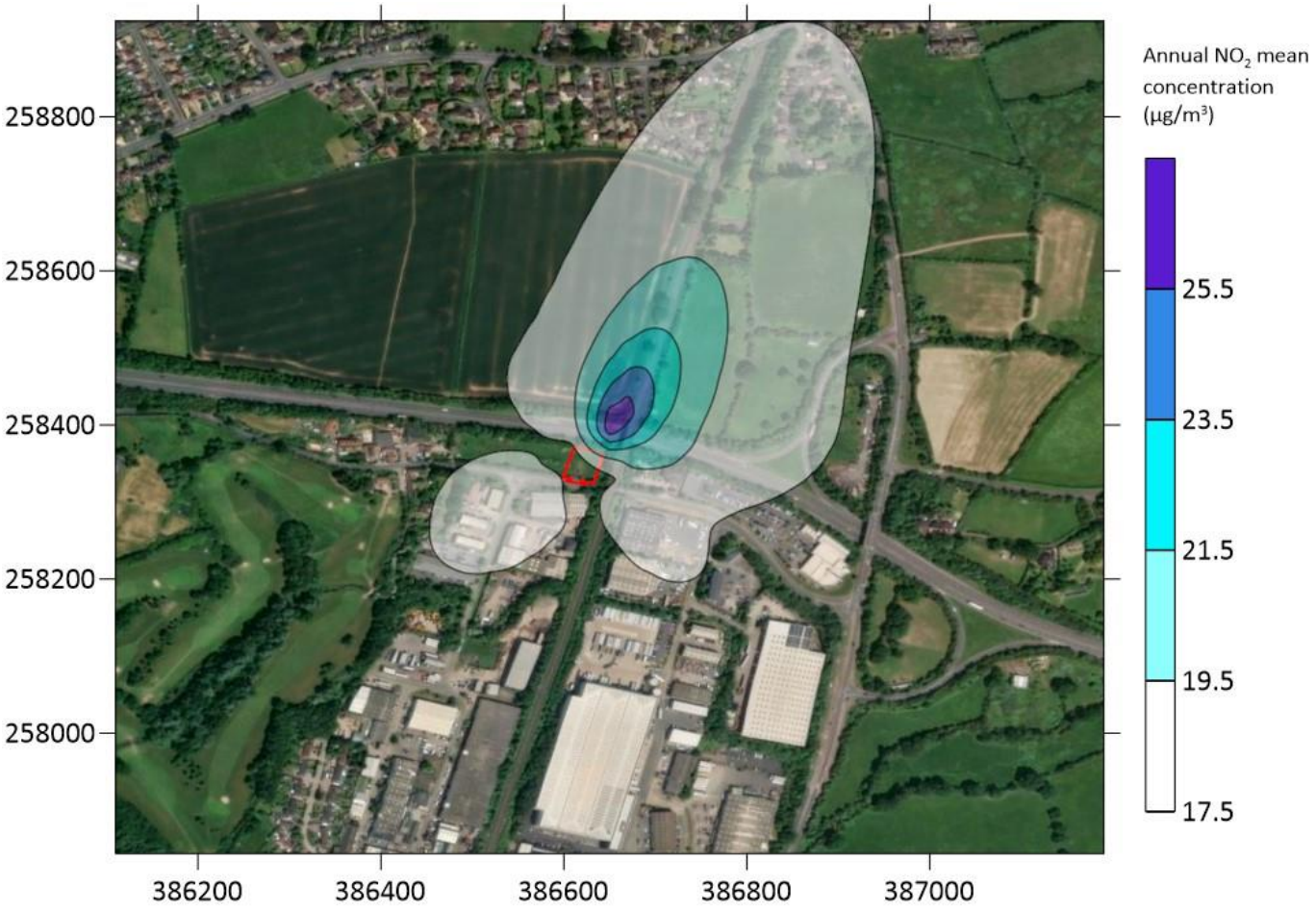
[35] Environment Agency. (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

[36] the PCs are greater than 1% of the long-term standards, and the 10% of the short-term standards

Figure 5.1 and Figure 5.2 present contour plots of the annual and hourly NO_2 PECs in the worst-case meteorological years for the Site.

The annual PECs for the Site (Figure 5.1) demonstrate that the air quality impacts are highly localised to the Site. The maximum offsite annual PECs are found to the northeast of the Site in an area of farmland, within 50m of the Site boundary.

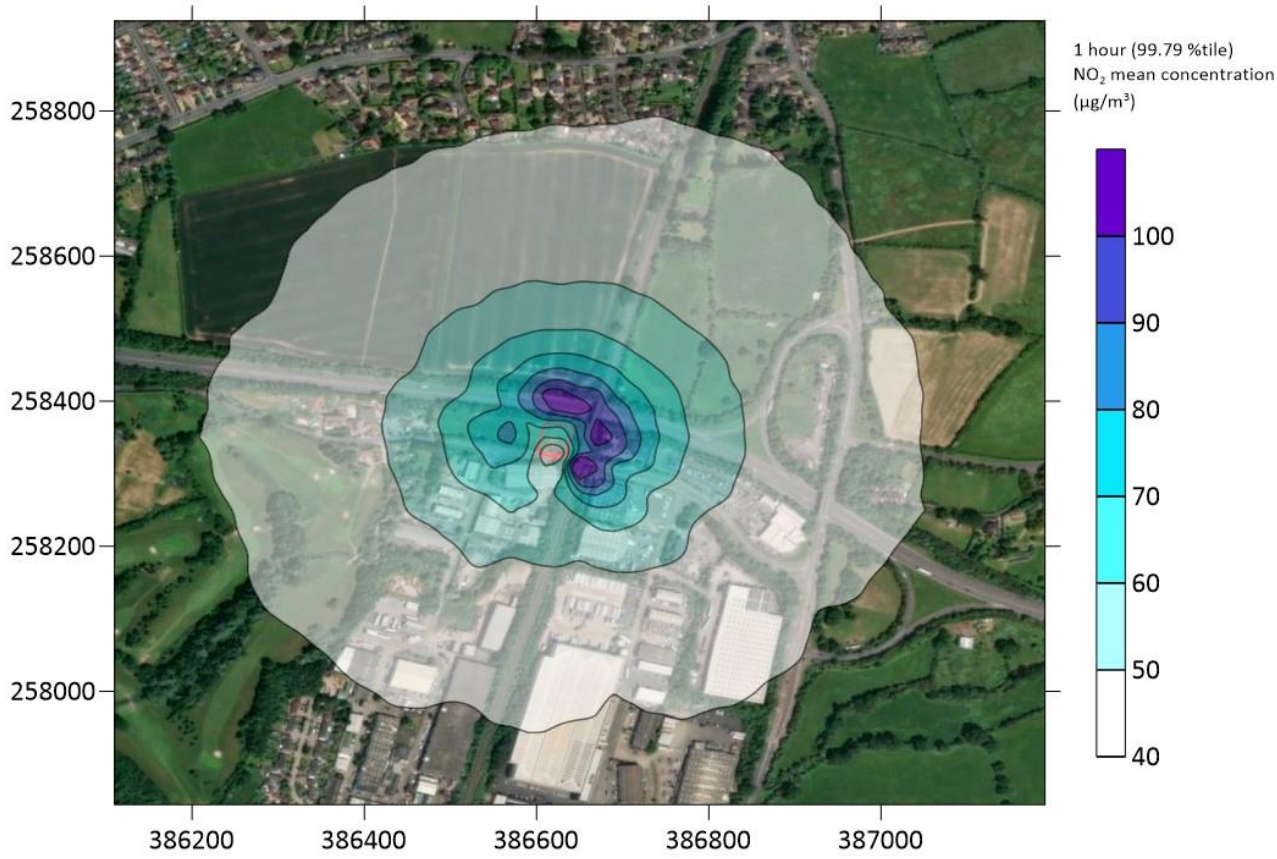
Figure 5.1: Annual mean NO_2 PEC (µg/m^3)



Note: Results presented for the worst-case meteorological year of 2020. Contour interval = 2µg/m³. Minimum contour= 17.5µg/m^3, maximum contour = 25.5µg/m^3. Ambient concentration is from WDC monitored 2024 concentration from site 'BG' = 16.4 µg/m^3. Site outlined in red.

The hourly PECs for the Site (Figure 5.2) demonstrate that the greatest air quality impacts are also highly local to the Site. The maximum offsite hourly PCs are found directly to the north and east of the site, over the A449, the railway and commercial property.

Figure 5.2: Hourly mean (99.79th percentile) NO_2 PEC (µg/m³)



Note: Results presented for the worst-case meteorological year of 2021. Contour interval = 10µg/m³. Minimum contour= 40µg/m³, maximum contour = 100µg/m³. Ambient concentration is from WDC monitored 2024 concentration from site 'BG' = 32.8µg/m³. Site outlined in red.

5.3 Discrete receptors

The annual and hourly (99.79th percentile) PCs and PECs at the discrete human health receptors are summarised in Table 5.2 and Table 5.3. The maximum hourly (100th percentile) PC and PECs have been presented in Appendix A.

Table 5.2 demonstrates that the annual PCs are greater than 1% of the long-term EQS at all receptors except for R4 and R8. The annual objectives do not apply to receptor R3 as this is a garden location. However, the PECs are well below the EQS at all receptors, therefore can be screened out as insignificant.

Table 5.3 demonstrates the hourly PCs are greater than 10% at receptor R2 and R3. However, the PECs are well below the EQS at all receptors, therefore can be screened out as insignificant.

Table 5.2: Annual NO_2 PCs and PECs (µg/m³) at discrete human health receptors

Receptor	EQS	Max PC	Max PC as % of EQS	AC	Max PEC	Max PEC as % if EQS
R1	40	1.0	**2.6**	16.4	17.4	43.6
R2	40	1.4	**3.5**	16.4	17.8	44.5

Receptor	EQS	Max PC	Max PC as % of EQS	AC	Max PEC	Max PEC as % if EQS
R4	40	0.3	0.9	16.4	16.7	41.9
R5	40	1.2	**3.0**	16.4	17.6	44.0
R6	40	0.8	**1.9**	16.4	17.2	42.9
R7	40	1.3	**3.2**	16.4	17.7	44.2
R8	40	0.2	0.5	16.4	16.6	41.5
R9	40	0.6	**1.6**	16.4	17.0	42.6

Note: Results rounded to 1 decimal place. AC= Ambient Concentration (WDC monitored 2024 concentration from site 'BG'); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); EQS = Environmental Quality Standard. Arithmetic discrepancies may occur due to rounding of results. The results in **bold** are those that cannot be screened out as insignificant according to EA criteria

Table 5.3: Hourly NO_2 (99.79th %ile) PCs and PECs (µg/m^3) at discrete human health receptors

Receptor	EQS	Max PC	Max PC as % of EQS	AC	Max PEC	Max PEC as % if EQS
R1	200	16.9	8.4	32.8	49.7	24.8
R2	200	22.5	**11.3**	32.8	55.3	27.7
R3	200	26.1	**13.1**	32.8	58.9	29.5
R4	200	6.4	3.2	32.8	39.2	19.6
R5	200	20.1	10.0	32.8	52.9	26.4
R6	200	8.4	4.2	32.8	41.2	20.6
R7	200	7.9	4.0	32.8	40.7	20.4
R8	200	5.0	2.5	32.8	37.8	18.9
R9	200	8.8	4.4	32.8	41.6	20.8

Note: Results rounded to 1 decimal place. AC= Ambient Concentration (WDC monitored 2024 concentration from site 'BG'); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); EQS = Environmental Quality Standard. Arithmetic discrepancies may occur due to rounding of results. The results in **bold** are those that cannot be screened out as insignificant according to EA criteria.

6 Conclusions

An assessment has been undertaken to determine the effect on air quality associated with emissions from the Site using advanced dispersion modelling. For gridded and human health receptors, the emissions of NOx have been considered in accordance with EA guidance. The method of the assessment has taken a conservative approach by assuming worst-case conditions for factors such as emissions characteristics, the operating envelope and meteorological conditions.

No exceedances of the EQS are predicted at locations of relevant public exposure as a result of the operation of the Site. The air quality effects are highly localised and the impact at sensitive human health receptors is insignificant in accordance with EA guidance. The Site is also not considered to conflict with the relevant air quality regulations.

Appendices

A. Maximum hourly NO_2 PECs

In accordance with the EA specified generator guidance[37], the maximum hourly (100th %ile) PCs and PECs for the Site have been presented in Table A.1. There is no EQS for this averaging period and therefore significance cannot be commented upon, however the maximum hourly NO_2 PEC for the Site are predicted to remain below the hourly NO_2 EQS, which is from the 99.79th percentile of values.

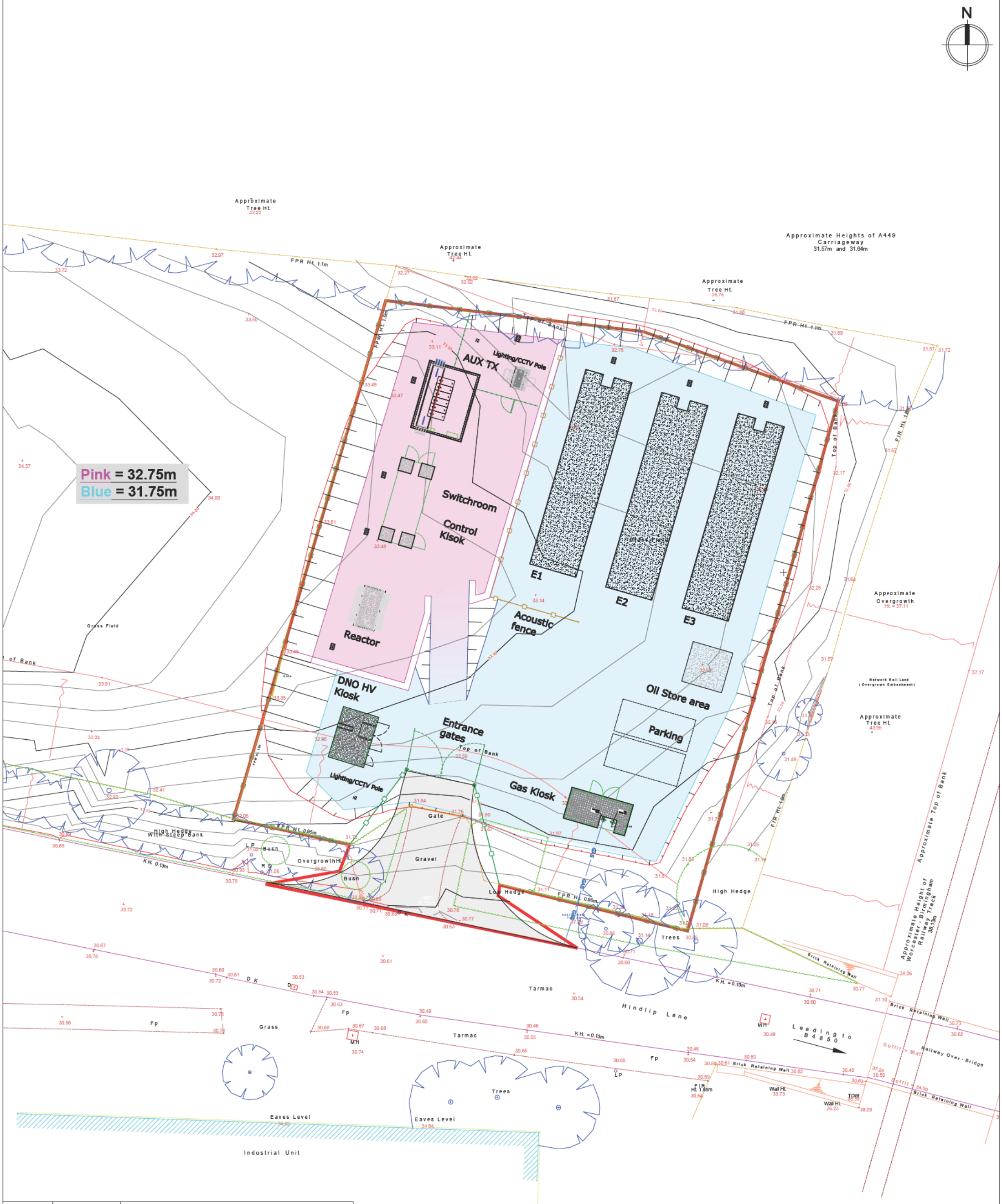
Table A.1: Hourly max NO_2 (100th %ile) PCs and PECs (µg/m³) at discrete human health receptors

Receptor	Max PC	AC	Max PEC
R1	18.3	32.8	51.1
R2	24.1	32.8	56.9
R3	30.5	32.8	63.3
R4	7.0	32.8	39.8
R5	22.5	32.8	55.3
R6	9.6	32.8	42.4
R7	8.4	32.8	41.2
R8	6.8	32.8	39.6
R9	10.0	32.8	42.8

Note: Results rounded to 1 decimal place. AC= Ambient Concentration (WDC monitored 2024 concentration from site 'BG'); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); EQS = Environmental Quality Standard. Arithmetic discrepancies may occur due to rounding of results.

[37] Environment Agency, 2019. Specified generators: dispersion modelling assessment. Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

B. Site plan



Rev.	Date	Comments
	25/07/2025	DRAFT for comment

MERCIA POWER RESPONSE Ltd
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TITLE: Hindlip - Two tier Layout DRAFT		
DATE:	25/07/2025	DRAWING NO. MPR-HIN-003
DRAWN BY:	P.FORD	
SCALE	1:250@A3	Rev: