BRACKNELL DATA CENTRE

Air Quality Assessment
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1 INTRODUCTION

1.1 Purpose of the Report

1.1.1 This Air Quality Assessment has been prepared to a planning application for the development of Land at Cain Road, Bracknell.

1.1.2 The Application Site is located within the administrative areas of Bracknell Forest Council (BFC). The nearest Air Quality Management Area (AQMA) is approximately 1.4 km to the east of the Application Site.

1.1.3 This air quality assessment covers the:

- Construction phase - an evaluation of the temporary effects from fugitive construction dust; and
- Operational phase –an evaluation of the impacts of the key emission sources to air (i.e. the 11 diesel-powered generators) during testing and emergency use on the local area.

1.1.4 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects have then been described. The baseline air quality conditions have been established taking into account Defra estimates, local authority documents and the results of any local monitoring. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual construction and operational-phase effects.

2 LEGISLATION AND POLICY CONTEXT

2.1 Legislation

The Ambient Air Quality Directive and Air Quality Standards Regulations

2.1.1 The 2008 Ambient Air Quality Directive (2008/50/EC) (EC, 2008) aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in England was transposed into domestic law by the Air Quality Standards Regulations 2010 (Defra, 2010), which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

UK Air Quality Strategy

2.1.2 The Environment Act 1995 (HMSO. 1995) established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 (Defra, 2007). The Strategy sets UK air quality standards♦ and objectives# for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

2.1.3 The 1995 Environment Act also established the UK system of Local Air Quality Management (LAQM), that requires local authorities to go through a process of review and assessment of air quality in their areas, identifying places where objectives are not likely to be met, then declaring Air Quality Management Areas (AQMAs) and putting in place Air Quality Action Plans to improve air quality. These plans also contribute, at local level, to the achievement of EU limit values.

2.1.4 For the purposes of this assessment, the limit values set out in the Air Quality Standards Regulations 2010 and the objective levels specified under the current UK AQS have been used.

2.1.5 The limit values and objectives relevant to this assessment are summarised in Table 2.1. Although the EU limit values and the UK AQS objectives are numerically equal, there are some differences in where they apply and who is responsible for their achievement.

♦ Standards are concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific evidence and medical evidence on the effects of the particular pollutant on health, or on the wider environment, as minimum or zero risk levels.

Objectives are policy targets expressed as a concentration that should be achieved, all the time or for a percentage of time, by a certain date.

2.1.6 The Environment Agency online guidance entitled *'Environmental management – guidance, Air emissions risk assessment for your environmental permit'* (EA, 2020) provides further assessment criteria in the form of Environmental Assessment Levels (EALs). For benzene, the EAL is more stringent that the AQS objective. The Environment Agency EAL has therefore been used to ensure that the assessment is conservative.

Table 2.1: Summary of Relevant Air Quality Limit Values, Objectives and EALs

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than
Nitrogen Dioxide (NO_2)	1 hour	200 μg.m^{-3}	18 times per calendar year
	Annual	40 μg.m^{-3}	-
Particulate Matter (PM_{10})	24 Hour	50 μg.m^{-3}	35 times per calendar year
	Annual	40 μg.m^{-3}	-
Particulate Matter ($PM_{2.5}$)	Annual	25 μg.m^{-3}	-
Sulphur Dioxide (SO_2)	15-minute	266 μg.m^{-3}	35 times per calendar year
	1 hour	350 μg.m^{-3}	24 times per calendar year
	24-hour	125 μg.m^{-3}	3 times per calendar year
Carbon monoxide	Maximum daily running 8 hour mean	10,000 μg.m^{-3}	-
	Maximum 1-hour	30,000 μg.m^{-3}	-
Benzene (a)	Annual	5 μg.m^{-3}	-
	Maximum 1-hour	195 μg.m^{-3}	-

(a) The generators emit hydrocarbons. The Environment Agency EAL for benzene (the most harmful local hydrocarbon pollutant) has been used for total hydrocarbons. This is a highly conservative and precautionary approach and unlikely in the extreme. This is a conservative approach.

2.2 Planning Policy

2.2.1 The National Planning Policy Framework (NPPF) (CLG, 2019) is a material consideration for local planning authorities and decision-takers in determining applications. At the heart of the NPPF, is a presumption in favour of sustainable development, subject to caveats where a plan or project affects a habitats site (A habitat is an assemblage of physical and biological elements which form a recognisable unit). For determining planning applications, this means approving development proposals if they accord with an up-to-date local development plan, unless material considerations indicate otherwise. If the development plan does not contain relevant policies, or the policies are out of date, then planning permission should be granted unless the application of policies in the NPPF that protect areas or assets of particular importance provides a clear reason for refusing the development, or any adverse impacts would significantly outweigh the benefits.

2.2.2 The NPPF sets out three overarching objectives to achieve sustainable development. The relevant objective in the context of this air quality assessment is:

"an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution and adapting to climate change, including moving to a low carbon economy" (Paragraph 8c)

2.2.3 Under the heading 'Promoting sustainable transport', the NPPF states:

"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 103)

2.2.4 Under the heading 'Conserving and enhancing the natural environment', the NPPF states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

…

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; …" (Paragraph 170)

"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 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." (Paragraph 181)

2.3 Guidance

2.3.1 The National Planning Practice Guidance (NPPG) was issued on-line on 6 March 2014 and is updated periodically by government as a live document. The last major update was on 1 November 2019. The Air Quality section of the NPPG describes the circumstances when air quality, odour and dust can be a planning concern, requiring assessment.

2.3.2 The NPPG advises that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity. The NPPG states that when deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

"Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the proposed development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus

station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;

Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; biomass boilers or biomass-fuelled Combined Heat and Power plant; centralised boilers or plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area; or extraction systems (including chimneys) which require approval or permits under pollution control legislation;

Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality;

Give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations;

Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value."

2.3.3 The NPPG provides advice on how air quality impacts can be mitigated and notes

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met."

2.4 Local Planning Policy

2.4.1 BFC's Core Strategy Development Plan Document (BFC,2008) was adopted in February 2008. The document contains the Council's long-term aspirations for the borough and policies to guide and manage development in Bracknell Forest until 2026. In relation to air quality, Policy CS1 'Sustainable Development Principles' states that:

"Development will be permitted which:

i makes efficient use of land, buildings and infrastructure; and

ii. is located so as to reduce the need to travel; and

iii. promotes a mix of uses; and

iv. conserves the use of resources including water and energy through a reduction in their use; and

v. supports the economic well being of the population; and

Protects and Enhances;

vi. the health, education and safety of the local population; and

vii. the quality of natural resources including water, air, land and biodiversity; and

viii. the character and quality of local landscapes and the wider countryside; and *ix. the historic and cultural features of acknowledged importance."*

2.4.2 The Draft Bracknell Forest Local Plan (BFC, 2018) was published in February 2018. The document has not been through examination in public so no weight can be given to any of the policies. However, it does give a clear direction to how Bracknell Forest Council wish to see the area developed in future.

2.4.3 In relation to air quality, *Policy LP45 - Strategic Transport Principles* states that:

"Development proposals must seek to minimise and mitigate negative impacts on the highways network and road safety. Where appropriate proposals will be supported which:

…

Provide transport solutions which reduce greenhouse gases and improve air quality;

…"

2.4.4 The Binfield Neighbourhood Plan (Binfield Council, 2016) was brought into legal force by Bracknell forest Council on 20 April 2016. It forms part of the development plan for Bracknell Forest and is used for determining planning applications in the Binfield Parish. The Application Site is located within Binfield.

2.4.5 In relation to air quality, Policy ENV2: '*Air Quality'* states that:

"Any development proposal which is required to be accompanied by an Environmental Statement will be expected to demonstrate the following:

1. it is not likely to result in the breach of European Union limits for air pollution; and

2. if such limits are likely to be breached, then measures will be expected to be put in place to adequately mitigate this impact and ensure that air pollution levels are maintained below the limit."

3 ASSESSMENT METHODOLOGY

3.1.1 Neither the NPPF nor the NPPG is prescriptive on the methodology for assessing air quality effects or describing significance; practitioners continue to use guidance provided by Defra and non-governmental organisations, including Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM). However, the NPPG does advise that "*Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific. The scope and content of supporting information is therefore best discussed and agreed between the local planning authority and applicant before it is commissioned."* It lists several areas that might be usefully agreed at the outset.

3.1.2 This air quality assessment covers the elements recommended in the NPPG. The approach is consistent with the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document (EPUK&IAQM, 2017), and, where relevant, Defra's Local Air Quality Management Technical Guidance: LAQM.TG16 (Defra, 2016). It includes the key elements listed below:

- Establishing the background Ambient Concentration (AC) from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of available air quality monitoring and Defra background map data in the vicinity of the Application Site.
- A qualitative assessment of likely construction-phase impacts with mitigation and controls in place; and
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a "new generation" Gaussian dispersion model, ADMS 5. Assessment of Process Contributions (PC) from the facility in isolation, and assessment of resultant Predicted Environmental Concentrations (PEC), taking into account cumulative impacts through incorporation of the AC.

3.1.3 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 15 years' experience in preparing air quality assessments.

3.2 Construction Phase - Methodology

3.2.1 Regarding exhaust emissions from construction-related vehicles (contractors' vehicles and Heavy Duty Vehicles (HDVs), diggers, and other diesel-powered vehicles), these are unlikely to have a significant impact on local air quality except for large, long-term construction sites: Highways England's Design Manual for Roads and Bridges (HE, 2019) states that an air quality assessment of construction-related vehicle traffic need only be assessed where construction activities are programmed to last more than two years. The programme in this case is expected to be approximately 10 - 12 months. Construction vehicle exhaust emissions have therefore not been assessed specifically.

3.2.2 Dust is the generic term used to describe particulate matter in the size range 1-75 µm in diameter (BSI, 1983). Particles greater than 75 µm in diameter are termed grit rather than dust. Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density;

together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

3.2.3 The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry). Additionally, dust can potentially have adverse effects on vegetation and fauna at sensitive habitat sites.

3.2.4 The IAQM *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) sets out 350 m as the distance from the site boundary and 50 m from the site traffic routes up to 500 m of the entrance, within which there could potentially be nuisance dust and PM_{10} effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. These distances are set to be deliberately conservative.

3.2.5 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

3.2.6 The IAQM dust guidance aims to estimate the impacts of both PM_{10} and dust through a risk-based assessment procedure. The IAQM dust guidance document states: *"The impacts depend on the mitigation measures adopted. Therefore, the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified."*

3.2.7 The IAQM dust guidance provides a methodological framework, but notes that professional judgement is required to assess effects: *"This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified."*

3.2.8 Consistent with the recommendations in the IAQM dust guidance, a risk-based assessment has been undertaken for the development, using the well-established source-pathway-receptor approach:

- The dust impact (the change in dust levels attributable to the development activity) at a particular receptor will depend on the magnitude of the dust source and the effectiveness of the pathway (i.e. the route through the air) from source to receptor.
- The effects of the dust are the results of these changes in dust levels on the exposed receptors, for example annoyance or adverse health effects. The effect experienced for a given exposure depends on the sensitivity of the particular receptor to dust. An assessment of the overall dust effect for the area as a whole has been made using professional judgement taking into account both the change in dust levels (as indicated by the Dust Impact Risk for individual receptors) and the absolute dust levels, together with the sensitivities of local receptors and other relevant factors for the area.

3.2.9 The detail of the dust assessment methodology is provided in Appendix A.

3.2.10 The dust risk categories that have been determined for each of the four activities (demolition, earthworks, construction and trackout) have been used to define the appropriate site-specific mitigation measures based on those described in the IAQM dust guidance. The guidance states that provided the mitigation measures are successfully implemented, the resultant effects of the dust exposure will normally be *"not significant"*.

3.2.11 The assessment methodology does not consider the air quality impacts of dust from any contaminated land or buildings including hazardous material that may become airborne during demolition. Mitigation measures are proposed to control dust emissions; however, in this case, the Application Site is not considered to be contaminated (see Ground Conditions Report – 2035B-RPS-XX-XX-RP-P-9734).

3.3 Operational Phase - Methodology

Summary of Key Pollutants Considered

3.3.1 The key pollutant emissions associated with the diesel-powered back-up generators are oxides of nitrogen (NO_x), PM_{10}, $PM_{2.5}$ (particles up to 2.5 µm in diameter, a subset of PM_{10}), SO_2, CO and hydrocarbons.

3.3.2 Emissions of total NO_x from combustion sources comprise nitric oxide (NO) and NO_2. The NO oxidises in the atmosphere to form NO_2. The assessment of operational impacts therefore focuses on changes in NO_2 concentrations at ground level receptors.

3.3.3 The EPUK/IAQM Land-Use Planning & Development Control: Planning For Air Quality document indicates that air quality assessments should include developments increasing annual average daily Light Duty Vehicle (LDV) traffic flows by more than 100 within or adjacent to an AQMA and more than 500 elsewhere. Once operational, the development is expected to generate a total of 89 vehicle movements, of which 12 would be HDVs. The EPUK/IAQM thresholds are highly unlikely to be exceeded; therefore, operational-vehicle exhaust emissions have not been assessed and can be considered negligible.

Atmospheric Dispersion Modelling of Pollutant Concentrations

3.3.4 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

3.3.5 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.

Dispersion Model Selection

3.3.6 Several commercially available dispersion models can predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 5, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions. The ADMS 5 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

3.3.7 ADMS comprises a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. Amongst the features of ADMS are:

- An up-to-date dispersion model in which the boundary layer structure is characterised by the height of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accurately than the use of Pasquill-Gifford stability categories does, which were used in many previous models (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non-Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;
- Several complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and
- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

Model Input Data

Meteorological Data

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

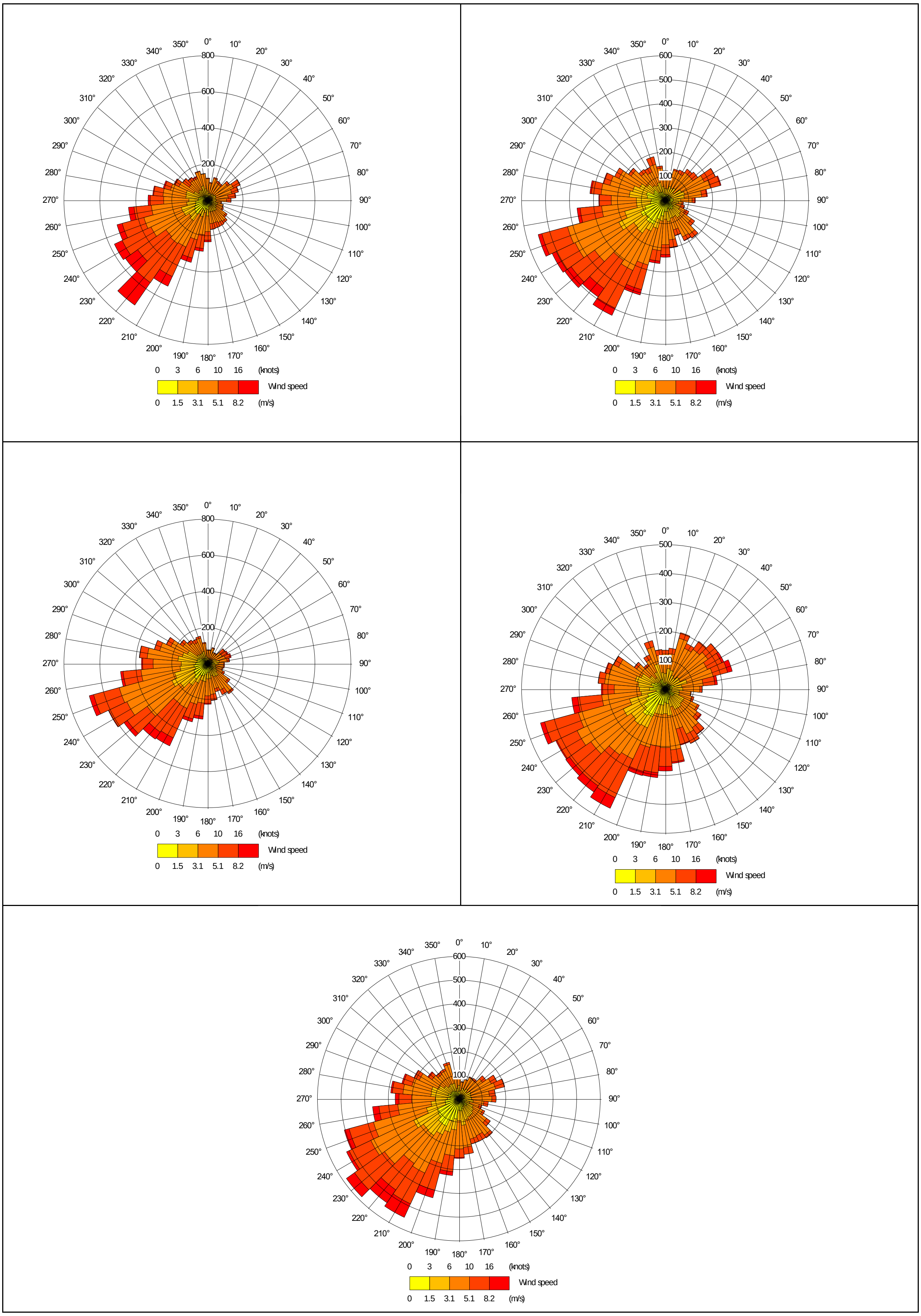
- wind direction determines the sector of the compass into which the plume is dispersed;
- wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- atmospheric stability is a measure 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. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

3.3.9 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological 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.

3.3.10 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from the Farnborough meteorological station between 2015 and 2019, approximately 15 km south of the site.

3.3.11 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 3.1.

Figure 3.1: Wind Roses - Farnborough 2015 to 2019



Terrain

3.3.12 The presence of elevated terrain can significantly affect (usually increase) 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 by increasing turbulence and, hence, plume mixing. A complex terrain has been included in the model.

Surface Roughness

3.3.13 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.

3.3.14 A surface roughness length of 0.5 m, which the software developer recommends for use in suburban areas, has been used within the model to represent the average surface characteristics across the study area.

Building Wake Effects

3.3.15 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. The dominant structures (i.e. with the greatest dimensions likely to promote turbulence) have been included within the model. The location and dimensions of the structure included in the model are listed in Table 3.1.

Table 3.1 : Dimensions of Buildings Included Within the Dispersion Model

Building ID	Approx. Building Centre		Length (m)	Width (m)	Height (m)	Angle (Degrees)
	X (m)	Y (m)				
Data Hall	484795	169022	136	67	12.4	137

Model Scenarios

3.3.16 Modelling has been undertaken for the following scenarios:

- Testing Scenario 1 – each generator unit tested separately at 25% load for 0.5 hour every two weeks per year and 1 hour each quarter, i.e. 17 hours per generator;
- Testing Scenario 2 - each generator unit tested separately at 100% load for 1.5 hours, twice a year, i.e. 3 hours per generator; and
- Scenario 3 (Emergency) – all 11 generators operating at 100% load for 72 hours.

3.3.17 The period of 72 hours used in the modelling for emergency operation is a highly conservative estimate. Such events are triggered by utility (grid) power outages or critical (and unplanned/emergency) maintenance of the power infrastructure system.

Stack Parameters and Emissions Rates used in the Model

3.3.18 A total of 11 generators is proposed comprising: 10 x 2,400 kW_e output and 1 x 1,000 kW_e output generator units. To ensure that the assessment is conservative, 11 generators have been modelled using the emissions data for the 2,400 kW_e generator. Table 3.2 summarises the stack emissions characteristics for each engine operating at 100% and 25% load. The stack coordinates for each stack are provided in Appendix C.

Table 3.2 :Stack Characteristics – 2,400 kW_e Diesel Generators

Parameters	Units	100% load	25% load
Stack height	From ground to the top of the stack (m)	15	
Internal diameter of the flue at point of release to air	m	0.6	
Temperature of the stack gases	°C	481	382
Actual volumetric flow	$Am^3.s^{-1}$	9.0	3.5
Actual O_2 (wet)	%	8.7	11.7
Actual H_2O	%	8.8	6.9
Normalised volumetric flow (0°C, dry, 5% O_2)	$Nm^3.s^{-1}$	2.1	0.7
NOx concentration	$mg.Nm^{-3}$	2181	1652
PM_{10} concentration	$mg.Nm^{-3}$	31	75
CO concentration	$mg.Nm^{-3}$	338	382
Hydrocarbons concentration#	$mg.Nm^{-3}$	43	172
NOx mass emission rate	$g.s^{-1}$	4.643	1.189
PM_{10} mass emission rate	$g.s^{-1}$	0.066	0.054
SO_2 mass emission rate*	$g.s^{-1}$	0.004	0.001
CO mass emission rate	$g.s^{-1}$	0.720	0.275
Hydrocarbons mass emission rate#	$g.s^{-1}$	0.092	0.124

Assumed to be total non-methane hydrocarbons *Based on fuel containing 0.0015% sulphur by mass. Pollutant concentrations are all at 5% O_2, dry.

3.3.19 For the modelling and assessment of hydrocarbons releases, the highly conservative and precautionary approach that has been taken is to assume all emissions are in the form of benzene (the most harmful local hydrocarbon pollutant), which is unlikely in the extreme. This is consistent with the Environment Agency's online guidance (Environment Agency, 2020a) which states that *"If you release volatile organic compounds into the air and do not know what all the substances in them are, treat them all as 100% benzene in your risk assessment."*

Model Outputs

Receptors

3.3.20 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. Local Air Quality Management Technical Guidance, LAQM.TG16 (Defra, 2016), provides examples of exposure locations and these are summarised in Table 3.3.

Table 3.3 : Examples of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	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's façades), or any other location where public exposure is expected to be short-term.
Daily-mean	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's façade), or any other location where public exposure is expected to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. 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 to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.3.21 The effects of the proposals have been assessed at the facades of a representative selection of discrete sensitive receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 3.4 and shown in Figure 3.2.

Table 3.4 : Modelled Sensitive Receptors

ID	Description	x	y
R1	Residential property	484635	169283
R2	Residential property	484711	169295
R3	Residential property	484538	168994
R4	Residential property	484531	168907
R5	Residential property	484813	168712
R6	Residential property	484940	168759
R7	Residential property	485085	168813
R8	Residential property	484964	169450
R9	Leisure (driving range)	484598	169045
R10	Leisure (ski slope)	484456	169078

ID	Description	x	y
R11	Leisure (playground)	484869	169369
R12	Leisure (tennis court)	484904	169300
R13	Leisure (playing field)	484823	169181
R14	Leisure (playing field)	484857	169161
R15	Leisure (playing field)	484886	169141

3.3.22 The locations of the ecological receptors (pre-fixed with ER) are shown in Figure 3.3. These are discussed in detail in Appendix D.

Figure 3.2: Stacks and Sensitive Human Health Receptors Modelled

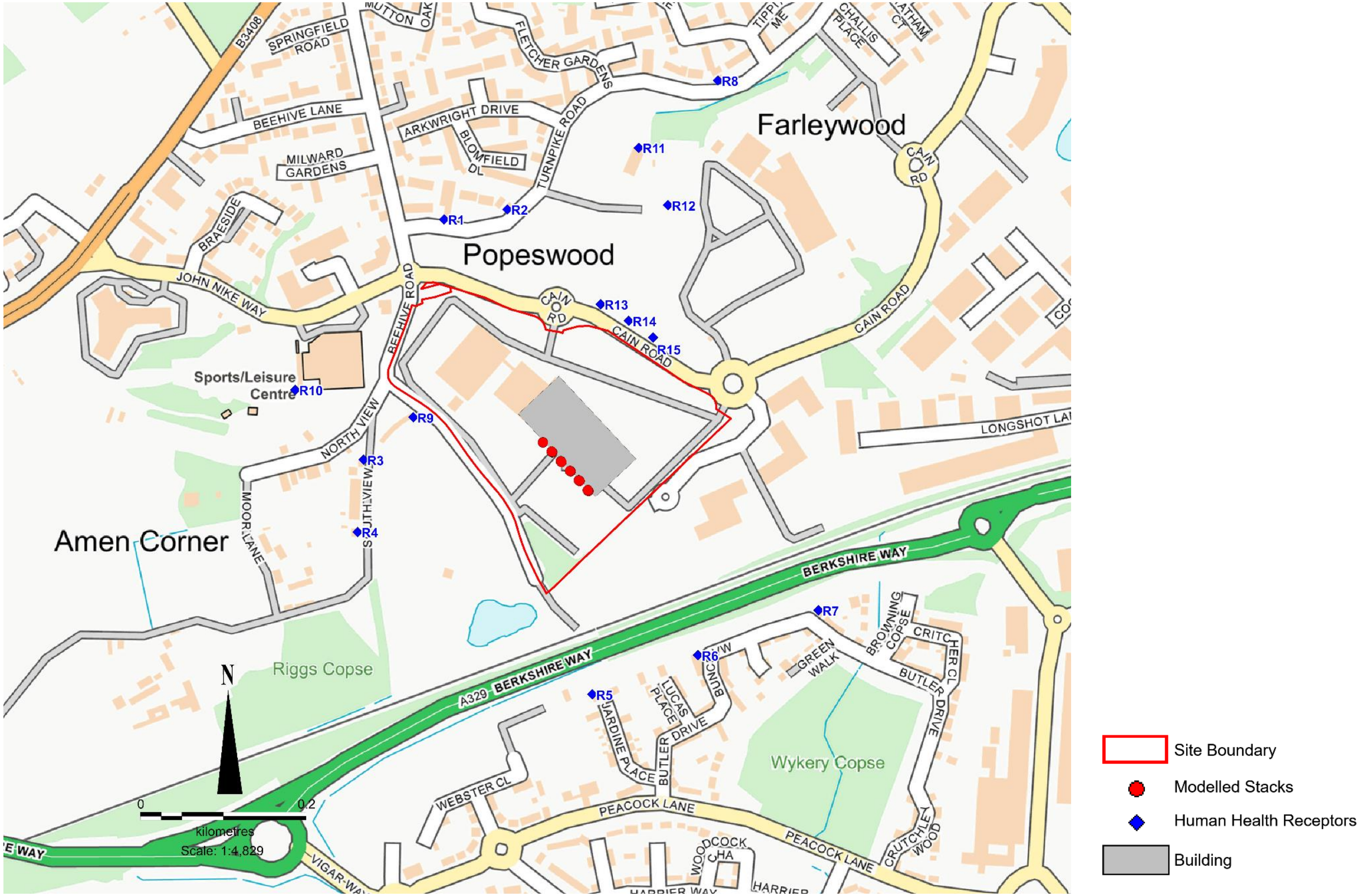
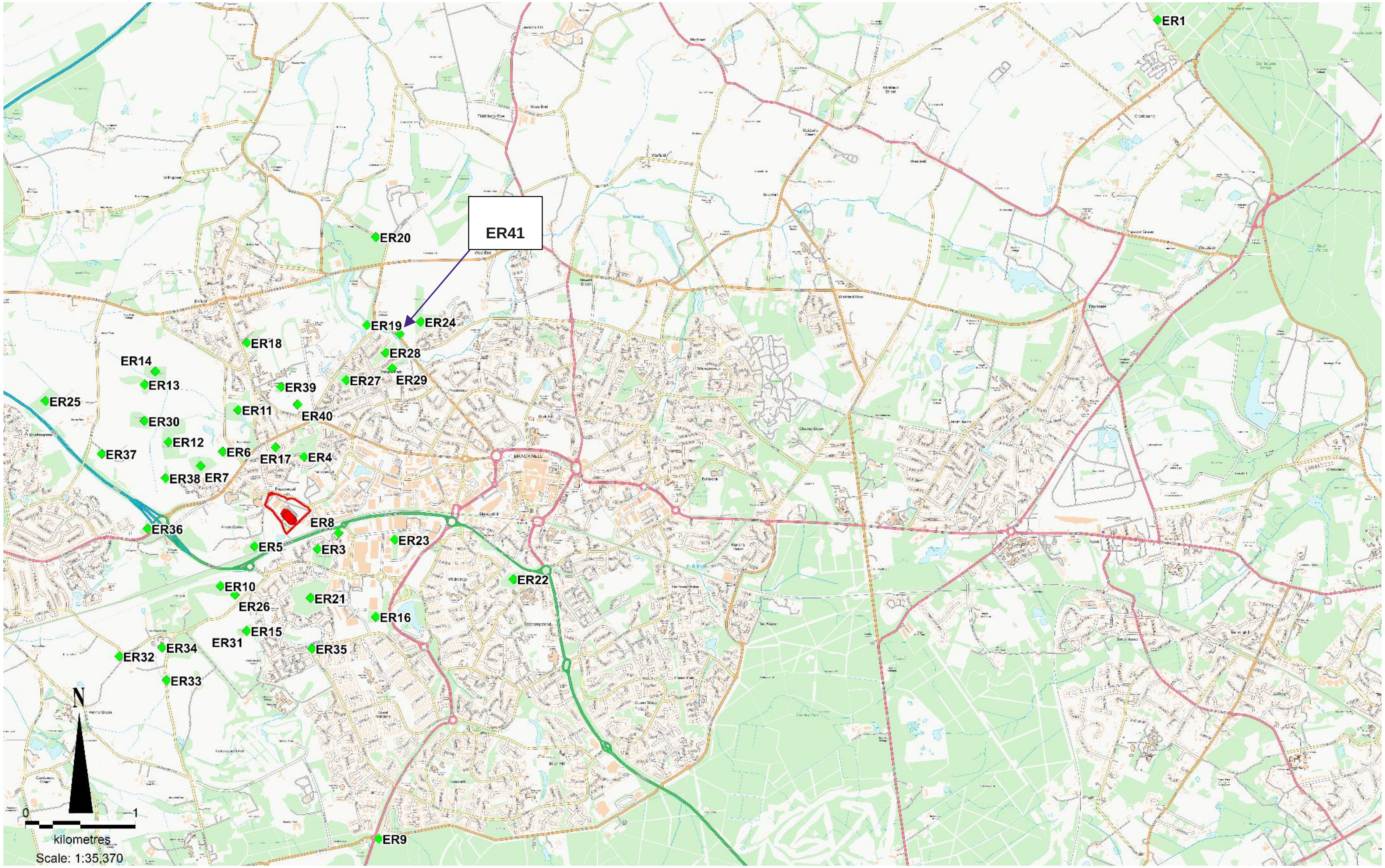


Figure 3.3: Stacks and Sensitive Ecological Receptors Modelled



3.3.23 In addition, concentrations have been modelled across a 3 km by 3 km grid, with a spacing of 30 m, at a height of 1.5 m (representative of average breathing height), centred on the Application Site.

3.3.24 The AQS objectives of all averaging periods (i.e. annual, daily and hourly-mean) apply at the front and rear façades of all the receptors modelled.

NO_X to NO_2 Relationship

3.3.25 The NO_x emissions will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at the point of release. 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.

3.3.26 There are various techniques available for estimating the proportion of NO_x converted to NO_2 by the time it has reached receptors which depends on the distance and hence travel time between the source and receptor. The methods used in this assessment are discussed below.

NO_X to NO_2 Assumptions for Annual-Mean Calculations

3.3.27 Total conversion (i.e. 100%) of NO to NO_2 is sometimes used for the estimation of the absolute upper limit of the annual mean NO_2. This technique assumes that all NO emitted is converted to NO_2 before it reaches ground level. However, in reality, the conversion is an equilibrium reaction and even at ambient concentrations a proportion of NO_X remains in the form of NO. Total conversion is, therefore, an unrealistic assumption, particularly in the near field (EA, 2017). While this approach is useful for screening assessments, it is not appropriate for detailed assessments.

3.3.28 Historically, the Environment Agency has recommended that for a 'worse case scenario', a 70% conversion of NO to NO_2 should be considered for calculation of annual average concentrations. If a breach of the annual average NO_2 objective/limit value occurs, the Environment Agency requires a more detailed assessment to be carried out with operators asked to justify the use of percentages lower than 70%.

3.3.29 Following the withdrawal of the Environment Agency's H1 guidance document, there is no longer an explicit recommendation; however, for the purposes of this detailed assessment, a 70% conversion of NO to NO_2 has been assumed for annual average NO_2 concentrations in line with the Environment Agency's historic recommendations.

NO_X to NO_2 Assumptions for Hourly-Mean Calculations

3.3.30 An assumed conversion of 35% follows the Environment Agency's recommendations (EA, undated) for the calculation of 'worse case scenario' short-term NO_2 concentrations.

Modelling of Long-Term and Short-Term Emissions

3.3.31 Long-term (annual-mean) pollutants have been modelled for comparison with the relevant annual mean objectives. The models were run with every engine assumed to run for all hours in the year. The model output was then multiplied by the percentage of the year each engine is expected to run.

3.3.32 For short-term NO_2, the objective is for the hourly-mean concentration not to exceed 200 $\mu g.m^{-3}$ more than 18 times per calendar year. As there are 8,760 hours in a non-leap year, the hourly-mean concentration would need to be below 200 $\mu g.m^{-3}$ in 8,742 hours, i.e. 99.79% of the time.

3.3.33 The model has been run with all generators operating in every hour to test the impacts associated with the widest range of meteorological conditions. Where the 99.79th percentile is exceeded, the cumulative hypergeometric distribution has been used to estimate the likelihood of there being 19 or more hours where the predicted hourly-mean NO_2 concentration exceeds 200 µg.m^{-3} in a calendar year, coinciding with operational hours. In accordance with the Environment Agency *Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators* version 1 (undated), the probability has then been multiplied by a *safety factor* of 2.5*.* For the purposes of this assessment, if the probability is below 1% an exceedance is considered highly unlikely. If it is below 5%, an exceedance is considered unlikely.

3.4 Significance Criteria for Process Impacts on the Local Area

3.4.1 The EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document (EPUK&IAQM, 2017) provides further advice on determining the significance of effects arising from the impacts on air quality. In particular, it advises that:

"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."

3.4.2 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 3.5 provides the EPUK & IAQM approach for describing the long-term air quality impacts at sensitive human-health receptors in the surrounding area.

Table 3.5 : Impact Descriptors for Individual Sensitive Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.
3. The table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

5. When defining the concentration as a percentage of the AQAL, use the ‘without scheme’ concentration where there is a decrease in pollutant concentration and the ‘with scheme;’ concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

3.4.3 The human-health impact descriptors above apply at individual receptors. The EPUK & IAQM guidance states that the impact descriptors *“are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are ‘slight’, ‘moderate’ or ‘substantial’ impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.“*

3.4.4 The above criteria and matrix are for assessing the long-term impacts; for short term impacts the EPUK/IAQM guidance states that:

“The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short term impact. This is a reasonable value to take and this guidance also adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect. Background concentrations are less important in determining the severity of impact for short-term concentrations, not least because the peak concentrations attributable to the source and the background are not additive.”

3.4.5 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

3.4.6 The on-line Environment Agency online guidance entitled *‘Environmental management – guidance, Air emissions risk assessment for your environmental permit’* (Environment Agency, 2020a). This guidance provides details for screening out substances for detailed assessment. In particular, it states that:

“To screen out a PC for any substance so that you don’t need to do any further assessment of it, the PC must meet both of the following criteria:

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don’t need to do any further assessment of the substance.

If you don’t meet them you need to carry out a second stage of screening to determine the impact of the PEC.”

3.4.7 It continues by stating that:

"You must do detailed modelling for any PECs not screened out as insignificant.[1]"

3.4.8 It then states that further action may be required where:

- *"your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributions – if you think this is the case contact the Environment Agency)*
- *The PEC is already exceeding an environmental standard"*

3.5 Uncertainty

3.5.1 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.5.2 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.5.3 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the uncertainty range informed by an analysis of relevant, available data.

3.5.4 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 3.6.

Table 3.6: Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of current baseline air quality conditions	The background concentration for the assessment is based on a comparison of monitored concentrations and Defra mapped concentration estimates.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes to the result being towards the top of the uncertainty range, rather than a central estimate.
	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the proposed development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to	

[1] PCs and PECs are explained in paragraph 3.1.2.

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
		reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	
Fraction from Modelled Sources	Generator emissions	A conservative approach has been adopted for modelling the emissions to air from the generators, as discussed in the sections above. In particular, for emergency usage, the generators are assumed to operate at 100% load.	The modelled fraction is likely to contribute to the result being between a central estimate and the top of the uncertainty range.
	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for five full years of meteorological conditions.	
	Receptors	Impacts at both discrete sensitive receptors and across a grid of receptors have been predicted.	

3.5.5 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the high end of the range of predictions (i.e. towards worst-case) rather than being a central estimate. The actual concentrations that will be found when the site is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

4 BASELINE

4.1 Baseline Methodology

4.1.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the ambient concentration selected for the assessment is realistic. NPPG and EPUK & IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality. LAQM.TG16 recommends that Defra mapped concentration estimates are used to inform background concentrations in air quality modelling and states that: *"Where appropriate these data can be supplemented by and compared with local measurements of background, although care should be exercised to ensure that the monitoring site is representative of background air quality".*

4.1.2 For this assessment, baseline air quality has been characterised by drawing on information from the following public sources:

- Defra maps (Defra, 2018), which show estimated pollutant concentrations across the UK in 1 km grid squares; and
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies.

4.1.3 A detailed description of how the baseline air quality has been derived for the Application Site is summarised in the following paragraphs.

4.2 Baseline Conditions

Review and Assessment Process

4.2.1 The Application Site is located within the administrative area of BFC. BFC has designated AQMAs in Bracknell and Crowthorne. Both AQMAs are designated due to high levels of NO_2 attributable to traffic emissions. The nearest AQMA, the Bracknell AQMA, is approximately 1.4 km to the east of the Application Site.

4.2.2 BFC has prepared action plans to improve air quality within the AQMAs. Both plans focus on reducing emissions from road vehicles.

Local Monitoring

4.2.3 BFC continuously measured pollutant concentrations at the Fox Hill School urban background site using an automatic analyser until the end of 2017. Concentrations in recent years are provided in **Table 4.1**.

Table 4.1 : Automatically Monitored Urban Background Annual-Mean Concentrations

Monitor Code	Monitor Name	Pollutant	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)			
				2014	2015	2016	2017
CM1	Fox Hill School	NO_2	2.5	17.9	16.9	18.9	15.8
		PM_{10}		17.0	16.8	15.1	14.1

4.2.4 BFC manually monitor NO_2 concentrations at an urban background location on Old Bracknell Close using passive diffusion tubes. BFC manually monitors NO_2 concentrations at several other locations, close to the Application Site.

4.2.5 The most recently passively measured annual-mean concentrations are presented in Table 4.2.

Table 4.2 : Passively Monitored Urban Background Annual-Mean NO_2 Concentrations

Monitor Code	Monitor Name	Site Location	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)				
				2014	2015	2016	2017	2018
32xyz	8 Old Bracknell Close	Urban Background	1.8	29.8	25.4	30.1	22.4	21.0
78x	John Nike Way	Roadside	0.4	32.5	27.9	35.2	27.9	22.8
111	3 Laureates Place	Roadside	0.5	-	-	-	23.3	21.0
112	9 Grouse Meadows	Roadside	0.5	-	-	-	25.3	22.0
113	10 Blackbird Place	Roadside	0.7	-	-	-	22.6	20.0
114	1 -10 Crossways St Marks Road	Suburban	0.6	-	-	-	27.1	20.3

All concentrations have been adjusted for bias.

Defra Mapped Concentration Estimates

4.2.6 Defra's total annual-mean NO_2 and PM_{10} concentration estimates have been collected for the 1 km grid square of the monitoring sites and the Proposed Development and are summarised in Table 4.3 and Table 4.4.

Table 4.3 : Defra Mapped Annual-Mean Background NO_2 Concentration Estimates

Monitor Code	Monitor Name	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)	
			Range of Monitored	Estimated Defra Mapped
Application Site	-	-	-	12.9
CM1	Fox Hill School	2.5	15.8 - 18.9	13.9
32xyz	8 Old Bracknell Close	1.8	21.0 - 30.1	15.5
78x	John Nike Way	0.4	22.8 - 35.2	14.1
111	3 Laureates Place	0.5	21.0 - 23.3	14.1
112	9 Grouse Meadows	0.5	22.0 - 25.3	14.4
113	10 Blackbird Place	0.7	20.0 - 22.6	14.4
114	1 -10 Crossways St Marks Road	0.6	20.3 - 27.1	14.1

Table 4.4 : Defra Mapped Annual-Mean Background PM_{10} Concentration Estimates

Monitor Code	Monitor Name	Approximate Distance from the Application Site (km)	Concentration (µg.m^{-3})	
			Range of Monitored	Estimated Defra Mapped
Application Site	-	-	-	15.4
CM1	Fox Hill School	2.5	14.1 – 17.0	15.8

Appropriate Ambient Concentrations for the Development Site

4.2.7 For NO_2, the Defra mapped background concentration estimate is smaller than the range of the results from monitoring at all locations. This indicates that the Defra mapped NO_2 concentration may not be conservative. Annual-mean NO_2 concentration measured at the closest monitor to the site, on John Nike Way, show some inter-annual variability. To ensure the assessment is realistic but conservative, the average of the monitored annual-mean NO_2 concentrations on John Nike Way of 29.3 µg.m^{-3} has been used as the ambient NO_2 concentration in the assessment.

4.2.8 For PM_{10}, the Defra mapped concentration estimate is within the range of the results at Fox Hill School, indicating that the mapped background concentration estimate is appropriate for this pollutant.

4.2.9 In the absence of local monitoring for the remaining pollutants, ambient annual-mean concentrations have been derived from the latest available Defra mapped background concentration estimates.

4.2.10 Historically the view has been that background traffic-related NO_2 concentrations in the UK would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions. After a prolonged period through the last decade where background annual-mean NO_2 concentrations did not generally decrease in line with expectations, the most recent monitoring studies indicate ambient traffic-related NO_2 concentrations are now falling. To ensure that the assessment presents conservative results, no reduction in the background has been applied for future years.

4.2.11 Table 4.5 summarises the annual-mean ambient concentrations for used in this assessment.

Table 4.5: Summary of Ambient Annual-Mean (Long-term) Concentrations used in the Assessment

Pollutant	Data Source	Concentration (µg.m^{-3})
NO_2	Average Monitored at John Nike Way (2014 - 2018)	29.3
PM_{10}	Defra mapped (2018)	15.4
SO_2	Defra mapped (2001)	3.1
CO		422
Benzene*		0.494

*Defra limits its hydrocarbon concentration estimate to those of the hydrocarbon of greatest concern, benzene.

4.2.12 For NO_2, SO_2 and benzene a short-term ambient concentration has been estimated as double the annual-mean concentration.

5 MITIGATION

5.1 Construction

5.1.1 The IAQM dust guidance lists mitigation measures for low, medium and high dust risks. The risk of dust impacts during construction is assessed in Section 6. Without mitigation, the risk is considered to be medium (see para 6.1.11).

5.1.2 The measures below are based on the IAQM general site measures described as 'highly recommended' for medium risks. Measures based on the 'highly recommended' measures for high risk demolition and medium risk construction and trackout are also listed. There are no 'highly recommended' measures for medium risk earthworks.

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information

Dust Management Plan
Measures to control the emissions from dust have been included in the CoCP (document ref 20305B-RPS-XX-XX-RP-P-9738).Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to SBC when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book.

Monitoring

- Carry out dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. Use screening intelligently where possible – e.g. locating site offices between potentially dusty activities and the receptors.
- Erect solid screens or barriers around the construction site boundary.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean.

- Provide enhanced screening for specific operations where there is a high potential for dust production and the site is active for an extended period.
- Remove materials that have a potential to produce dust from the Application Site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Depending on the duration that stockpiles will be present and their size - cover, seed, fence or water to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary – no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible.
- Use enclosed chutes, conveyors and covered skips, where practicable.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

- Bonfires and burning of waste materials will not be permitted.

Medium risk measures specific to trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the Application Site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as practicable.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site).
- Record all inspections of haul routes and any subsequent action in a site log book.

- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Proposed access gates are located at least 10 m from receptors;

High risk measures specific to demolition

- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Appropriate manual or mechanical demolition methods will be used as an alernative to explosive blasting.
- Bag and remove any biological debris or damp down such material before demolition

Medium risk measures specific to construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

5.1.3 The IAQM dust guidance states that with the appropriate dust mitigation measures in place the residual effect will normally be “*not significant*”, and recommends the mitigation is secured by for example planning conditions, a legal obligation, or by legislation.

5.2 Operation

5.2.1 The key mitigation of the operational impacts is determining the optimum height for the generator stacks. The results of the stack height determination are provided in Appendix B.

6 ASSESSMENT OF EFFECTS

6.1 Construction

Construction Dust

6.1.1 The type of activities that could cause fugitive dust emissions are: demolition; earthworks; handling and disposal of spoil; wind-blown particulate material from stockpiles; handling of loose construction materials; and movement of vehicles, both on and off site.

6.1.2 The level and distribution of construction dust emissions will vary according to factors such as the type of dust, duration and location of dust-generating activity, weather conditions and the effectiveness of suppression methods.

6.1.3 The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows and cars. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse effects, although short-term events may occur (for example, due to technical failure or exceptional weather conditions). The following assessment, using the IAQM methodology, predicts the risk of dust impacts and the level of mitigation that is required to control the residual effects to a level that is "not significant".

Risk of Dust Impacts

Source

6.1.4 The total volume of the buildings to be demolished exceeds 50,000 m^2 and the dust emission magnitude for the demolition phase is classified as large.

6.1.5 The site area is more than 10,000 m^2 and the dust emission magnitude for the earthworks phase is classified as large.

6.1.6 The total volume of the buildings to be built exceeds 100,000 m^3 and the dust emission magnitude for the construction phase is classified as large.

6.1.7 The maximum number of outwards movements in any one day is over 50 HDVs and the dust emission magnitude for trackout would be classified as large.

Table 6.1 Dust Emission Magnitude for Demolition, Earthworks, Construction and Trackout

Demolition	Earthworks	Construction	Trackout
Large	Large	Large	Large

Pathway and Receptor - Sensitivity of the Area

6.1.8 All demolition, earthworks and construction activities are assumed to occur within the Application Site boundary. Figure 6.1**Error! Reference source not found.** shows the areas potentially affected by construction dust. The sensitivity of the area has been classified and the results are provided in Table 6.2 below.

Figure 6.1: Construction Dust Impacts

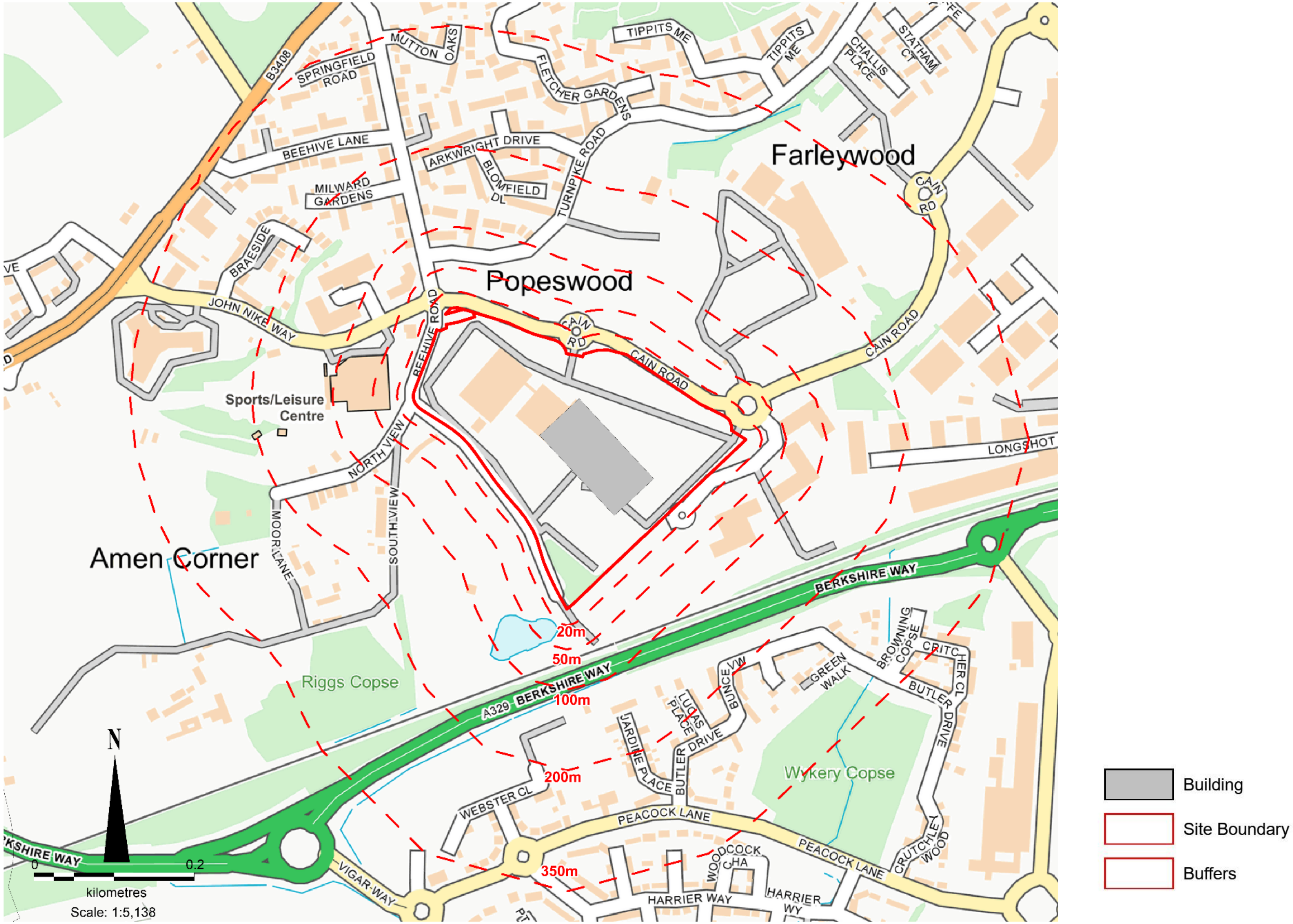


Table 6.2 Sensitivity of the Surrounding Area for Demolition, Earthworks and Construction

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	Low	1 - 10 high sensitivity (residential) receptors within 100 m of the Application Site boundary (Table A.4).
Human Health	Low	1 - 10 high sensitivity (residential) receptors within 100 m of the Application Site boundary and background PM_{10} concentration below 24 µg.m^{-3} (Table A.5).

6.1.9 The Dust Emission Magnitude for trackout is classified as large and trackout may occur on roads up to 500 m from the Application Site. The major route within 500 m is the Cain Road, John Nike Way and B3408. The sensitivity of the area has been classified and the results are provided in Table 6.3.

Table 6.3 Sensitivity of the Surrounding Area for Trackout

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	Medium	1-10 high sensitivity receptors located within 20 m of the roads (Table A.4)
Human Health	Low	1-10 high sensitivity receptors located within 20 m of the roads and PM_{10} concentrations below 24 µg.m^{-3} (Table A.5)

Overall Dust Risk

6.1.10 The Dust Emission Magnitude has been considered in the context of the Sensitivity of the Area (Appendix A - Tables A.4 and A.5) to give the Dust Impact Risk. Table 6.4 summarises the Dust Impact Risk for the four activities.

Table 6.4 Dust Impact Risk for Demolition, Earthworks, Construction and Trackout

Source	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Low	Low	Medium
Human Health	Low	Low	Low	Low
Risk	Low	Low	Low	Medium

6.1.11 Taking the site as a whole, the overall risk is deemed to be medium. The mitigation measures appropriate to a level of risk for the site as a whole and for each of the phases are set out in Section 5.1.

6.1.12 Provided this package of mitigation measures is implemented, the residual construction dust effects will not be significant. The IAQM dust guidance states that "*For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.*" The IAQM dust guidance recommends that significance is only assigned to the effect after the activities are considered with mitigation in place.

6.2 Operation

Results of Stack Emissions Modelling

6.2.1 For the long-term impacts, the highest PCs predicted for scenario 1 and 2 (added together) and the emergency scenario at sensitive receptors and at the point of maximum impact across the grid have been presented. As the operational hours for the emergency scenario (scenario 3) are the highest, the emergency scenario results have been presented for long-term impacts at human-health receptors.

6.2.2 For the short-term impacts, the highest PCs predicted for each of the three scenarios is presented as the generator testing will not occur within the same hour and an emergency will not occur every year.

Long-term Impacts

6.2.3 Table 6.5 summarises the maximum NO_2 PC and PEC values for the modelled scenarios at the selected discrete sensitive receptors. The EPUK/IAQM impact descriptors are also shown.

Table 6.5 Long-term Predicted NO_2 Concentrations at Sensitive Receptors – All Scenarios

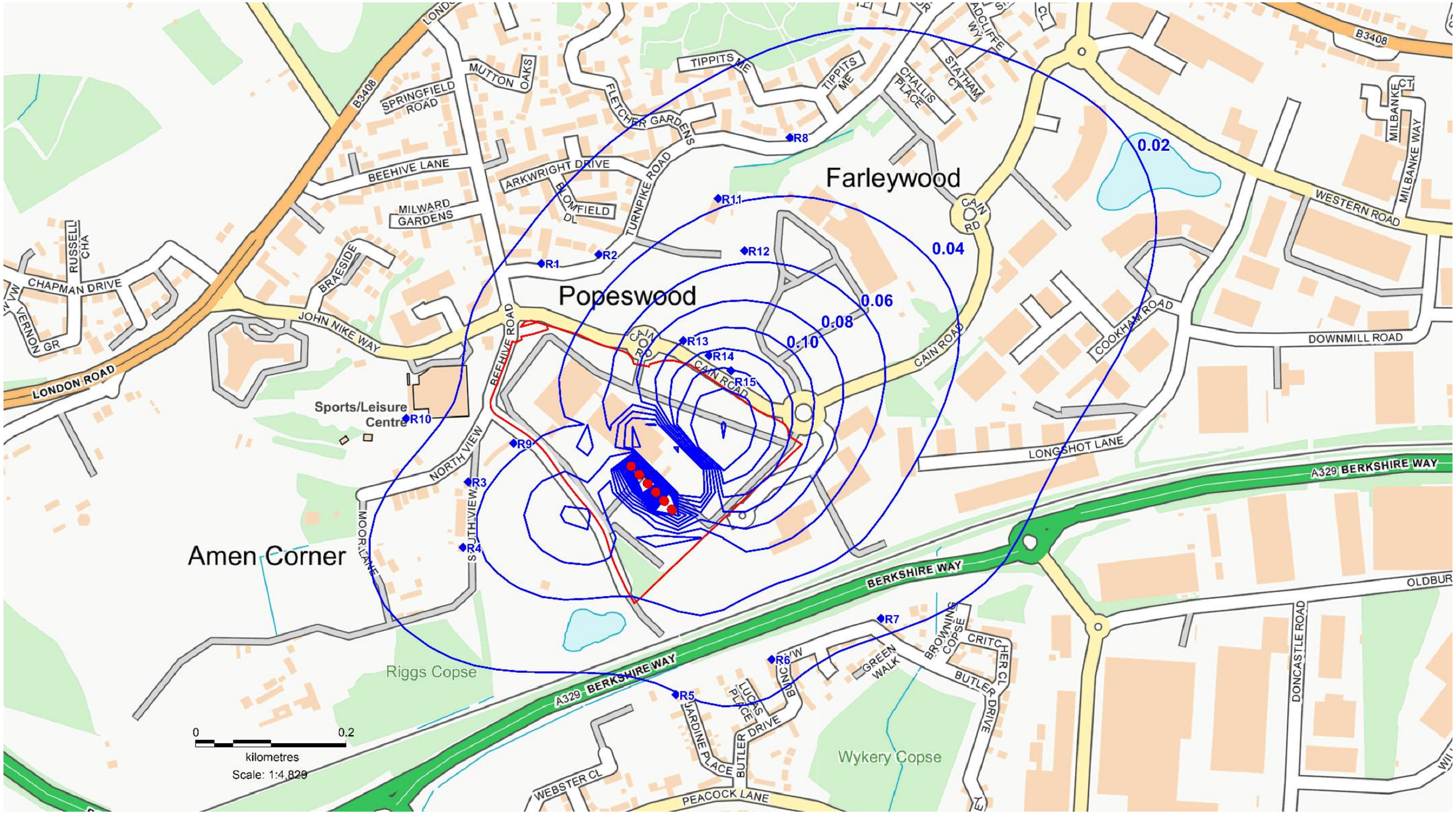
Receptors	Process Contribution (Annual mean) ($\mu g.m^{-3}$)	Process Contribution as % of AQAL	Predicted Environmental Concentration ($\mu g.m^{-3}$)	Impact Descriptor
R1	0.20	1	29.46	Negligible
R2	0.28	1	29.54	Negligible
R3	0.24	1	29.50	Negligible
R4	0.31	1	29.57	Negligible
R5	0.21	1	29.47	Negligible
R6	0.22	1	29.48	Negligible
R7	0.21	1	29.47	Negligible
R8	0.27	1	29.53	Negligible
R9	0.23	1	29.49	Negligible
R10	0.12	0	29.38	Negligible
R11	0.31	1	29.57	Negligible
R12	0.51	1	29.77	Negligible
R13	0.77	2	30.03	Negligible
R14	1.10	3	30.36	Slight
R15	1.32	3	30.58	Slight
Max across grid	2.84	7	32.10	Moderate

AQAL for annual-mean NO_2 is 40 $\mu g.m^{-3}$

6.2.4 The PCs at sensitive receptors for all scenarios do not exceed 1% of the annual-mean limit value of 40 $\mu g.m^{-3}$ except for at R13, R14 and R15. The PC also exceeds 1% of the AQAL at the point of maximum impact across the grid. When the PCs are added to the background concentration, the total PECs are all below 40 μg.m^{-3} at all receptors and across the grid. The impact descriptor at all receptors and across the grid is 'negligible to moderate'.

6.2.5 Figure 6.2 and **Error! Reference source not found.** show the long-term contours for Scenarios 1 and 2 respectively.

Figure 6.2: Annual-mean NO_2 Concentrations – Scenario 1 and 2



Short-term Impacts

6.2.6 As the EPUK & IAQM impact descriptors only apply to long-term concentrations, the Environment Agency criterion of 10% of the short-term AQAL has been used to screen-out impacts as not having a significant effect.

6.2.7 Table 6.6 summarises the maximum PCs for each modelled scenario at the selected discrete sensitive receptors.

Table 6.6 Short-term Predicted NO_2 Concentrations at Sensitive Receptors

Receptors	Scenario 1				Scenario 2				Emergency			
	PC as 99.79 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PEC ($\mu g.m^{-3}$)	Total PEC as % of AQAL	PC as 99.79 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PEC ($\mu g.m^{-3}$)	Total PEC as % of AQAL	PC as 99.79 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PEC ($\mu g.m^{-3}$)	Total PEC as % of AQAL
R1	9.1	5	68	34	24.2	12	83	41	266.5	133	325	163
R2	10.0	5	69	34	26.3	13	85	42	289.4	145	348	174
R3	12.2	6	71	35	32.8	16	91	46	360.4	180	419	209
R4	10.8	5	69	35	30.0	15	89	44	329.8	165	388	194
R5	11.4	6	70	35	31.6	16	90	45	347.9	174	406	203
R6	11.2	6	70	35	29.4	15	88	44	323.6	162	382	191
R7	8.4	4	67	33	22.5	11	81	40	247.3	124	306	153
R8	6.3	3	65	32	15.4	8	74	37	169.9	85	228	114
R9	15.6	8	74	37	40.1	20	99	49	441.0	221	500	250
R10	8.2	4	67	33	22.5	11	81	41	248.0	124	306	153
R11	7.5	4	66	33	20.2	10	79	39	222.4	111	281	140
R12	8.7	4	67	34	23.8	12	82	41	261.4	131	320	160
R13	15.3	8	74	37	40.7	20	99	50	447.4	224	506	253
R14	15.4	8	74	37	40.5	20	99	50	445.8	223	504	252
R15	15.0	7	74	37	39.9	20	98	49	438.5	219	497	249
Max across grid	38.0	19	97	48	70.2	35	129	64	771.7	386	830	415

AQAL for NO_2 hourly-mean percentile is 200 $\mu g.m^{-3}$

6.2.8 The results show that the maximum short-term PC at all receptors for scenario 1 is below 10% of the AQAL. The PCs only exceed 10% of the AQAL at the point of maximum impact across the grid. When the PC is added to twice the background concentration of 29.3 $\mu g.m^{-3}$, the total PEC is well below 200 $\mu g.m^{-3}$.

6.2.9 The results show that the maximum short-term PC at all receptors, except R8 and R11, for scenario 2 is above 10% of the AQAL. The PC also exceeds 10% of the AQAL at the point of maximum impact across the grid. When the PCs are added to twice the background concentration of 29.3 $\mu g.m^{-3}$, the total PEC is well below 200 $\mu g.m^{-3}$. As such, the short-term NO_2 impacts are not considered to be potentially significant for scenarios 1 and 2.

6.2.10 The results show that the maximum short-term PC at all receptors for scenario 3 is above 10% of the AQAL. The model has been run again to determine the hourly concentrations at the worst affected receptor, R13. Analysis of the data indicates that when the PC is added to the background concentration, the maximum number of hourly concentrations above 200 $\mu g.m^{-3}$ is predicted to be 865. The cumulative hypergeometric distribution has been used to estimate the probability of there being 19 or more hours where the predicted hourly-mean NO_2 concentration exceeds 200 $\mu g.m^{-3}$ in a calendar year, coinciding with the 72 hours of operation. The probability is 4.8×10^{-5} %. When this is multiplied by 2.5, the probability is 1.2×10^{-4} %. In other words, well below 1% and extremely unlikely.

6.2.11 Figure 6.3 and Figure 6.4 show the short-term contours for Scenarios 1 and 2 respectively.

Figure 6.3: Hourly Mean NO_2 Process Contribution – Scenario 1

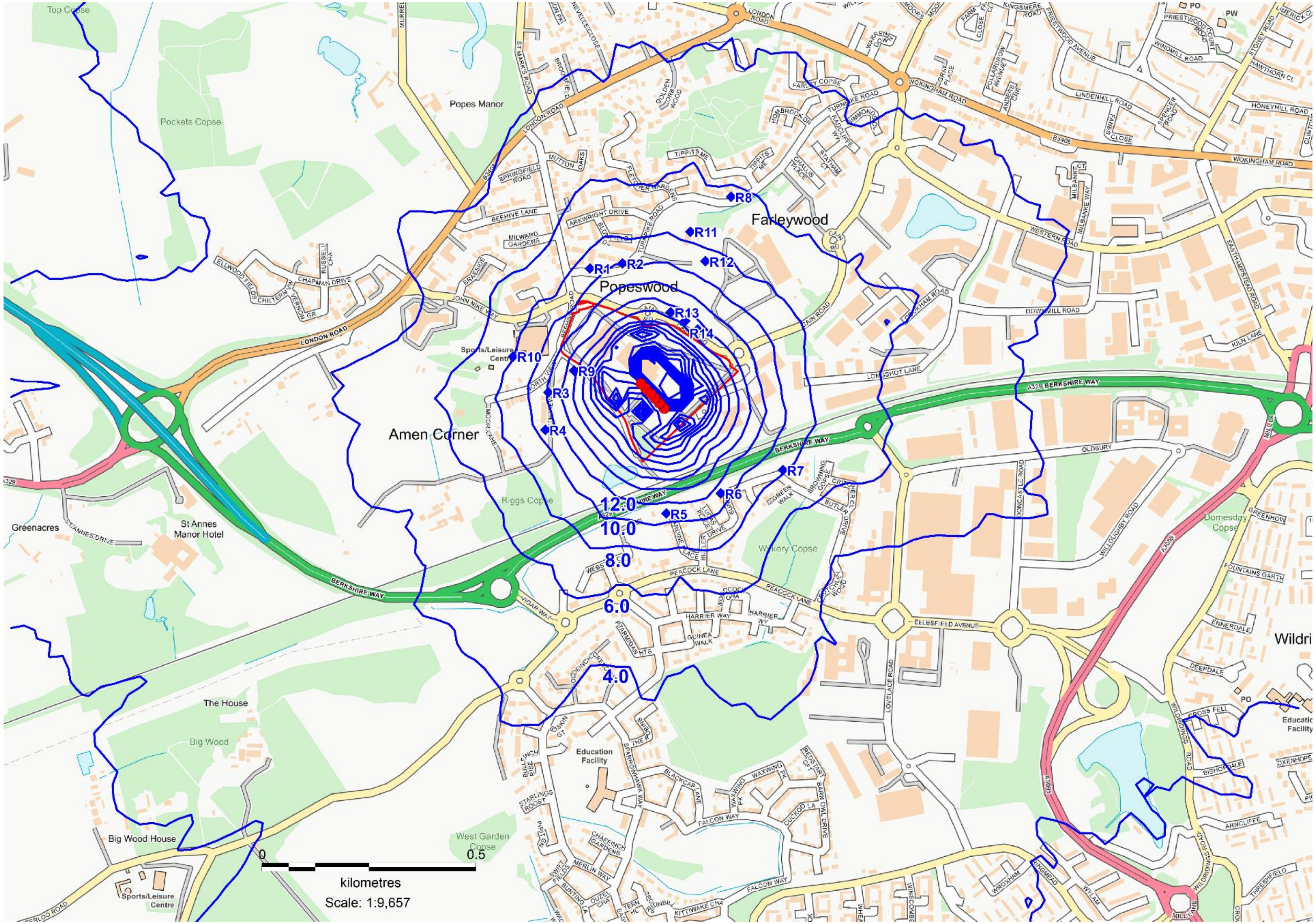
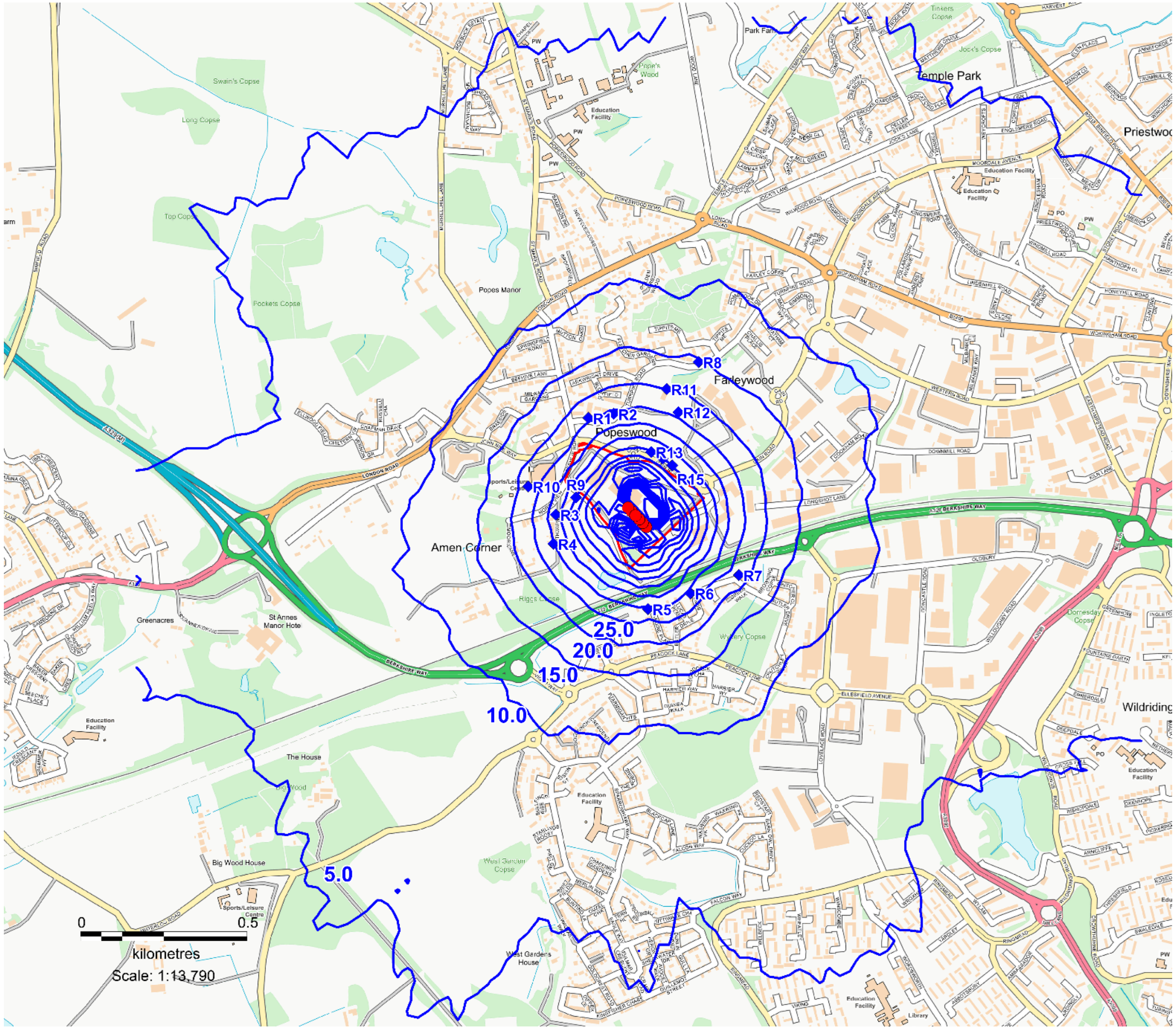


Figure 6.4: Hourly Mean NO_2 Process Contribution – Scenario 2



6.3 Particulate Matter (PM_{10} and $PM_{2.5}$) Impacts

Long-term Impacts

6.3.1 Table 6.7 summarises the maximum PM_{10} PC and PEC values for all modelled scenarios at the selected discrete sensitive receptors. The EPUK & IAQM impact descriptors are also shown.

Table 6.7 Long-term Predicted PM_{10} Concentrations at Sensitive Receptors – All Scenarios

Receptors	Process Contribution (Annual mean) ($\mu g.m^{-3}$)	Process Contribution as % of AQAL	Predicted Environmental Concentration ($\mu g.m^{-3}$)	Impact Descriptor
R1	0.004	0	15.36	Negligible
R2	0.006	0	15.36	Negligible
R3	0.005	0	15.36	Negligible
R4	0.006	0	15.36	Negligible
R5	0.005	0	15.36	Negligible
R6	0.004	0	15.36	Negligible
R7	0.004	0	15.36	Negligible
R8	0.005	0	15.36	Negligible
R9	0.005	0	15.36	Negligible
R10	0.003	0	15.36	Negligible
R11	0.006	0	15.36	Negligible
R12	0.010	0	15.37	Negligible
R13	0.015	0	15.37	Negligible
R14	0.022	0	15.38	Negligible
R15	0.026	0	15.38	Negligible
Max across grid	0.057	0	15.41	Negligible

AQAL for annual-mean PM_{10} is 40 $\mu g.m^{-3}$

6.3.2 The PCs for all scenarios do not exceed 1% of the annual-mean limit value of 40 $\mu g.m^{-3}$. When the PCs are added to the background concentration, the total PECs are all below 40 $\mu g.m^{-3}$. The impact descriptor at all receptors is 'negligible'.

6.3.3 For $PM_{2.5}$, if it conservatively assumed that all PM_{10} is $PM_{2.5}$, then the maximum PC across the grid of 0.057 $\mu g.m^{-3}$ is 0.2% of the annual-mean limit value of 25 $\mu g.m^{-3}$. As this rounds to 0%, the impact descriptor is also 'negligible' at the point of maximum impact.

Short-term Impacts

6.3.4 Table 6.8 summarises the maximum PCs for scenarios 1 and 2 at the selected sensitive receptors. The emergency scenario has not been modelled as the hours of operation (72 hours, i.e. 3 days) are fewer than the number required by the objective (35 days).

Table 6.8 Short-term Predicted PM_{10} Concentrations at Sensitive Receptors

Receptors	Scenario 1		Scenario 2	
	PC as 90.41 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PC as 90.41 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL
R1	0.24	0	0.19	0
R2	0.31	1	0.23	0
R3	0.29	1	0.21	0
R4	0.38	1	0.29	1
R5	0.23	0	0.18	0
R6	0.27	1	0.22	0
R7	0.21	0	0.17	0
R8	0.20	0	0.19	0
R9	0.31	1	0.20	0
R10	0.13	0	0.11	0
R11	0.25	1	0.22	0
R12	0.36	1	0.34	1
R13	0.68	1	0.54	1
R14	0.85	2	0.74	1
R15	0.95	2	0.83	2
Max across grid	2.00	4	1.30	3

AQAL for PM_{10} 24-hour percentile is 50 $\mu g.m^{-3}$

6.3.5 The results show that the maximum short-term PC at all receptors is below 10% of the AQAL. As such, the short-term PM_{10} impacts are not considered to be potentially significant.

6.4 Sulphur Dioxide (SO_2) Impacts

Short-term Impacts

6.4.1 Table 6.9, Table 6.10 and Table 6.11 summarises the maximum PCs for each modelled scenario at the selected discrete sensitive receptors.

Table 6.9 Short-term Predicted SO_2 Concentrations at Sensitive Receptors – 15-minute mean

Receptors	Scenario 1		Scenario 2		Scenario 3 - Emergency	
	PC as 99.9 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PC as 99.9 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL	PC as 99.9 Percentile ($\mu g.m^{-3}$)	PC as % of AQAL
R1	0.04	0	0.07	0	0.81	0
R2	0.04	0	0.08	0	0.86	0

R3	0.05	0	0.10	0	1.06	0
R4	0.04	0	0.09	0	0.97	0
R5	0.05	0	0.09	0	1.03	0
R6	0.05	0	0.09	0	0.98	0
R7	0.04	0	0.07	0	0.74	0
R8	0.03	0	0.05	0	0.56	0
R9	0.06	0	0.12	0	1.27	0
R10	0.04	0	0.07	0	0.75	0
R11	0.03	0	0.06	0	0.68	0
R12	0.04	0	0.07	0	0.79	0
R13	0.06	0	0.11	0	1.25	0
R14	0.06	0	0.11	0	1.24	0
R15	0.06	0	0.11	0	1.21	0
Max across grid	0.16	0	0.19	0	2.14	1

AQAL for SO_2 15-minute-mean percentile is 266 μg.m^{-3}

Table 6.10 Short-term Predicted SO_2 Concentrations at Sensitive Receptors – 1-hour mean

Receptors	Scenario 1		Scenario 2		Scenario 3 - Emergency	
	PC as 99.73 Percentile (μg.m^{-3})	PC as % of AQAL	PC as 99.73 Percentile (μg.m^{-3})	PC as % of AQAL	PC as 99.73 Percentile (μg.m^{-3})	PC as % of AQAL
R1	0.03	0	0.06	0	0.68	0
R2	0.03	0	0.07	0	0.75	0
R3	0.04	0	0.08	0	0.93	0
R4	0.04	0	0.08	0	0.86	0
R5	0.04	0	0.08	0	0.90	0
R6	0.04	0	0.08	0	0.83	0
R7	0.03	0	0.06	0	0.63	0
R8	0.02	0	0.04	0	0.44	0
R9	0.05	0	0.10	0	1.12	0
R10	0.03	0	0.06	0	0.64	0
R11	0.03	0	0.05	0	0.57	0
R12	0.03	0	0.06	0	0.68	0
R13	0.05	0	0.11	0	1.17	0
R14	0.05	0	0.11	0	1.16	0
R15	0.05	0	0.10	0	1.15	0
Max across grid	0.12	0	0.18	0	2.00	1

AQAL for SO_2 1-hour mean percentile is 350 µg.m^{-3}

Table 6.11 Short-term Predicted SO_2 Concentrations at Sensitive Receptors – 24-hour mean

Receptors	Scenario 1		Scenario 2		Scenario 3 - Emergency	
	PC as 99.18 Percentile (µg.m-3)	PC as % of AQAL	PC as 99.18 Percentile (µg.m-3)	PC as % of AQAL	PC as 99.18 Percentile (µg.m-3)	PC as % of AQAL
R1	0.015	0	0.030	0	0.33	0
R2	0.016	0	0.034	0	0.37	0
R3	0.023	0	0.045	0	0.50	0
R4	0.024	0	0.053	0	0.58	0
R5	0.021	0	0.046	0	0.50	0
R6	0.017	0	0.035	0	0.39	0
R7	0.012	0	0.027	0	0.29	0
R8	0.008	0	0.021	0	0.24	0
R9	0.023	0	0.045	0	0.49	0
R10	0.011	0	0.023	0	0.25	0
R11	0.013	0	0.029	0	0.32	0
R12	0.015	0	0.039	0	0.43	0
R13	0.035	0	0.073	0	0.81	1
R14	0.036	0	0.081	0	0.89	1
R15	0.036	0	0.080	0	0.88	1
Max across grid	0.070	0	0.123	0	1.35	1

AQAL for SO_2 24-hour mean percentile is 125 µg.m^{-3}

6.4.2 The results show that the maximum short-term PC at all receptors is below 10% of the AQAL. As such, the short-term SO_2 impacts are not considered to be potentially significant.

6.5 Carbon Monoxide (CO) Impacts

Short-term Impacts

6.5.1 Table 6.12 summarises the maximum running 8-hour PCs for all modelled scenarios at the selected sensitive receptors.

Table 6.12 Short-term Predicted CO Concentrations at Sensitive Receptors – All Scenarios

Receptors	Scenario 1		Scenario 2		Emergency	
	Process Contribution (8hr running mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (8hr running mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (8hr running mean) (µg.m^{-3})	Process Contribution as % of AQAL
R1	6.48	0	11.31	0	124.38	1
R2	5.96	0	11.39	0	125.27	1
R3	7.89	0	14.45	0	158.90	2
R4	7.24	0	13.15	0	144.68	1
R5	7.13	0	13.98	0	153.80	2
R6	6.80	0	12.08	0	132.93	1
R7	5.87	0	9.97	0	109.68	1
R8	4.01	0	6.70	0	73.65	1
R9	10.15	0	15.45	0	169.92	2
R10	5.73	0	8.86	0	97.48	1
R11	5.66	0	8.33	0	91.64	1
R12	5.92	0	10.40	0	114.43	1
R13	9.51	0	17.87	0	196.54	2
R14	9.99	0	17.09	0	187.94	2
R15	9.92	0	16.97	0	186.63	2
Max across grid	29.95	0	29.63	0	325.89	3

AQAL for CO as an 8-hour running mean is 10,000 µg.m^{-3}

6.5.2 The PCs for all scenarios do not exceed 10% of the 8-hr running mean limit value of 10,000 µg.m^{-3}. As such the short-term CO impacts are not considered to be potentially significant.

6.5.3 Table 6.13 summarises the maximum hourly-mean PCs for all modelled scenarios at the selected sensitive receptors.

Table 6.13 Short-term Predicted CO Concentrations at Sensitive Receptors – All Scenarios

Receptors	Scenario 1		Scenario 2		Emergency	
	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL
R1	11.16	0	11.75	0	129.20	0
R2	10.98	0	13.17	0	144.90	0
R3	8.47	0	15.66	0	172.27	1

Receptors	Scenario 1		Scenario 2		Emergency	
	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL
R4	7.78	0	13.87	0	152.54	1
R5	10.58	0	15.01	0	165.16	1
R6	12.06	0	14.81	0	162.90	1
R7	10.70	0	11.25	0	123.73	0
R8	58.88	0	8.28	0	91.10	0
R9	44.15	0	19.59	0	215.47	1
R10	6.19	0	11.15	0	122.70	0
R11	5.52	0	9.57	0	105.27	0
R12	6.82	0	11.44	0	125.86	0
R13	10.85	0	19.13	0	210.42	1
R14	11.15	0	18.87	0	207.58	1
R15	10.63	0	18.59	0	204.53	1
Max across grid	59.89	0	60.83	0	669.17	2

AQAL for CO as a maximum 1-hour mean is 30,000 µg.m^{-3}

6.5.4 The PCs for all scenarios do not exceed 10% of the maximum hourly-mean limit value of 30,000 µg.m^{-3}. As such the short-term CO impacts are not considered to be potentially significant.

6.6 Hydrocarbon Impacts (Expressed as Benzene)

Long-term Impacts

6.6.1 Table 6.14 summarises the maximum PCs for all modelled scenarios at the selected sensitive receptors taking the extremely conservative approach that all the hydrocarbon emissions are benzene. The EPUK/IAQM impact descriptors are also shown.

Table 6.14 Long-term Predicted Benzene Concentrations at Sensitive Receptors – All Scenarios

Receptors	Process Contribution (Annual mean) (µg.m^{-3})	Process Contribution as % of AQAL	Predicted Environmental Concentration (µg.m^{-3})	Impact Descriptor
R1	0.006	0	0.50	Negligible
R2	0.008	0	0.50	Negligible
R3	0.007	0	0.50	Negligible
R4	0.009	0	0.50	Negligible

R5	0.006	0	0.50	Negligible
R6	0.006	0	0.50	Negligible
R7	0.006	0	0.50	Negligible
R8	0.008	0	0.50	Negligible
R9	0.007	0	0.50	Negligible
R10	0.003	0	0.50	Negligible
R11	0.009	0	0.50	Negligible
R12	0.014	0	0.51	Negligible
R13	0.022	0	0.52	Negligible
R14	0.031	1	0.53	Negligible
R15	0.037	1	0.53	Negligible
Max across grid	0.080	2	0.57	Negligible

AQAL for annual-mean for benzene is 5 µg.m^{-3}

6.6.2 The results show that the maximum long-term PC at all receptors for all scenarios is below 1% of the AQAL. The PCs only exceed 1% of the AQAL at the point of maximum impact across the grid. When the PC is added to the background concentration of 0.494 µg.m^{-3}, the total PEC is well below 5 µg.m^{-3}. The impact descriptor at all receptors is 'negligible'.

Short-term Impacts

6.6.3 Table 6.15 summarises the maximum PCs for all modelled scenarios at the selected sensitive receptors.

Table 6.15 Short-term Predicted Benzene Concentrations at Sensitive Receptors – All Scenarios

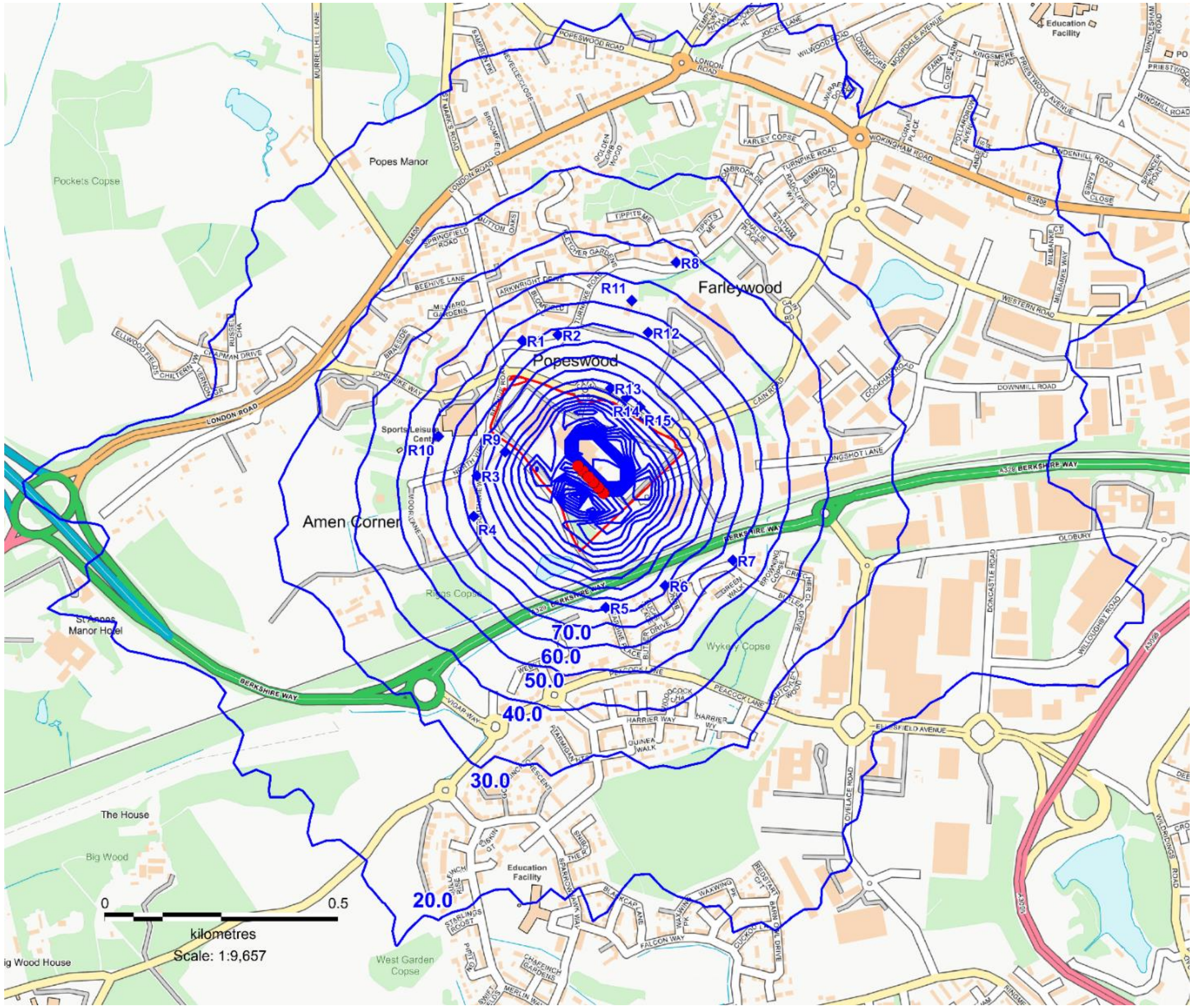
Receptors	Scenario 1		Scenario 2		Emergency	
	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) (µg.m^{-3})	Process Contribution as % of AQAL
R1	2.98	2	1.49	1	16.44	8
R2	3.37	2	1.68	1	18.43	9
R3	4.08	2	1.99	1	21.92	11
R4	3.50	2	1.76	1	19.41	10
R5	3.83	2	1.91	1	21.01	11
R6	3.87	2	1.88	1	20.72	11
R7	3.31	2	1.43	1	15.74	8
R8	2.27	1	1.05	1	11.59	6
R9	5.02	3	2.49	1	27.41	14
R10	2.82	1	1.42	1	15.61	8
R11	2.56	1	1.22	1	13.39	7

Receptors	Scenario 1		Scenario 2		Emergency	
	Process Contribution (Maximum hourly-mean) ($\mu g.m^{-3}$)	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) ($\mu g.m^{-3}$)	Process Contribution as % of AQAL	Process Contribution (Maximum hourly-mean) ($\mu g.m^{-3}$)	Process Contribution as % of AQAL
R12	3.21	2	1.46	1	16.01	8
R13	4.89	3	2.43	1	26.77	14
R14	5.43	3	2.40	1	26.41	14
R15	4.79	2	2.37	1	26.02	13
Max across grid	26.97	14	7.74	4	85.13	44

AQAL for hourly-mean for benzene is 195 $\mu g.m^{-3}$

6.6.4 The PCs only exceed 10% of the maximum hourly mean of 195 $\mu g.m^{-3}$ at receptors R3, R4, R5, R6, R13, R14 and R15 in the emergency scenario and at the point of maximum impact across the grid in scenario 1 and in the emergency scenario. When the PCs are added to twice the existing concentration of 0.494 $\mu g.m^{-3}$, all PECs are well below 195 $\mu g.m^{-3}$. As such the short-term benzene impacts are not considered to be potentially significant.

Figure 6.5: Hourly Mean Benzene Process Contribution – Scenario 3



6.7 Significance of Effects

6.7.1 It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

6.7.2 The impacts predicted at individual receptors and the geographical extent over which such impacts occur, can be used to inform the judgement on the impact on the surrounding area as a whole, and whether the resulting overall effect is significant or not. The IAQM guidance states, *"Whilst it may be that there are 'slight', 'moderate', or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."* and *"…a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health."*

6.7.3 Using professional judgement, the resulting air quality effect is considered to be 'not significant' overall.

6.8 Sensitivity and Uncertainty

6.8.1 Section 3 provided an analysis of the sources of uncertainty in the results of the assessment. The conclusion of that analysis was that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

6.8.2 The impacts at existing receptors are shown to be not significant even for this conservative scenario. Consequently, further sensitivity analysis has not been undertaken and, in practice, the impacts at sensitive receptors are likely to be lower than those reported in this conservative assessment.

6.9 Cumulative

6.9.1 There are a number of developments in the vicinity of the site:

- 18/00217/OUT Land At Former Golf Driving Range South View Binfield Bracknell Berkshire - Outline application for erection of one-form entry primary school and associated playing fields with access from Beehive Road. Decision pending.
- 18/00200/PAC Technology House The Boulevard Cain Road Bracknell Berkshire RG12 1WP - Application for Prior Approval for the change of use from Office (B1) use to Residential (C3), forming 81 no. units.
- 17/01319/FUL Technology House The Boulevard Cain Road Bracknell Berkshire RG12 1WP - Creation of 12 apartments in the roof space of the building with the inclusion of dormer windows in the existing roof structure together with associated infrastructure and works.
- 17/00222/PAC Building 2 Technology House The Boulevard Cain Road Bracknell Berkshire RG12 1WP - Application for Prior Approval for the change of use of 1st, 2nd and 3rd floor from Office (B1) use to Residential (C3) to form 60 no. flats. (Re-submission of 16/01062/PAC and 17/00041/PAC).

- 19/01118/FUL Land Adjoining Coppid Beech House, South Of London Road Binfield Bracknell Berkshire - Erection of 54 dwellings with associated open space, landscaping, amenity space, car and cycle parking, access and other associated works.
- 19/01046/FUL Land At Buckhurst Moors Moor Lane Binfield Bracknell Berkshire - Phased redevelopment of site, following demolition of existing buildings, for commercial development comprising 8 units totalling 5,294sqm GEA floor space within four buildings for B1c (light industrial), B2 (general industrial), and B8 (storage and distribution) purposes, together with associated car parking, landscaping and works to Moor Lane. Decision pending.
- 18/00242/OUT Land At Amen Corner South London Road Binfield Bracknell Berkshire - Hybrid planning application for a residential-led mixed-use development comprising: outline planning application for commercial development (Use Classes A2 (financial and professional services)/B1 (business)/B8 (storage or distribution)) on 0.95ha (all matters reserved); and full planning application for 422 residential dwellings, public open space, replacement car park and spine road. Decision pending.
- 19/01004/OUT 3M United Kingdom Cain Road Bracknell Berkshire RG12 8HT - Outline application for erection of up to 27 dwellings, with principal access from Turnpike Road, and associated vehicle parking, landscaping and ancillary works following demolition of existing buildings and clearance of the site. [All matters reserved apart from Access]. Decision pending.
- 20/00947/FUL Land North of Cain Road - Erection of 70 bed care home (Class C2) with garden, parking and dedicated access off Turnpike Road and erection of 55 dwellings (7no. one bedroom, 13no. two bedroom, 28no. three bedroom and 7no. 4 bedroom) with associated parking, landscaping and access off Cain Road. Decision pending
- Policy SA6 Site Allocations Local Plan Policy SA6: Land at Amen Corner (North) - Land at Amen Corner North is allocated for a comprehensive well designed development that maintains a gap between Binfield, Wokingham and Bracknell, including the following: 400 residential units (including affordable housing). On-site open space and Suitable Alternative Natural Greenspace (SANG). Maintenance of a gap between Binfield, Wokingham and Bracknell (comprising on-site open space and/or SANG).
- Policy SA8 Site Allocations Local Plan Policy SA8 - Land at Amen Corner South, Binfield is allocated for a comprehensive well designed mixed-use development that maintains a gap between Wokingham and Bracknell, including the following: 725 residential units (including affordable housing). Employment. Neighbourhood Centre. Primary School. On-site open space and Suitable Alternative Natural Greenspace (SANG).

Construction

6.9.2 The risk of dust impacts is best mitigated at source. Assuming that all developments implement dust mitigation and controls proportionate to the level of risk, there should be no residual cumulative air quality effect.

Operation

6.9.3 A time extension (to December 2020) has been sought for the 18/00217/OUT Land At Former Golf Driving Range South View Binfield Bracknell Berkshire application. At present, the documents accompanying the planning application do not include an air quality assessment.

6.9.4 There is no evidence that air quality was considered to be a material issue in determining the 18/00200/PAC Technology House, The Boulevard Cain Road Bracknell Berkshire RG12 1WP application.

6.9.5 The 17/01319/FUL Technology House, The Boulevard Cain Road Bracknell Berkshire RG12 1WP application comprises the development of 12 apartments. This is highly unlikely to affect traffic flows on the local road network.

6.9.6 There is no evidence that air quality was considered to be a material issue in determining the 17/00222/PAC Building 2 Technology House The Boulevard Cain Road Bracknell Berkshire RG12 1WP - Application for Prior Approval.

6.9.7 There is no evidence that air quality was considered to be a material issue in determining the 19/01118/FUL Land Adjoining Coppid Beech House, South Of London Road Binfield Bracknell Berkshire - Erection of 54 dwellings application.

6.9.8 The Transport Assessment submitted for the 19/01046/FUL Land At Buckhurst Moors Moor Lane Binfield Bracknell Berkshire application states that a substantial reduction in vehicular activity is expected. The development is therefore likely to be beneficial in the context of air quality. The ambient concentrations of traffic-related pollutants adopted in the assessment of the data centre are likely to be conservative.

6.9.9 The 18/00242/OUT Land At Amen Corner South London Road Binfield Bracknell Berkshire - Hybrid planning application for a residential-led mixed-use development comprising: outline planning application for commercial development (Use Classes A2 (financial and professional services)/B1 (business)/B8 (storage or distribution)) on 0.95ha (all matters reserved); and full planning application for 422 residential dwellings is pending consideration. The documents state that an air quality assessment will be undertaken once traffic data is available; however, there is no evidence that an assessment (other than an assessment of baseline air quality conditions) has been undertaken.

6.9.10 There is no evidence that air quality was considered a material issue in determining the 19/01004/OUT 3M United Kingdom Cain Road Bracknell Berkshire RG12 8HT - Outline application for erection of up to 27 dwellings. There is no evidence that an assessment has been undertaken.

6.9.11 610511 Hewlett Packard Cain Road Binfield Bracknell Berkshire RG12 1HN - Outline Application. There is no evidence that an assessment has been undertaken.

6.9.12 10/00310/REM Hewlett Packard Cain Road Bracknell Berkshire RG12 1HN - Submission of details of scale, appearance and landscaping for the erection of a 2-storey office building. There is no evidence that an assessment has been undertaken.

6.9.13 The 20/00947/FUL Land North of Cain Road, Bracknell Air Quality Assessment shows that the maximum increase in NO_2 concentrations at selected sensitive receptors due to traffic-related emissions is 0.17 $\mu g.m^{-3}$. If this is added to the maximum predicted PEC of 32.1 $\mu g.m^{-3}$ in Table 6.5, the impact would still be considered ‘slight adverse’ at the worst affected receptors. This would not alter the conclusion that the resulting air quality effect is considered to be ‘not significant’ overall.

6.9.14 For the Site Allocations (Policy SA6 and SA8), Figure 6.2 shows that the NO_2 PC from the Bracknell Data Centre for the Scenario 1 and 2 is below 0.16 $\mu g.m^{-3}$ outside the site boundary. As such, the NO_2 PC rounds to 0% of the annual-mean NO_2 objective at all locations outside the site boundary. Table 6.7 shows that for all scenarios the Bracknell Data Centre PM_{10} PC is 0% of the annual-mean PM_{10} objective at the site allocations. The EPUK/IAQM guidance indicates that when the PC is 0% the impact descriptor is ‘negligible’ regardless of the absolute air quality concentration. On that basis, the cumulative effects are considered to be not significant.

6.9.15 The suitability of all sites is already accounted for in the assessment by the modelling of a grid of receptors surrounding the site.

7 SUMMARY

7.1.1 This air quality assessment has been undertaken to support the planning application for the proposed data centre on land at Cain Road, Bracknell.

7.1.2 Impacts during construction, such as dust generation and plant vehicle emissions, are predicted to be of short duration and only relevant during the construction phase. The results of the risk assessment of construction dust impacts undertaken using the IAQM dust guidance, indicates that before the implementation of mitigation and controls, the risk of dust impacts will be medium. Implementation of the highly-recommended mitigation measures described in the IAQM construction dust guidance should reduce the residual dust effects to a level categorised as "*not significant*".

7.1.3 Once operational, the key sources of emissions to air are the 11 diesel-powered generators. Concentrations of NO_2, PM_{10}, SO_2, CO and benzene have been predicted at selected sensitive receptors using a detailed atmospheric dispersion model and compared with the relevant long and short-term AQS objectives.

7.1.4 The long-term operational impacts for all pollutants are predicted to be 'negligible', considering the changes in pollutant concentrations and absolute levels.

7.1.5 The short-term operational impacts for all pollutants have been screened-out as being insignificant at all receptors.

7.1.6 Using professional judgement, the resulting air quality effect is considered 'not significant'.

APPENDICES

Appendix A

Detailed Construction Dust Assessment Methodology

Source

The IAQM dust guidance gives examples of the dust emission magnitudes for demolition, earthworks and construction activities and trackout. These example dust emission magnitudes are based on the site area, building volume, number of HDV movements generated by the activities and the materials used. These example magnitudes have been combined with details of the period of construction activities to provide the ranking for the source magnitude that is set out in Table A.1.

Table A.1 Risk Allocation – Source (Dust Emission Magnitude)

Features of the Source of Dust Emissions	Dust Emission Magnitude
Demolition - building over 50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities > 20 m above ground level. **Earthworks** – total site area over 10,000 m^2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved > 100,000 tonnes. **Construction** - total building volume over 100,000 m^3, activities include piling, on-site concrete batching, sand blasting. Period of activities more than two years. **Trackout** – 50 HDV outwards movements in any one day, potentially dusty surface material (e.g. High clay content), unpaved road length > 100 m.	Large
Demolition - building between 20,000 to 50,000 m^3, potentially dusty construction material and demolition activities 10 - 20 m above ground level. **Earthworks** – total site area between 2,500 to 10,000 m^2, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 - 8 m in height, total material moved 20,000 to 100,000 tonnes. **Construction** - total building volume between 25,000 and 100,000 m^3, use of construction materials with high potential for dust release (e.g. concrete), activities include piling, on-site concrete batching. Period of construction activities between one and two years. **Trackout** – 10 - 50 HDV outwards movements in any one day, moderately dusty surface material (e.g. High clay content), unpaved road length 50 – 100 m.	Medium
Demolition - building less than 20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities < 10 m above ground, demolition during winter months. **Earthworks** – total site area less than 2,500 m^2. Soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 10,000 tonnes earthworks during winter months. **Construction** - total building volume below 25,000 m^3, use of construction materials with low potential for dust release (e.g. metal cladding or timber). Period of construction activities less than one year. **Trackout** – < 10 HDV outwards movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.	Small

Pathway and Receptor - Sensitivity of the Area

Pathway means the route by which dust and particulate matter may be carried from the source to a receptor. The main factor affecting the pathway effectiveness is the distance from the receptor to the source. The orientation of the receptors to the source compared to the prevailing wind direction is a relevant risk factor for long-duration construction projects; however, short-term construction projects may be limited to a few months when the most frequent wind direction might be quite different, so adverse effects can potentially occur in any direction from the site.

As set out in the IAQM dust guidance, a number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

Table A.2 Table A.3 and Table A.4 sets out the IAQM basis for categorising the sensitivity of people and property to dust and PM_{10} respectively.

Table A.2 Sensitivities of People and Property Receptors to Dust

Receptor	Sensitivity
Principles:- Users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. Indicative Examples:- Dwellings. Museums and other culturally important collections. Medium and long-term car parks and car showrooms.	High
Principles:- Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative Examples:- Parks. Places of work.	Medium
Principles:- the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative Examples:- Playing fields, farmland (unless commercially-sensitive horticultural). Footpaths and roads. Short-term car parks.	Low

Table A.3 Sensitivities of People and Property Receptors to PM_{10}

Receptor	Sensitivity
Principles:- Locations where members of the public are exposed over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- • Residential properties. • Schools, hospitals and residential care homes.	High
Principles:- Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- • Office and shop workers (but generally excludes workers occupationally exposed to PM_{10} as protection is covered by Health and Safety at Work legislation).	Medium

Receptor	Sensitivity
Principles:- Locations where human exposure is transient exposure. Indicative Examples:- Public footpaths. Playing fields, parks. Shopping streets.	Low

Table A.4 Sensitivities of Ecological Receptors to Dust

Receptor	Sensitivity
Principles:- • Locations with an international or national designation and the designated features may be affected by dust soiling; or • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. Indicative Examples:- • Special Area of Conservation (SAC) designated for acid heathlands adjacent to the demolition of a large site containing concrete (alkali) buildings or for the presence of lichen.	High
Principles:- • Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • locations with a national designation where the features may be affected by dust deposition. Indicative Examples:- • Site of Special Scientific Interest (SSSI) with dust sensitive features.	Medium
Principles:- • Locations with a local designation where the features may be affected by dust deposition. Indicative Examples:- • A Local Nature Reserve with dust sensitive features	Low

The IAQM methodology combines consideration of the pathway and receptor to derive the 'sensitivity of the area'. Table A.5, Table A.6, Table A.7 show how the sensitivity of the area has been derived for this assessment.

Table A.5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors [a]	Distance from the Source (m) [b]			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low

Receptor Sensitivity	Number of Receptors [a]	Distance from the Source (m) [b]			
		<20	<50	<100	<350
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

b For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table A.6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d]				
			<20	<50	<100	<200	<350
High	> 32 µg.m^{-3}	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 µg.m^{-3}	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 - 28 µg.m^{-3}	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	< 24 µg.m^{-3}	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	> 32 µg.m^{-3}	>10	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	28 – 32 µg.m^{-3}	> 10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	< 28 µg.m^{-3}	>1	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a This refers to the background concentration derived from the assessment of baseline conditions later in this report. The concentration categories listed in this column apply to England, Wales and Northern Ireland but not to Scotland.

b The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d]				
			<20	<50	<100	<200	<350

c For high sensitivity receptors with high occupancy (such as schools or hospitals), the approximate number of occupants has been used to derive an equivalent number of receptors.

d For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table A.7 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m) [a]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout and for each designated site.

a Only the highest level of area sensitivity has been recorded.

The IAQM dust guidance lists the following additional factors that can potentially affect the sensitivity of the area and, where necessary, professional judgement has been used to adjust the sensitivity allocated to a particular area:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which are considered go beyond the classifications given in the table above.

The matrices in Table A.8, Table A.9, Table A.10 and Table A.11 have been used to assign the risk for each activity to determine the level of mitigation that should be applied. For those cases where the risk category is 'negligible', no mitigation measures are required beyond those mandated by legislation.

Table A.8 Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Low	Medium Risk	Low Risk	Negligible

Table A.9 Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A.10 Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A.11 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix B

Stack Height Determination

A stack height determination has been undertaken to establish the height at which there is minimal additional environmental benefit associated with the cost of further increasing the generator stacks. The Environment Agency removed their detailed guidance, Horizontal Guidance Note EPR H1 (EA, 2010), for undertaking risk assessments on 1 February 2016; however, the approach used here by RPS is consistent with that EA guidance which required the identification of *“an option that gives acceptable environmental performance but balances costs and benefits of implementing it.”*

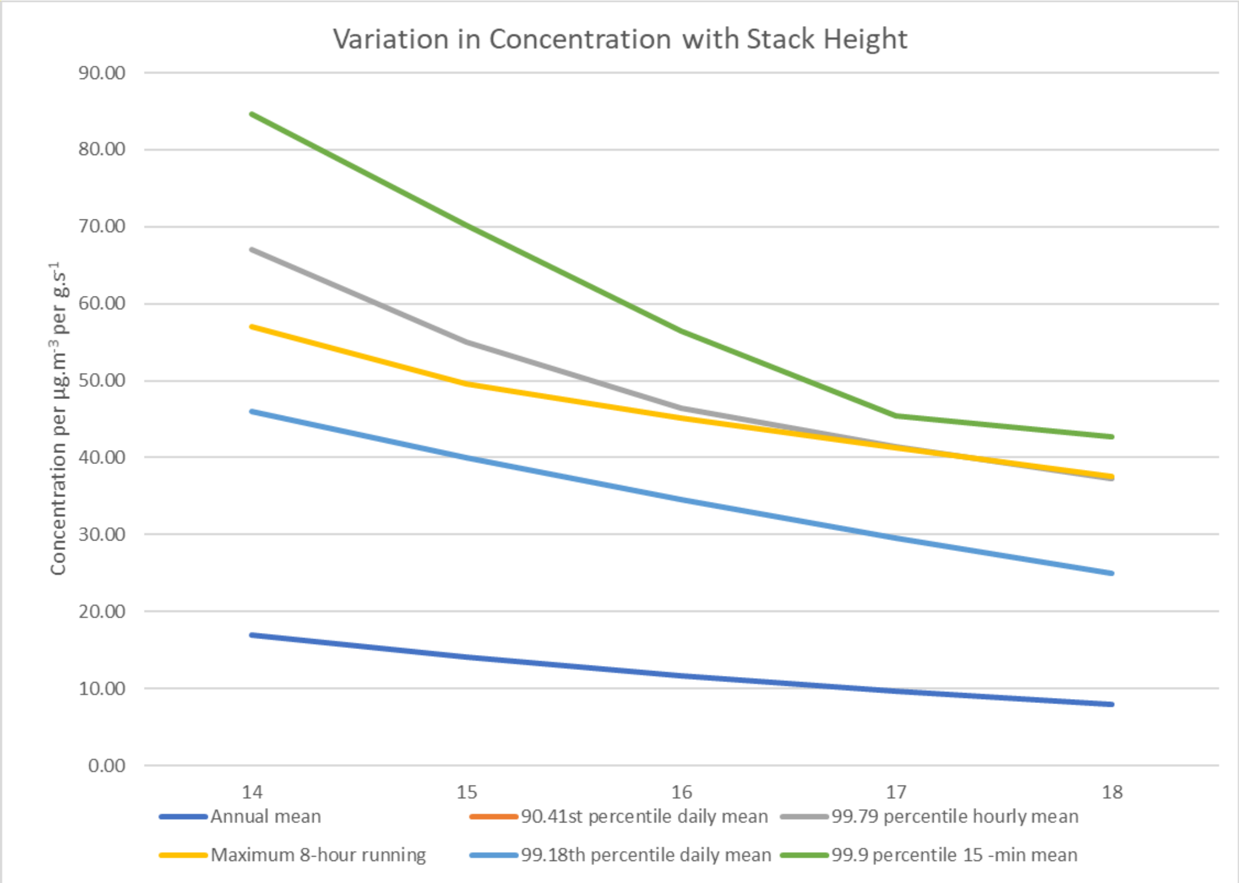
The emissions data used in the stack height determination are summarised in Section 3 of the report. Simulations have been run using ADMS 5 to determine what stack height is required to provide adequate dispersion/dilution and to overcome local building wake effects.

The stack height determination considers ground level concentrations over the averaging periods relevant to the air quality assessment, together with the full range of all likely meteorological conditions using three years of hourly sequential meteorological data from Farnborough. As only one generator will be operated at a time during testing, the model was run for a single stack. The modelling included a range of stack heights between 14 m to 18 m at 1 m intervals.

The dispersion modelling for the purposes of stack height determination assumed a domain of 3 km by 3 km centred on the proposed development and with a grid spacing of 100 m.

The maximum predicted contributions have been plotted against height to determine if there is a height at which no benefit is gained from increases in stack heights in Graph B.1 below.

Graph B.1 Variation in Concentration (as µg.m^{-3} per g.s^{-1}) with Stack Height (m)



The graph does not indicate that there would be any appreciable improvement in an increase in the stack height above the 15 m modelled.

Appendix C

Stack Coordinates

Table C.1 Stack Coordinates

Stack	x	Y
1	484808.3	168956.6
2	484807.5	168957.5
3	484797.8	168968.4
4	484796.9	168969.2
5	484786.9	168980.0
6	484786.2	168980.6
7	484765.0	169003.0
8	484764.2	169003.8
9	484753.6	169014.8
10	484775.2	168992.2
11	484775.9	168991.4

Appendix D

Ecological Impacts

Scope

The Environment Agency guidance on 'Screening for protected conservations areas' (EA, 2020b) requires identification of:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites (protected wetlands) within 10 km of the proposed development; and
- Sites of Special Scientific Interest (SSSIs) and Local Nature sites (ancient woods, local wildlife sites (LWSs) and national and local nature reserves) within 2 km of the proposed development.

The relevant sites have been identified by the project's ecologists and are listed in Table D.1.

Critical Levels

Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. Annual-mean PCs and PECs of NO_x have been calculated for comparison with the 30 $\mu g.m^{-3}$ critical level. The maximum daily-mean PCs and PECs of NO_x have been calculated for comparison with the 75 $\mu g.m^{-3}$ critical level. Annual-mean PCs and PECs of SO_2 have been calculated for comparison with the 20 $\mu g.m^{-3}$ critical level. Where relevant, background concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database (APIS, 2020).

Critical Loads

Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.

Critical Loads – Nutrient Nitrogen Deposition

Percentage contributions to nutrient nitrogen deposition have been derived from the results of the ADMS dispersion modelling. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows:

- The dry deposition flux ($\mu g.m^{-2}.s^{-1}$) has been calculated by multiplying the ground level NO_2 concentrations ($\mu g.m^{-3}$) by the deposition velocity. The Environment Agency guidance provides deposition velocities of 0.0015 $m.s^{-1}$ for short habitats and 0.003 $m.s^{-1}$ for tall habitats.
- Units of $\mu g.m^{-2}.s^{-1}$ have been converted to units of $kg.ha^{-1}.year^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_X.
- Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads – Acidification

The dry deposition flux ($\mu g.m^{-2}.s^{-1}$) has been calculated by multiplying the ground level SO_2 concentrations ($\mu g.m^{-3}$) by the deposition velocity. The Environment Agency guidance provides deposition velocities of 0.012 $m.s^{-1}$ for short habitats and 0.024 $m.s^{-1}$ for tall habitats. Units of $\mu g.m^{-2}.s^{-1}$ have been converted to units of $kg.ha^{-1}.year^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 157.7 for SO_2.

The acid deposition rate, in equivalents $keq.ha^{-1}.year^{-1}$, has been calculated by multiplying the dry deposition flux ($kg.ha^{-1}.year^{-1}$) by a conversion factor of 0.071428 for N and 0.0625 for S. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

Wet deposition in the near field is not significant compared with dry deposition for N (CEH, 2011) and therefore for the purposes of this assessment, wet deposition has not been considered.

Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with the designated site as derived from the APIS database.

Significance Criteria

The PC and PEC of NO_x and N/acid deposition have been compared against the relevant critical level/load, for the relevant habitat type/interest feature.

For SACs, SPAs, Ramsars and SSSIs, the Environment Agency guidelines (EA, 2020b) state that:

> *"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:*
>
> *the short-term PC is less than 10% of the short-term environmental standard*
>
> *the long-term PC is less than 1% of the long-term environmental standard*
>
> *If you meet both of these criteria you don't need to do any further assessment of the substance.*
>
> *If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."*

It continues by stating that:

> *"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further. If your PEC is greater than 70% of the long-term environmental standard, you need to do detailed modelling."*

For LWSs, it states:

> *If your emissions meet both of the following criteria they're insignificant – you don't need to assess them any further:*
>
> *the short-term PC is less than 100% of the short-term environmental standard*
>
> *the long-term PC is less than 100% of the long-term environmental standard*
>
> *You don't need to calculate PEC for local nature sites. If your PC exceeds the screening criteria you need to do detailed modelling."*

Results

The relevant sites have been identified by the project's ecologists and are listed in Table D.1. The receptors modelled (pre-fixed with ER) are shown in Figure 3.2. The ambient NO_x concentrations and existing deposition rates have been obtained from APIS. The deposition rates have been obtained for the various habitats across the sites.

The predicted annual-mean NO_X concentrations are compared with the critical level in Table D.1.

The predicted annual-mean SO_2 concentrations are compared with the critical level in Table D.2.

The predicted nutrient N deposition rates are compared with the critical load in Table D.3. The lowest critical loads for nitrogen deposition have been also obtained from APIS.

The maximum predicted acid deposition rates are compared with the critical load function in Tables D.4. The critical loads for the nitrogen and sulphur component for acid deposition have been also obtained from APIS.

The predicted maximum daily-mean NO_X concentrations are compared with the critical level in Table D.5, D.6 and D.7.

Table D.1 Predicted Annual-Mean NOx Concentrations at Designated Habitat Sites

Habitat Site	Critical Level ($\mu g.m^{-3}$)	Scenario 1 and 2		Emergency	
		PC ($\mu g.m^{-3}$)	PC/Critical Level (%)	PC ($\mu g.m^{-3}$)	PC/Critical Level (%)
ER1 Windsor Forest and Great Park Special Area of Conservation (SAC)	30	0.001	0	0.01	0
ER2 Thursley Ash SAC		0.000	0	0.00	0
ER3 Wykery Copse Site of Special Scientific interest (SSSI)		0.027	0	0.21	1
ER4 Farleymoor Copse Ancient Woodland (AW) and Local Nature Reserve (LNR)		0.031	0	0.25	1
ER5 Rigg's Copse		0.035	0	0.28	1
ER6 The Grove AW		0.008	0	0.06	0
ER7 Blackman's Copse AW		0.006	0	0.04	0
ER8 Bulsreads Grove AW		0.033	0	0.25	1
ER9 Thames Basin Heaths Special Protection Area (SPA)		0.002	0	0.01	0
ER10 Big Wood		0.011	0	0.09	0
ER11Popes Meadow		0.007	0	0.05	0
ER12 Pockets Copse		0.004	0	0.03	0
ER13 Long Copse		0.004	0	0.03	0
ER14 Swain's Copse		0.004	0	0.03	0
ER15 Peacock Meadow		0.008	0	0.06	0
ER16 Northrams Wood		0.005	0	0.04	0
ER17 The copse		0.018	0	0.15	0
ER18 Binfield Hall		0.005	0	0.04	0

ER19 Binfield Manor		0.007	0	0.06	0
ER20 Binfield Manor		0.004	0	0.03	0
ER21 Tarman's copse		0.009	0	0.07	0
ER22 Bill Hill		0.005	0	0.04	0
ER23 Wildridings Copse		0.014	0	0.10	0
ER24 Long Copse		0.007	0	0.06	0
ER25 Pebblestone Copse		0.002	0	0.01	0
ER26 Ryehurst Meadow		0.011	0	0.09	0
ER27 Temple Copse		0.011	0	0.09	0
ER28 Tinkers Copse		0.009	0	0.07	0
ER29 Jock's Copse		0.010	0	0.08	0
ER30 Top Copse		0.004	0	0.03	0
ER31 West Garden Copse		0.008	0	0.06	0
ER32 Wood at Locks Farm		0.004	0	0.03	0
ER33 Wood across Old Wokingham Rd		0.004	0	0.03	0
ER34 Wood at Oakwood Youth Challenge		0.005	0	0.04	0
ER35 Wood off Falcon Way		0.005	0	0.04	0
ER36 Wood off the A329(M) roundabout		0.005	0	0.04	0
ER37 Wood off Binfield Rd		0.002	0	0.02	0
ER38 Wood off Ellwood Fields		0.004	0	0.03	0
ER39 Wood by Newbold College		0.009	0	0.07	0
ER40 Wood off Popeswood Rd		0.011	0	0.09	0
ER41 Wood off B3018		0.008	0	0.06	0

Table D.2 Predicted Annual-Mean SO_2 Concentrations at Designated Habitat Sites

Habitat Site	Critical Level (µg.m^{-3})	Scenario 1 and 2		Emergency	
		PC (µg.m^{-3})	PC/Critical Level (%)	PC (µg.m^{-3})	PC/Critical Level (%)
ER1	10	1.63E-06	0	1.19E-05	0
ER2		4.68E-07	0	3.53E-06	0
ER3		2.96E-05	0	1.91E-04	0
ER4	20	3.45E-05	0	2.32E-04	0
ER5		3.86E-05	0	2.57E-04	0
ER6		9.41E-06	0	5.69E-05	0
ER7		6.77E-06	0	4.10E-05	0
ER8		3.70E-05	0	2.26E-04	0
ER9		1.91E-06	0	1.24E-05	0
ER10		1.23E-05	0	8.22E-05	0
ER11		7.62E-06	0	4.96E-05	0
ER12		4.93E-06	0	3.03E-05	0
ER13		4.06E-06	0	2.51E-05	0
ER14		4.06E-06	0	2.58E-05	0
ER15		8.59E-06	0	5.53E-05	0
ER16		5.74E-06	0	3.72E-05	0
ER17		2.06E-05	0	1.34E-04	0

ER18		5.36E-06	0	3.55E-05	0
ER19		8.25E-06	0	5.14E-05	0
ER20		5.01E-06	0	3.07E-05	0
ER21		1.05E-05	0	6.47E-05	0
ER22		5.92E-06	0	3.74E-05	0
ER23		1.56E-05	0	9.36E-05	0
ER24		8.33E-06	0	5.09E-05	0
ER25		2.16E-06	0	1.34E-05	0
ER26		1.23E-05	0	8.21E-05	0
ER27		1.24E-05	0	8.06E-05	0
ER28		1.03E-05	0	6.59E-05	0
ER29		1.14E-05	0	7.38E-05	0
ER30		4.08E-06	0	2.52E-05	0
ER31		8.59E-06	0	5.53E-05	0
ER32		3.93E-06	0	2.69E-05	0
ER33		4.18E-06	0	2.86E-05	0
ER34		5.10E-06	0	3.50E-05	0
ER35		5.53E-06	0	3.47E-05	0
ER36		5.48E-06	0	3.59E-05	0
ER37		2.56E-06	0	1.61E-05	0
ER38		4.16E-06	0	2.63E-05	0
ER39		9.69E-06	0	6.36E-05	0
ER40		1.24E-05	0	8.05E-05	0

ER41		9.05E-06	0	5.66E-05	0

Table D.3 Predicted Nutrient N Deposition at Designated Habitat Sites

Habitat Site	Interest Feature	Critical Load ($kgN.ha^{-1}.yr^{-1}$)	Scenario 1 and 2		Emergency	
			PC ($kgN.ha^{-1}.yr^{-1}$)	PC/Critical Load (%)	PC ($kgN.ha^{-1}.yr^{-1}$)	PC/Critical Load (%)
ER1	Old acidophilous oak woods and Atlantic acidophilous beech forests	10	<0.0005	0	0.003	0
ER2	Northern Atlantic wet heath and European dry heath	10	<0.0005	0	<0.0005	0
ER3	Coniferous woodland and dry shrub heath	15	0.005	0	0.042	0
ER4	Ancient woodland	10	0.006	0	0.051	1
ER5	Ancient woodland	10	0.007	0	0.057	1
ER6	Ancient woodland	10	0.002	0	0.013	0
ER7	Ancient woodland	10	0.001	0	0.009	0
ER8	Mixed broadleaved deciduous ancient woodland	10	0.007	0	0.050	0
ER9	Coniferous woodland and dry shrub heath	5	<0.0005	0	0.003	0
ER10	Ancient woodland with areas of open grassland	10	0.002	0	0.018	0

ER11	Area of parkland with a copse of ancient woodland	10	0.001	0	0.005	0
ER12	Ancient woodland	10	0.001	0	0.007	0
ER13	Ancient woodland	10	0.001	0	0.006	0
ER14	Ancient woodland	10	0.001	0	0.006	0
ER15	Amenity and wild flower meadow with areas of Ancient woodland	10	0.001	0	0.006	0
ER16	Ancient woodland	10	0.001	0	0.008	0
ER17	Small area of suburban woodland	10	0.004	0	0.029	0
ER18	Ancient woodland	10	0.001	0	0.008	0
ER19	Woodland and amenity grassland with stream and footpath passing through	10	0.001	0	0.011	0
ER20	Plantation woodland	10	0.001	0	0.007	0
ER21	Ancient woodland	10	0.002	0	0.014	0
ER22	Ancient woodland	10	0.001	0	0.008	0
ER23	Ancient woodland	10	0.003	0	0.021	0
ER24	Ancient woodland	10	0.002	0	0.011	0

ER25	Ancient woodland	10	<0.0005	0	0.003	0
ER26	Amenity and wild flower meadow	20	0.001	0	0.009	0
ER27	Ancient woodland	10	0.002	0	0.018	0
ER28	Ancient woodland with stream and footpath passing through	10	0.002	0	0.014	0
ER29	Ancient woodland	10	0.002	0	0.016	0
ER30	Ancient woodland	10	0.001	0	0.006	0
ER31	Ancient woodland	10	0.002	0	0.012	0
ER32	Ancient woodland	10	0.001	0	0.006	0
ER33	Ancient woodland	10	0.001	0	0.006	0
ER34	Ancient woodland	10	0.001	0	0.008	0
ER35	Ancient woodland	10	0.001	0	0.008	0
ER36	Ancient woodland	10	0.001	0	0.008	0
ER37	Ancient woodland	10	<0.0005	0	0.004	0
ER38	Ancient woodland	10	0.001	0	0.006	0

ER39	Ancient woodland	10	0.002	0	0.014	0
ER40	Ancient woodland	10	0.002	0	0.018	0
ER41	Ancient woodland	10	0.002	0	0.012	0

Table D.4 Predicted Acid Deposition at Designated Habitat Sites

Habitat Site	Critical Load (keq.ha^{-1}.yr^{-1})			Scenario 1 and 2				Emergency			
	Min N Cl	Max N CL	Max S CL	N PC	S PC	Total PC	PC as % of CL	N PC	S PC	Total PC	PC as % of CL
				(keq.ha^{-1}.yr^{-1})				(keq.ha^{-1}.yr^{-1})			
ER1	0.142	1.044	0.759	2.12E-05	3.85E-07	2.16E-05	0	1.9E-04	2.8E-06	1.9E-04	0
ER2	0.321	0.532	0.211	3.07E-06	5.54E-08	3.12E-06	0	2.8E-05	4.2E-07	2.8E-05	0
ER3	0.357	2.697	2.34	3.82E-04	7.00E-06	3.89E-04	0	3.0E-03	4.5E-05	3.0E-03	0
ER4	0.357	2.698	2.341	4.47E-04	8.17E-06	4.56E-04	0	3.6E-03	5.5E-05	3.7E-03	0
ER5	0.357	2.697	2.34	5.00E-04	9.14E-06	5.09E-04	0	4.0E-03	6.1E-05	4.1E-03	0
ER6	0.357	2.698	2.341	1.21E-04	2.22E-06	1.23E-04	0	8.9E-04	1.3E-05	9.1E-04	0
ER7	0.357	2.696	2.339	8.70E-05	1.60E-06	8.86E-05	0	6.4E-04	9.7E-06	6.5E-04	0
ER8	0.357	2.717	2.36	4.76E-04	8.75E-06	4.85E-04	0	3.5E-03	5.3E-05	3.6E-03	0

ER9	0.142	0.536	0.251	2.47E-05	4.53E-07	2.52E-05	0	1.9E-04	2.9E-06	2.0E-04	0
ER10	0.357	2.697	2.34	1.60E-04	2.91E-06	1.63E-04	0	1.3E-03	1.9E-05	1.3E-03	0
ER11	0.357	2.698	2.34	4.93E-05	9.02E-07	5.02E-05	0	3.9E-04	5.9E-06	4.0E-04	0
ER12	0.357	2.696	2.339	6.35E-05	1.17E-06	6.47E-05	0	4.8E-04	7.2E-06	4.8E-04	0
ER13	0.357	2.67	2.313	5.23E-05	9.61E-07	5.33E-05	0	3.9E-04	5.9E-06	4.0E-04	0
ER14	0.357	2.67	2.313	5.24E-05	9.61E-07	5.34E-05	0	4.0E-04	6.1E-06	4.1E-04	0
ER15	0.357	2.699	2.342	5.55E-05	1.02E-06	5.65E-05	0	4.3E-04	6.5E-06	4.4E-04	0
ER16	0.357	2.717	2.36	7.42E-05	1.36E-06	7.56E-05	0	5.8E-04	8.8E-06	5.9E-04	0
ER17	0.357	2.698	2.341	2.66E-04	4.87E-06	2.71E-04	0	2.1E-03	3.2E-05	2.1E-03	0
ER18	0.357	2.672	2.315	6.94E-05	1.27E-06	7.06E-05	0	5.6E-04	8.4E-06	5.7E-04	0
ER19	0.357	2.709	2.352	1.06E-04	1.95E-06	1.08E-04	0	8.1E-04	1.2E-05	8.2E-04	0
ER20	0.357	2.708	2.351	6.44E-05	1.18E-06	6.56E-05	0	4.8E-04	7.3E-06	4.9E-04	0
ER21	0.357	2.697	2.34	1.35E-04	2.49E-06	1.38E-04	0	1.0E-03	1.5E-05	1.0E-03	0
ER22	0.357	2.719	2.362	7.64E-05	1.40E-06	7.78E-05	0	5.9E-04	8.8E-06	6.0E-04	0

ER23	0.357	2.717	2.36	2.01E-04	3.69E-06	2.04E-04	0	1.5E-03	2.2E-05	1.5E-03	0
ER24	0.357	2.709	2.352	1.07E-04	1.97E-06	1.09E-04	0	8.0E-04	1.2E-05	8.1E-04	0
ER25	0.357	2.669	2.312	2.78E-05	5.11E-07	2.83E-05	0	2.1E-04	3.2E-06	2.1E-04	0
ER26	1.071	5.071	4	7.99E-05	1.46E-06	8.14E-05	0	6.4E-04	9.7E-06	6.5E-04	0
ER27	0.357	2.709	2.352	1.61E-04	2.94E-06	1.64E-04	0	1.3E-03	1.9E-05	1.3E-03	0
ER28	0.357	2.709	2.352	1.33E-04	2.43E-06	1.35E-04	0	1.0E-03	1.6E-05	1.0E-03	0
ER29	0.357	2.709	2.352	1.47E-04	2.69E-06	1.50E-04	0	1.2E-03	1.7E-05	1.2E-03	0
ER30	0.357	2.696	2.339	5.25E-05	9.65E-07	5.35E-05	0	4.0E-04	6.0E-06	4.0E-04	0
ER31	0.357	2.699	2.342	1.11E-04	2.03E-06	1.13E-04	0	8.7E-04	1.3E-05	8.8E-04	0
ER32	0.357	2.695	2.338	5.10E-05	9.29E-07	5.19E-05	0	4.2E-04	6.4E-06	4.3E-04	0
ER33	0.357	2.695	2.338	5.42E-05	9.88E-07	5.52E-05	0	4.5E-04	6.8E-06	4.6E-04	0
ER34	0.357	2.695	2.338	6.63E-05	1.21E-06	6.75E-05	0	5.5E-04	8.3E-06	5.6E-04	0
ER35	0.357	2.699	2.342	7.13E-05	1.31E-06	7.26E-05	0	5.4E-04	8.2E-06	5.5E-04	0
ER36	0.142	1.201	1.059	7.09E-05	1.30E-06	7.22E-05	0	5.6E-04	8.5E-06	5.7E-04	0

ER37	0.357	2.696	2.339	3.30E-05	6.06E-07	3.36E-05	0	2.5E-04	3.8E-06	2.6E-04	0
ER38	0.357	2.696	2.339	5.37E-05	9.85E-07	5.47E-05	0	4.1E-04	6.2E-06	4.2E-04	0
ER39	0.357	2.672	2.315	1.25E-04	2.29E-06	1.28E-04	0	1.0E-03	1.5E-05	1.0E-03	0
ER40	0.357	2.672	2.315	1.60E-04	2.93E-06	1.63E-04	0	1.3E-03	1.9E-05	1.3E-03	0
ER41	0.357	2.709	2.352	1.17E-04	2.14E-06	1.19E-04	0	8.9E-04	1.3E-05	9.0E-04	0

Table D.5 Predicted Daily-Mean NOx Concentrations at Designated Habitat Sites – Scenario 1

Habitat Site	Critical Level ($\mu g.m^{-3}$)	PC ($\mu g.m^{-3}$)	PC/Critical Level (%)	Ambient Concentration ($\mu g.m^{-3}$)	PEC ($\mu g.m^{-3}$)	PEC/ Critical Level (%)
ER1	200	0.4	0	38	38.4	19
ER2		0.3	0	34.36	34.6	17
ER3		11.0	5	47.86	58.9	29
ER4		7.5	4	43.42	50.9	25
ER5		12.2	6	44.18	56.4	28
ER6		9.2	5	43.42	52.7	26
ER7		3.7	2	47.78	51.5	26
ER8		9.4	5	47.9	57.3	29
ER9		1.3	1	36.38	37.7	19
ER10		4.2	2	44.18	48.3	24
ER11		2.6	1	43.42	46.0	23

ER12		2.7	1	47.78	50.5	25
ER13		4.0	2	42.02	46.0	23
ER14		4.5	2	42.02	46.5	23
ER15		3.3	2	35.1	38.4	19
ER16		2.5	1	47.9	50.4	25
ER17		6.2	3	43.42	49.6	25
ER18		1.5	1	39.12	40.6	20
ER19		1.5	1	39.64	41.2	21
ER20		1.3	1	38.44	39.7	20
ER21		5.9	3	44.18	50.1	25
ER22		1.9	1	47.78	49.6	25
ER23		3.9	2	47.9	51.8	26
ER24		2.4	1	39.64	42.1	21
ER25		1.9	1	47.26	49.1	25
ER26		5.2	3	44.18	49.4	25
ER27		2.0	1	39.64	41.6	21
ER28		2.4	1	39.64	42.0	21
ER29		2.3	1	39.64	41.9	21
ER30		2.1	1	47.78	49.9	25
ER31		3.3	2	35.1	38.4	19
ER32		1.3	1	34.36	35.7	18
ER33		1.9	1	34.36	36.3	18
ER34		1.9	1	34.36	36.2	18

ER35		3.0	1	35.1	38.1	19
ER36		3.3	2	42.52	45.8	23
ER37		2.2	1	47.78	50.0	25
ER38		2.8	1	47.78	50.6	25
ER39		2.9	1	39.12	42.0	21
ER40		3.3	2	39.12	42.4	21
ER41		2.5	1	39.64	42.1	21

Table D.6 Predicted Daily-Mean NOx Concentrations at Designated Habitat Sites – Scenario 2

Habitat Site	Critical Level ($\mu g.m^{-3}$)	PC ($\mu g.m^{-3}$)	PC/Critical Level (%)	Ambient Concentration ($\mu g.m^{-3}$)	PEC ($\mu g.m^{-3}$)	PEC/ Critical Level (%)
ER1	200	1.3	1	38	39.3	20
ER2		0.9	0	34.36	35.3	18
ER3		31.7	16	47.86	79.5	40
ER4		24.4	12	43.42	67.8	34
ER5		37.6	19	44.18	81.7	41
ER6		14.9	7	43.42	58.3	29
ER7		9.8	5	47.78	57.6	29
ER8		24.6	12	47.9	72.5	36
ER9		2.9	1	36.38	39.3	20
ER10		12.8	6	44.18	57.0	29
ER11		7.3	4	43.42	50.7	25

ER12		6.9	3	47.78	54.7	27
ER13		11.3	6	42.02	53.3	27
ER14		13.1	7	42.02	55.1	28
ER15		9.6	5	35.1	44.7	22
ER16		6.6	3	47.9	54.5	27
ER17		18.5	9	43.42	62.0	31
ER18		4.7	2	39.12	43.9	22
ER19		3.9	2	39.64	43.5	22
ER20		2.7	1	38.44	41.2	21
ER21		13.7	7	44.18	57.9	29
ER22		4.7	2	47.78	52.4	26
ER23		8.3	4	47.9	56.2	28
ER24		3.2	2	39.64	42.8	21
ER25		4.7	2	47.26	51.9	26
ER26		15.8	8	44.18	60.0	30
ER27		6.2	3	39.64	45.9	23
ER28		4.7	2	39.64	44.3	22
ER29		4.6	2	39.64	44.2	22
ER30		5.4	3	47.78	53.2	27
ER31		9.6	5	35.1	44.7	22
ER32		4.3	2	34.36	38.7	19
ER33		6.2	3	34.36	40.6	20
ER34		6.1	3	34.36	40.4	20

ER35		7.5	4	35.1	42.6	21
ER36		7.7	4	42.52	50.2	25
ER37		4.7	2	47.78	52.5	26
ER38		5.6	3	47.78	53.4	27
ER39		8.2	4	39.12	47.3	24
ER40		9.4	5	39.12	48.5	24
ER41		3.9	2	39.64	43.6	22

Table D.7 Predicted Daily-Mean NOx Concentrations at Designated Habitat Sites – Emergency

Habitat Site	Critical Level ($\mu g.m^{-3}$)	PC ($\mu g.m^{-3}$)	PC/Critical Level (%)	Ambient Concentration ($\mu g.m^{-3}$)	PEC ($\mu g.m^{-3}$)	PEC/ Critical Level (%)
ER1	200	15	7	38	52.5	26
ER2		10	5	34.36	44.4	22
ER3		348	174	47.86	396.2	198
ER4		269	134	43.42	312.1	156
ER5		413	207	44.18	457.4	229
ER6		164	82	43.42	207.6	104
ER7		108	54	47.78	155.9	78
ER8		271	135	47.9	318.8	159
ER9		32	16	36.38	68.6	34
ER10		141	71	44.18	185.2	93
ER11		80	40	43.42	123.6	62

ER12		76	38	47.78	123.4	62
ER13		124	62	42.02	166.1	83
ER14		144	72	42.02	186.3	93
ER15		106	53	35.1	141.2	71
ER16		72	36	47.9	120.4	60
ER17		204	102	43.42	247.3	124
ER18		52	26	39.12	91.3	46
ER19		43	21	39.64	82.4	41
ER20		30	15	38.44	68.5	34
ER21		151	76	44.18	195.4	98
ER22		51	26	47.78	99.1	50
ER23		92	46	47.9	139.6	70
ER24		35	17	39.64	74.4	37
ER25		51	26	47.26	98.7	49
ER26		174	87	44.18	217.8	109
ER27		68	34	39.64	108.1	54
ER28		52	26	39.64	91.3	46
ER29		51	25	39.64	90.3	45
ER30		60	30	47.78	107.4	54
ER31		106	53	35.1	141.2	71
ER32		48	24	34.36	82.0	41
ER33		69	34	34.36	103.0	51
ER34		67	33	34.36	101.1	51

ER35		82	41	35.1	117.5	59
ER36		85	42	42.52	127.1	64
ER37		52	26	47.78	99.6	50
ER38		61	31	47.78	109.1	55
ER39		90	45	39.12	128.8	64
ER40		103	52	39.12	142.3	71
ER41		43	22	39.64	82.8	41

Interpretation of Results

Tables D.1, D.2, D.3 and D.4 show that the maximum annual-mean PCs are less than 1% of the critical level/load at all receptors for all scenarios. As such, the impacts are not likely to have a significant effect.

Table D.5 to D.7 shows the maximum daily-mean NO_X PC as a percentage of a critical level of 200 µg.m^{-3}. The IAQM 2019 *'Guide to the assessment of air quality impacts on designated nature conservation sites guidance' says: "The critical level is generally considered to be 75 µg/m^3; but this only applies where there are high concentrations of SO_2 and ozone, which is not generally the current situation in the UK…. If a regulator does require the use of the short term NOx critical level, given the low UK SO_2 concentrations IAQM consider it is most appropriate to use 200 µg/m^3 as the short term critical load (sic)."* For the testing scenarios (scenarios 1 and 2), the PC is above 10% of 200 µg.m^{-3} at some receptors ; however, the PEC is below 200 µg.m^{-3} at all sites. As such, the impact during testing is not likely to have a significant effect.

In the emergency scenario (scenario 3), the PEC exceeds 200 µg.m^{-3} at several habitat sites close to the Application Site. The emergency scenario assumes that all 11 engines run at the same time for a period of 72 hrs. The critical level would only be exceeded should an emergency occur. It is highly unlikely that any grid outage requiring the operation of all engines simultaneously will last longer than 24 hours. In the rare event of a loss of utility power to the site, an outage is expected to be significantly less than 24 hours and therefore the modelled results for the emergency scenario are likely to be highly conservative due to the very low probability of an emergency event of such a long duration.

At ER5, for the worst meteorological year:

- The model predicts 34 daily-mean NO_x concentrations above 200 µg.m^{-3}. Using the cumulative hypergeometric distribution, the probability of an emergency occurring on one of those 34 days, when randomly selecting 3 days, is 0.25%. When this is multiplied by the safety factor of 2.5, the probability is 0.6%.
- The model predicts 78 daily-mean NO_x concentrations above 75 µg.m^{-3}. Using the cumulative hypergeometric distribution, the probability of the emergency occurring on one of those 78 days, when randomly selecting 3 days, is 0.51%. When this is multiplied by the safety factor of 2.5, the probability is 1.3%.

As both, probabilities are below 5%, an exceedance is considered unlikely. Furthermore, these probabilities reduce to 0.2% and 0.5% respectively, when randomly selecting a single day. For probabilities below 1%, an exceedance is considered highly unlikely.

REFERENCES

APIS (2020) Air Pollution Information Systems, www.apis.ac.uk

Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4

BFC (2008) Bracknell Forest Borough Local Development Framework Core Strategy Development Plan Document

BFC (2018) Draft Bracknell Forest Local Plan

Binfield Parish Council (2016) Binfield Neighbourhood Plan 2015-2026

British Standard Institute (1983) BS 6069:Part 2:1983, ISO 4225-1980 Characterization of air quality. Glossary

CEH (2011) Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4

Communities and Local Government (2019) National Planning Policy Framework

Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.

Defra (2010) The Air Quality Standards Regulations.

Defra (2016) Local Air Quality Management Technical Guidance, 2016 (LAQM.TG16)

Defra (2018) Drawn from Defra Maps at http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

EC (2008) Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

Environment Agency (2007) Review of methods for NO to NO2 conversion in plumes at short ranges

Environment Agency (2010) Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex K

Environment Agency (2020a) https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions

Environment Agency (2020b) https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

Environment Agency (undated) Conversion Ratios for NOx and NO2

EPUK&IAQM (2017) Land-Use Planning & Development Control: Planning For Air Quality

HMSO(1995) Environment Act 1995

Highways England (2019) Design Manual for Roads and Bridges LA 105 Air Quality

IAQM (2012) Air Quality Monitoring in the Vicinity of Demolition and Construction Sites

IAQM (2014) Guidance on the assessment of dust from demolition and construction