Air Quality Assessment for Permit

Rassau Industrial Estate

For Beaufort Power Limited

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Quality Management			
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Executive Summary

This Air Quality Assessment has been undertaken to accompany the permit application for the power generating facility in Rassau Industrial Estate, Ebbw Vale. The facility generates electricity using fourteen natural-gas powered generators with a total electrical output of approximately $20MW_e$. The plant will operate during times that there is a high-power demand from the national grid.

The report found that the facility can operate up to 7,000 hours per year before there are potential impacts on local relevant human health or ecological receptors.

Blaenau Gwent County Borough Council has not designated any Air Quality Management Areas (AQMAs), suggesting air quality in the local area is relatively good.

The assessment has been undertaken based upon appropriate information on the Proposed Development provided. In undertaking this assessment, RPS experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour. These professional responsibilities are in accordance with the code of professional conduct set by the Institution of Environmental Sciences for members of the Institute of Air Quality Management (IAQM).

Regarding the operational-phase, the most important consideration is stack emissions. This assessment predicts that ground-level concentrations will be within acceptable levels at sensitive receptors and will not give rise to any significant adverse effects based on the criteria in the Environment Agency online guidance 'Environmental management – guidance, Air emissions risk assessment for your environmental permit'.

The proposed development does not, in air quality terms, conflict with national or local policies. There are no constraints to the development in the context of air quality.

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1 Introduction

1.1 This Air Quality Assessment has been undertaken to accompany the permit variation application for the power generating facility in Rassau Industrial Estate, Ebbw Vale. The facility generates electricity using fourteen natural-gas powered generators with a total electrical output of approximately $20MW_e$. The plant will operate during times that there is a high-power demand from the national grid.

1.2 The report found that the facility can operate up to 7,000 hours per year before there are potential impacts on local relevant human health or ecological receptors.

1.3 Blaenau Gwent County Borough Council has not designated any Air Quality Management Areas, suggesting air quality in the area is good.

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 and the results from 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 effects.

2 Legislation and Policy Context

Ambient Air Quality Legislation and National Policy

Air Quality Standards Regulations

2.1 The Air Quality Standards Regulations 2010 [1], amended by The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 [2], sets limit values for ambient air concentrations 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, certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs).

2.2 These limit values are legally binding on the Secretary of State. 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

2.3 The Environment Act 1995 [3] 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 [4]. 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 Air Quality Standards Regulations.

2.4 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 the limit values in the Air Quality Standards Regulations.

♦ 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.

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

2.6 The Environment Agency online guidance entitled 'Environmental management – guidance, Air emissions risk assessment for your environmental permit' [5] provides further assessment criteria in the form of Environmental Assessment Levels (EALs).

2.7 Where the EALs, limit values and the AQS objectives differ, the more stringent has been used.

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}	-

Environmental Permitting Regulations

2.8 The Environmental Permitting Regulations (EPR) 2016 [6] define activities that require an Environmental Permit from the Environment Agency (EA).

2.9 EPR is a regulatory system that employs an integrated approach to control the environmental impacts of certain listed industrial activities including the generation of energy from waste. The intention of the regulatory system is to ensure that best available techniques (BAT) are used to prevent or minimise the effects of an activity on the environment, having regard to the effects of emissions to air, land and water via a single permitting process.

2.10 To gain a permit, Operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use are the BAT for their installation and meet certain other requirements taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements are included for permitted sites to which these apply.

2.11 The essence of BAT is that the techniques selected to protect the environment should achieve a high degree of protection of people and the environment taken as a whole. Indicative BAT standards are laid out in national guidance and where relevant, should be applied unless a different standard can be justified for a particular installation. The EA is legally obliged to go beyond BAT requirements where EU Air Quality Limit Values may be exceeded by an existing operator.

2.12 The Environment Agency's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit*' [5] provides guidelines for air dispersion modelling. The assessment of air quality effects for the generators is consistent with this guidance.

3 Assessment Methodology

Approach

3.1 This air quality assessment 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 site.
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a "new generation" Gaussian dispersion model, ADMS 6. 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.

3.2 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 Member of the Institute of Air Quality Management and Member of the Institution of Environmental Science and have the required academic qualifications for these professional bodies.

Operational Phase - Methodology

Summary of Key Pollutants Considered

3.3 The key pollutant emissions of local concern associated with the natural gas fired facility are oxides of nitrogen (NO_x). 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.

3.4 The generators will comply with Environmental Permitting (England and Wales) (Amendment) Regulations 2018 [6] which adopts the *'EU Directive of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from medium combustion plants'* (referred to hereafter as the Medium Combustion Plant Directive or the MCPD).

Atmospheric Dispersion Modelling of Pollutant Concentrations

3.5 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.

3.6 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

3.7 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 6, 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 6 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

3.8 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 does the use of Pasquill-Gifford stability categories, 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

Stack Parameters and Emissions Rates used in the Model

3.9 The Proposed Development comprises fourteen identical natural gas fuelled generators, each with its own flue stack. The stack locations are shown in Figure 2. The emissions characteristics for each stack modelled are provided in Table 3.1.

Table 3.1 :Stack Characteristics

Parameters	Units	
Stack heights	From ground to the top of the stack (m)	9.125
Internal diameter of the flue at point of release to air	m	0.40
Temperature of the stack gases	°C	377
Velocity of stack gases	$m.s^{-1}$	21.59
NOx concentration	$mg.Nm^{-3}$	95
NOx mass emission rate	$g.s^{-1}$	0.293

Table 3.2:Stack Locations

Stack Number	X	Y
1	314269.6	211769.8
2	314267.8	211775.5
3	314266.0	211781.3
4	314264.3	211787.0
5	314262.5	211792.7
6	314260.8	211798.5
7	314259.0	211804.2
8	314257.2	211810.0
9	314246.0	211807.7
10	314247.8	211801.9
11	314249.5	211796.2
12	314251.3	211790.5
13	314253.1	211784.7
14	314254.8	211779.0

Operating Hours

3.10 The results presented in this report assume that the engines will be operational for up to 7,000 hours per year.

Meteorological Data

3.11 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.

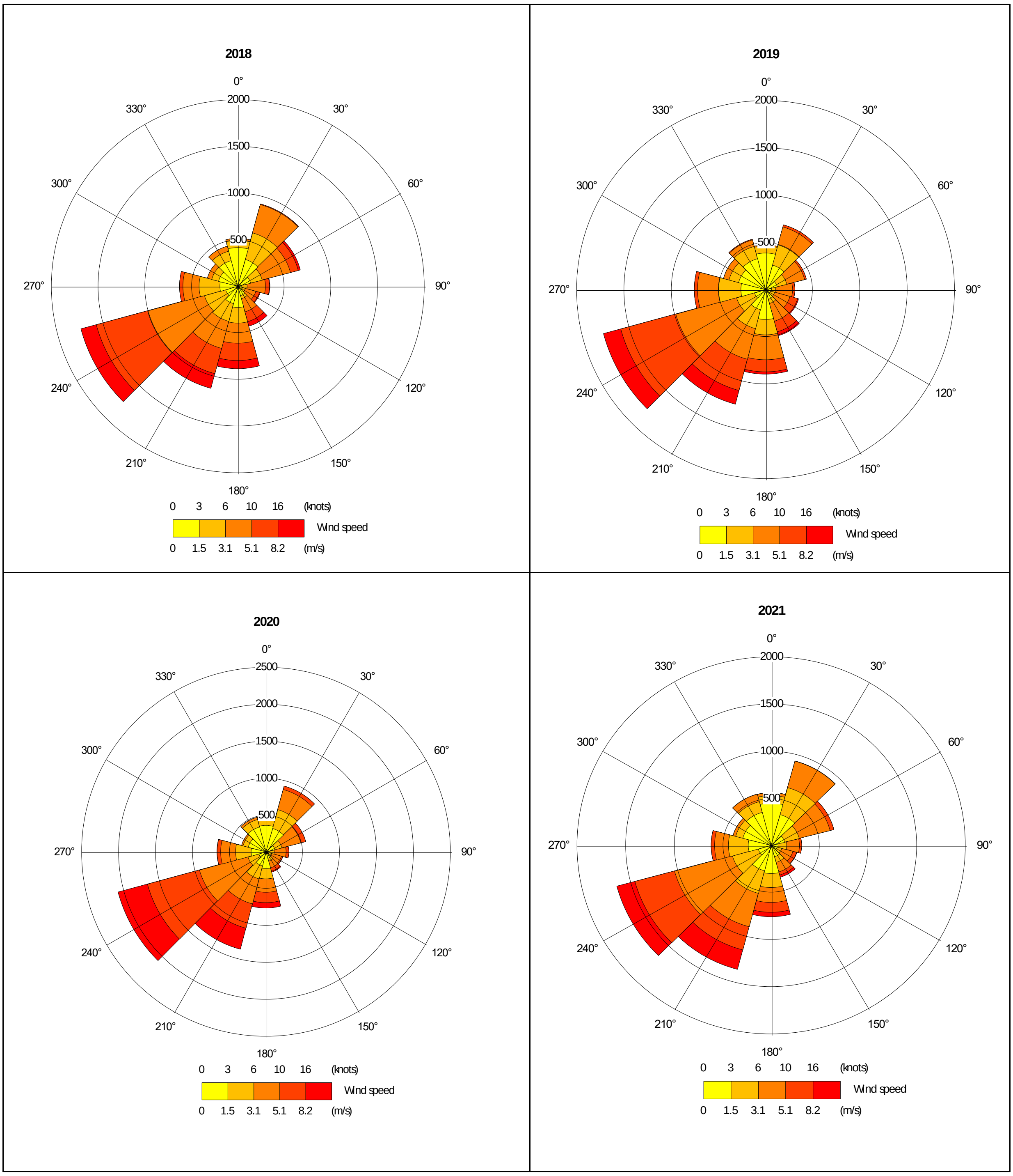
3.12 It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

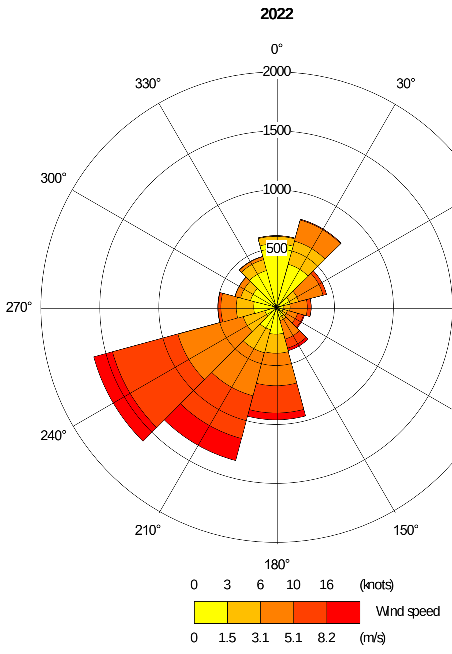
3.13 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological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

3.14 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 Sennybridge meteorological station between 2018 and 2022, approximately 40 km northeast of the site.

3.15 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 1.

Figure 1: Wind Roses – Sennybridge 2018 to 2022





Terrain

3.16 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

3.17 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.

3.18 A surface roughness length of 0.2 m has been used within the model to represent the average surface characteristics across the study area.

Building Wake Effects

3.19 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 3.3.

Table 3.3 : Dimensions of Buildings Included Within the Dispersion Model

Building ID	Approx. Building Centre		Height (m)	Length(m)	Width(m)	Angle (Degrees)
	X (m)	Y (m)				
Building 1	314308	211795	8	56	44	162
Building 2	314263	211812	3	3	13	163
Building 3	314265	211808	3	3	13	163
Building 4	314267	211801	3	3	13	163
Building 5	314268	211795	3	3	13	161
Building 6	314270	211789	3	3	13	161
Building 7	314272	211784	3	3	13	163
Building 8	314273	211778	3	3	13	161
Building 9	314275	211772	3	3	13	162
Building 10	314242	211806	3	3	13	161
Building 11	314243	211800	3	3	13	161
Building 12	314245	211794	3	3	13	160
Building 13	314247	211789	3	3	13	160
Building 14	314249	211783	3	3	13	161
Building 15	314251	211777	3	3	13	160
Building 16	314283	211874	8	42	55	74

Model Outputs

Receptors

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.TG22 [7], provides examples of exposure locations and these are summarised in Table 3.4.

Table 3.4 : 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.

3.21 Concentrations have been predicted across a 1 km by 1 km grid with a grid spacing of 10 m. In addition, the effects of the proposed development have been assessed at the façades of local existing 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 3.5 and shown in Figure 2.

3.22 Ecological Receptors are considered in Appendix A.

Table 3.5 : Modelled Sensitive Receptors

ID	Type	X	Y
1	Residential	314473	211647
2	Residential	314414	211621
3	Residential	314419	211584
4	Residential	314461	211597
5	Residential	314508	211620
6	Residential	314627	211524

ID	Type	X	Y
7	Residential	314635	211504
8	Residential	314747	211592
9	Residential	314780	211599
10	Residential	314790	211561
11	Residential	314773	211553
12	Residential	314802	211586
13	Residential	314816	211588
14	Residential	314817	211562
15	Residential	314829	211585
16	Residential	314846	211563
17	Residential	314849	211586
18	Residential	314865	211584
19	Residential	314874	211562
20	Residential	314881	211586
21	Residential	314322	211319
22	Residential	313729	210985
23	Residential	313734	210954
24	Residential	313773	210969
25	Residential	313196	211534
26	Residential	313194	211520
27	Residential	315199	211780
28	Residential	315346	211823
29	Residential	315326	211927
30	Residential	315344	211872
31	Residential	315355	211854
32	Residential	315378	211799
33	Residential	315369	211755
34	Residential	315238	211633
35	Residential	315077	211577
36	Residential	315338	211659
37	Residential	315364	211717

3.23 The annual, daily and hourly-mean AQS objectives apply at the front and rear façades of all residential properties. The approaches used to predict the concentrations for these different averaging periods are described below.

Figure 2: Stacks and Sensitive Receptors Modelled

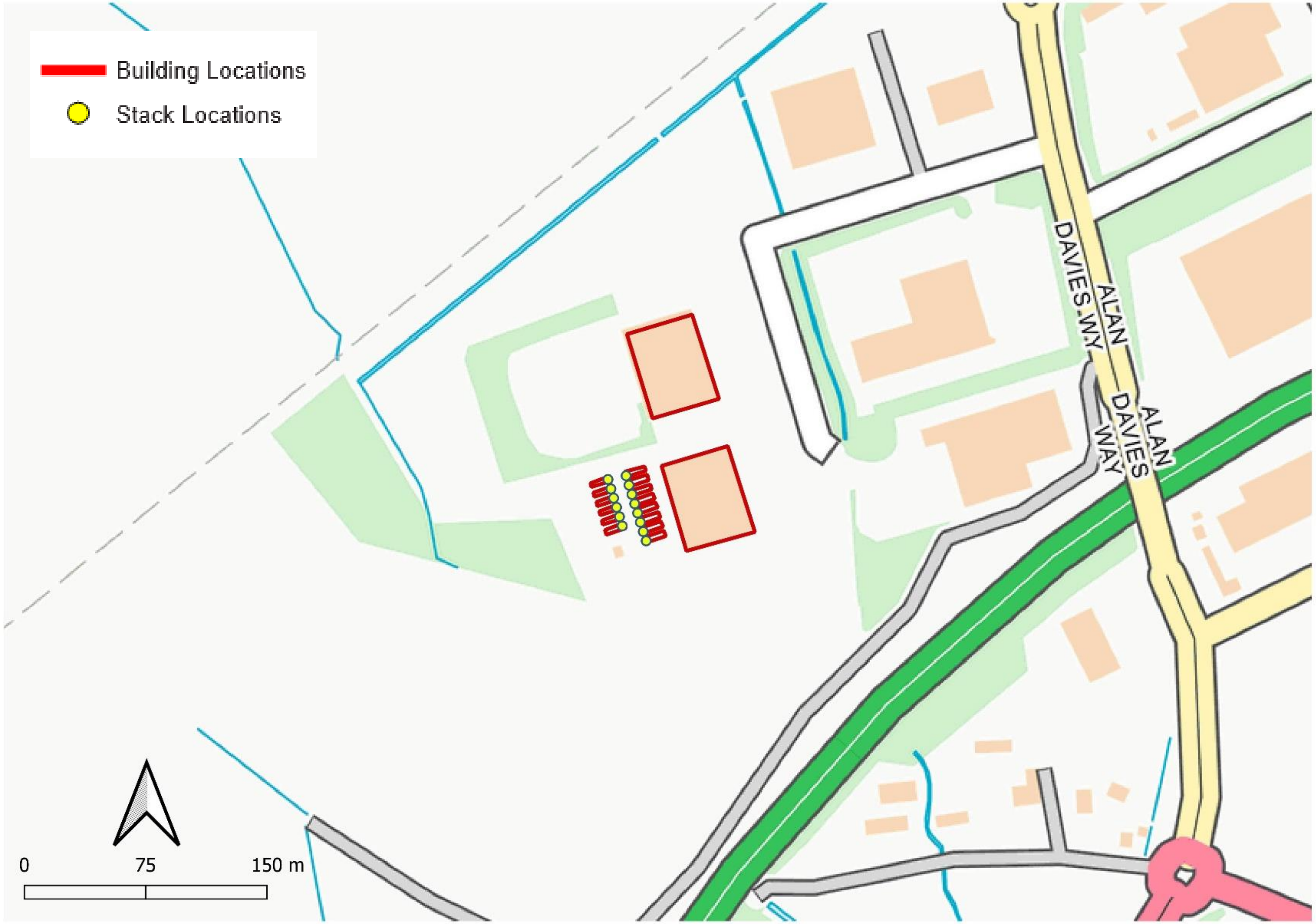


Figure 3: Human Health Receptors Modelled

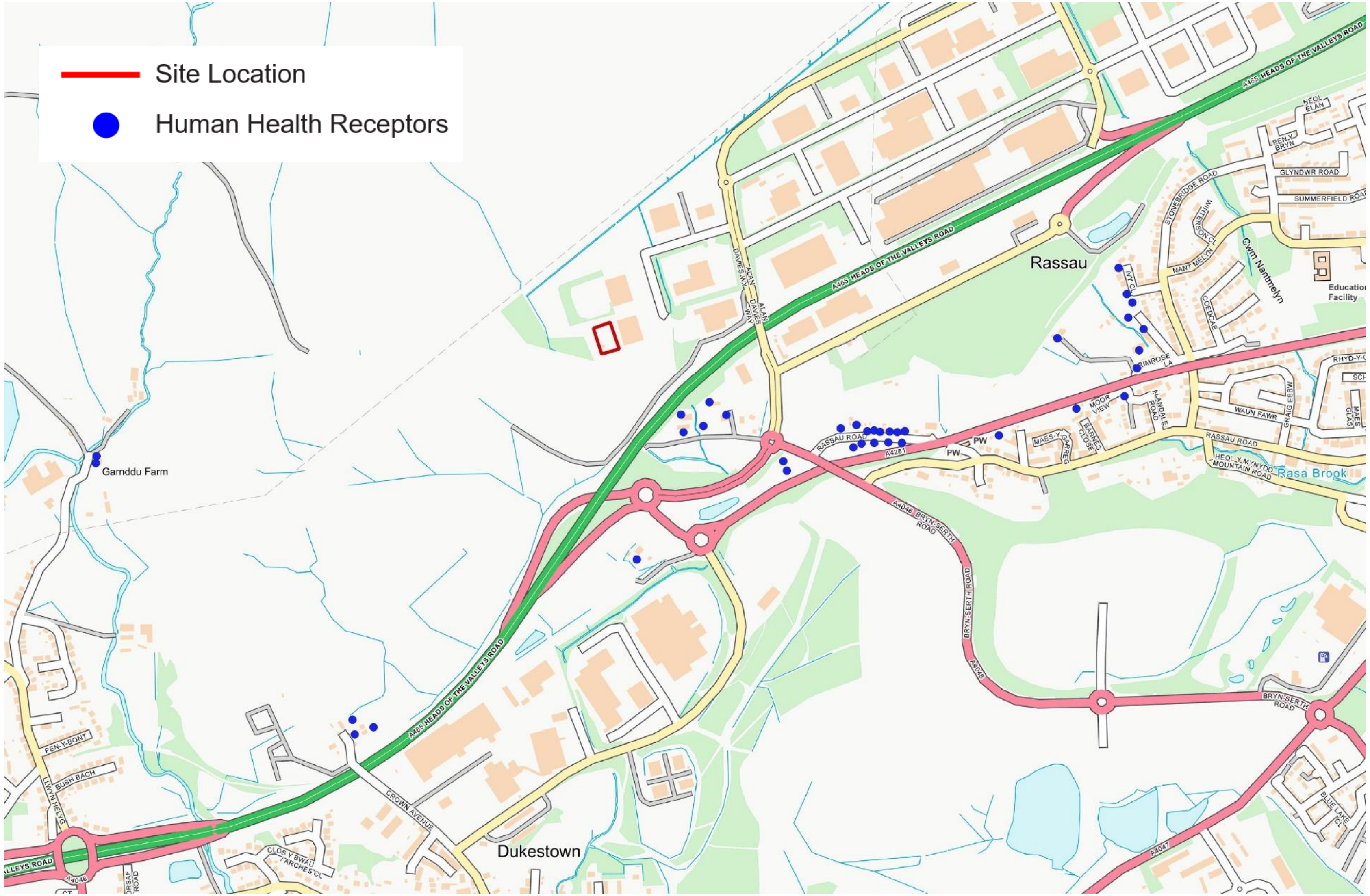
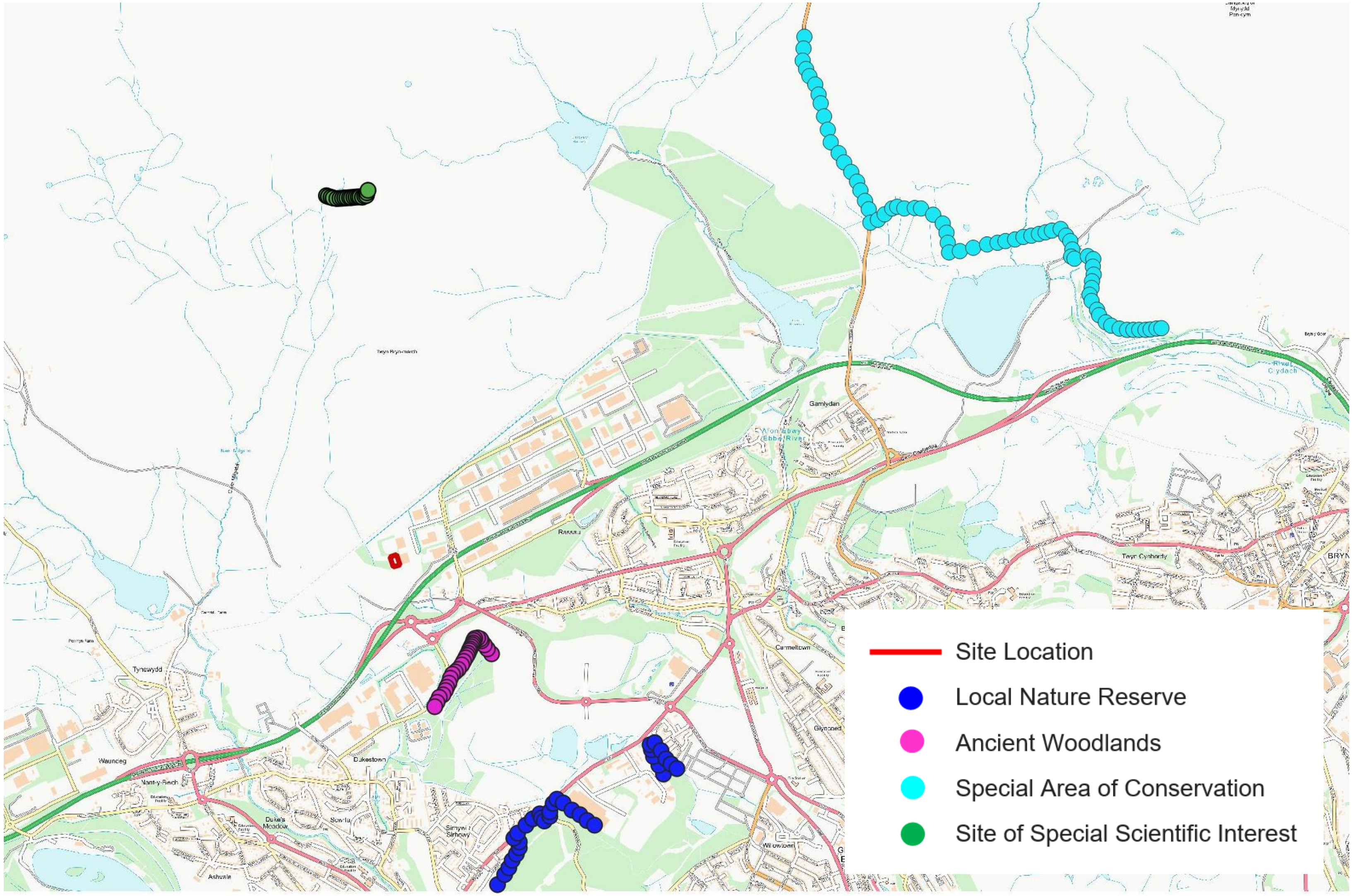


Figure 4: Ecological Receptors Modelled



NO_X to NO_2 Assumptions

3.24 The NOx 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. The Environment Agency advises [8] that:

"For combustion processes where no more than 10% of nitrogen oxides are emitted as nitrogen dioxide, you can assume worst case conversion ratios to nitrogen dioxide of:

35% for short-term average concentrations

70% for long-term average concentrations"

3.25 These ratios have been used in the assessment.

Modelling of Long-Term and Short-Term Emissions

3.26 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.

3.27 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.

3.28 The model has been run with all generators operating in every hour to test the impacts associated with the widest range of meteorological conditions.

Significance Criteria

3.29 The on-line Environment Agency online guidance entitled *'Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [5] 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."

3.30 It continues by stating that:

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

3.31 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"

3.32 The EA online guidance 'Environmental permitting: air dispersion modelling reports' [9] states:

"For a detailed modelling assessment PCs are insignificant where they are less than:

- *10% of a short-term environmental standard*
- *1% of a long-term environmental standard*

At the detailed modelling stage there are no criteria to determine whether:

- *PCs are significant*
- *PECs are insignificant or significant*

You must explain how you judged significance and base this on the site specific circumstances."

3.33 On that basis, the results of the detailed modelling presented in this report have been used as follows:

- The effects are not considered significant if the short-term PC is less than 10% of the short-term Environmental Assessment Level (EAL) or the PEC is below the EAL; and
- The effects are not considered significant if the long-term PC is less than 1% of the long-term EAL or the PEC is below the EAL.

Uncertainty

3.34 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).

3.35 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.

3.36 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.

3.37 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 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.	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	The model has been run for a number of specific human health and ecological receptors. Receptor locations have been identified where concentrations are highest or where the greatest changes are expected	

3.38 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 Air Quality Conditions

Overview

4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. EPUK/IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality.

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

- Defra maps [10], which show estimated pollutant concentrations across the UK in 1 km grid squares;
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies; and
- results published by national monitoring networks.

4.3 Background concentrations have been derived from comparisons of monitored local data and Defra background maps. Table 4.1 shows the results of local monitoring.

Table 4.1. Monitored Annual-Mean Concentrations

Monitor Name	Approximate Distance from the Application Site (km)	2017	2018	2019
BGBC-28	0.25	7.5	8.7	8.1
BGBC-29	1.05	-	7.4	7.2
BGBC-24	1.5	12	12.6	12

4.4 Defra's total annual-mean NO_2 concentration estimates have been collected for the 1 km grid squares of the monitoring sites and the Proposed Development and are summarised in Table 4.2.

Table 4.2 Defra Mapped Annual-Mean NO_2 Concentration Estimates

Monitor Name	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)	
		Range of Monitored	Estimated Defra Mapped
BGBC-28	0.25	7.5-8.7	8.1
BGBC-29	1.05	7.2-7.4	8.0
BGBC-24	1.5	12-12.6	8.9

4.5 The BGBC-28 monitor is the closest monitoring location to the Application Site. Automatically monitored annual-mean NO_2 concentrations at this monitor range from 7.5 to 8.7 $\mu g.m^{-3}$. To ensure the assessment is conservative, the background annual-mean NO_2 concentration has been derived from the 8.7 $\mu g.m^{-3}$, monitored in 2019.

4.6 The background concentrations used in the assessment are set out in Table 4.3.

Table 4.3 Summary of Assumed Background Concentrations

Pollutant	Averaging Period	Concentration ($\mu g.m^{-3}$)	Data Source
NO_2	1 hour (99.79th percentile) (a)	17.4	BGBC-28 (2019)
	1 hour (annual mean)	8.7	

Note:

(a) Short-term background data approximately equate to the 90th percentile, which is approximately equivalent to 2 x the annual mean.

5 Assessment of Air Quality Impacts

Results of Stack Emissions Modelling

5.1 Table 5.1 show the maximum predicted long-term PCs and PECs as percentages of the EAL at selected sensitive receptors.

Table 5.1 Maximum Predicted Contributions of NO_2 at Selected Sensitive Receptors

Receptor ID	Annual Mean NO_2 PC	PC as % of EAL	PEC as % of EAL	99.79^{th} Percentile Hourly Mean NO_2 PC	PC as % of EAL	PEC as % of EAL
1	2.27	6	27	40.33	20	29
2	2.82	7	29	46.81	23	32
3	2.44	6	28	41.51	21	29
4	2.08	5	27	36.12	18	27
5	1.77	4	26	32.18	16	25
6	0.93	2	24	18.35	9	18
7	0.88	2	24	18.00	9	18
8	0.81	2	24	18.84	9	18
9	0.78	2	24	18.75	9	18
10	0.70	2	23	17.21	9	17
11	0.70	2	24	17.15	9	17
12	0.73	2	24	17.87	9	18
13	0.72	2	24	17.30	9	17
14	0.67	2	23	15.70	8	17
15	0.70	2	23	16.74	8	17
16	0.65	2	23	15.63	8	17
17	0.68	2	23	16.19	8	17
18	0.67	2	23	15.46	8	16
19	0.62	2	23	15.67	8	17
20	0.66	2	23	15.45	8	16
21	0.80	2	24	16.82	8	17
22	0.93	2	24	15.40	8	16
23	0.95	2	24	15.08	8	16
24	1.03	3	24	14.60	7	16
25	0.45	1	23	12.32	6	15

26	0.45	1	23	12.02	6	15
27	0.74	2	24	12.64	6	15
28	0.68	2	23	11.31	6	14
29	0.87	2	24	12.33	6	15
30	0.75	2	24	11.63	6	15
31	0.72	2	24	11.44	6	14
32	0.63	2	23	11.03	6	14
33	0.59	1	23	10.84	5	14
34	0.53	1	23	12.72	6	15
35	0.53	1	23	12.12	6	15
36	0.52	1	23	11.72	6	15
37	0.56	1	23	11.41	6	14

5.2 For annual-mean NO_2, the PCs at discrete receptors closest to the site exceed 1% of the EAL but the PECs at all discrete receptors are well below the EAL and the impacts can be screened out as insignificant.

5.3 For 99.79th percentile hourly-mean NO_2, the PCs at discrete receptors closest to the site exceed 10% of the EAL but the PECs at all discrete receptors are well below the EAL and the impacts can be screened out as insignificant.

5.4 It can be informative to see the geographical extent of the impact: Figure 5.1 and 5.2 show the contour plot for the annual mean NO_2 PCs and the 99.79th percentile hourly-mean NO_2 PCs.

Figure 5.1: Annual-Mean NO_2 Process Contribution (µg.m^{-3})

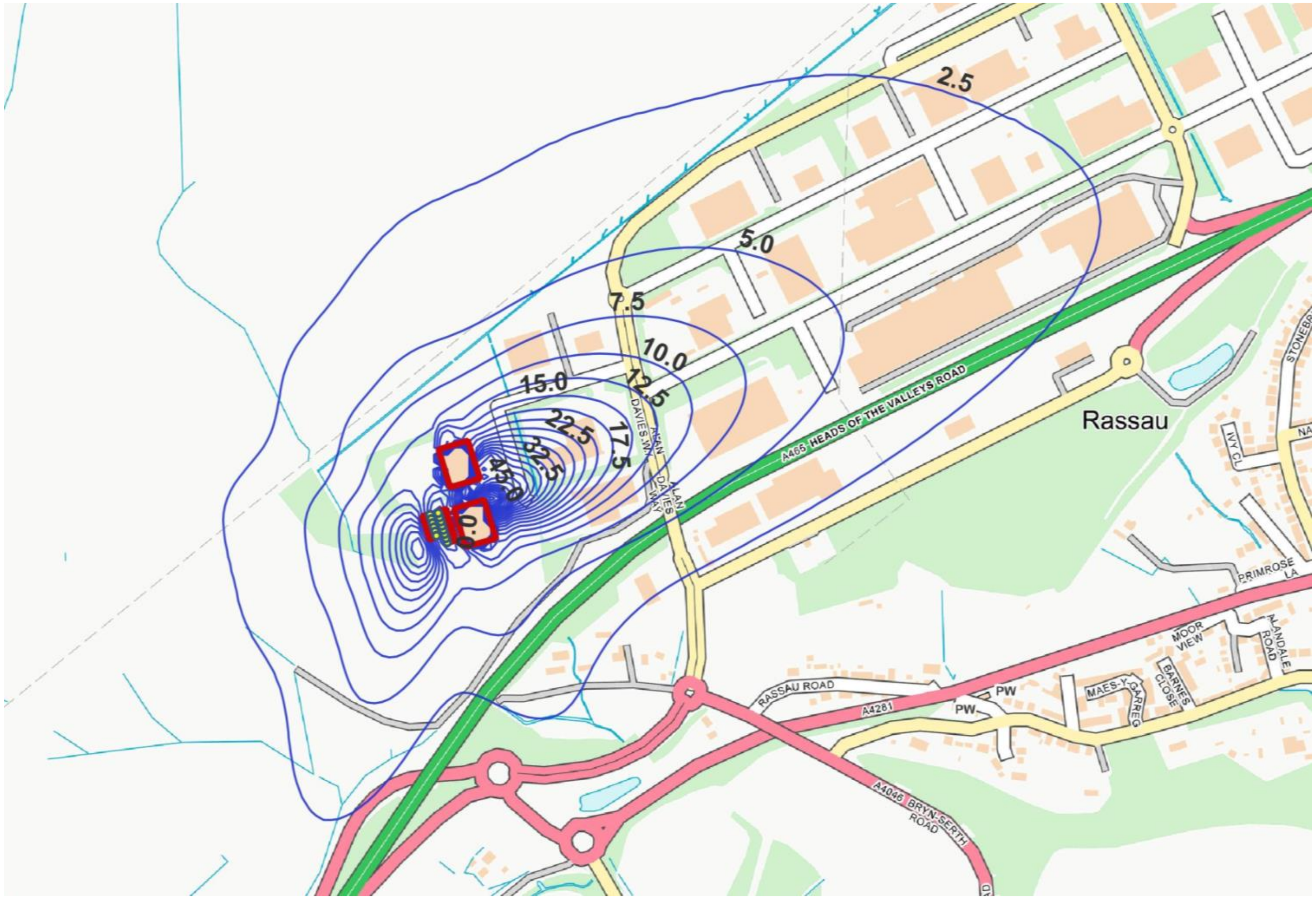
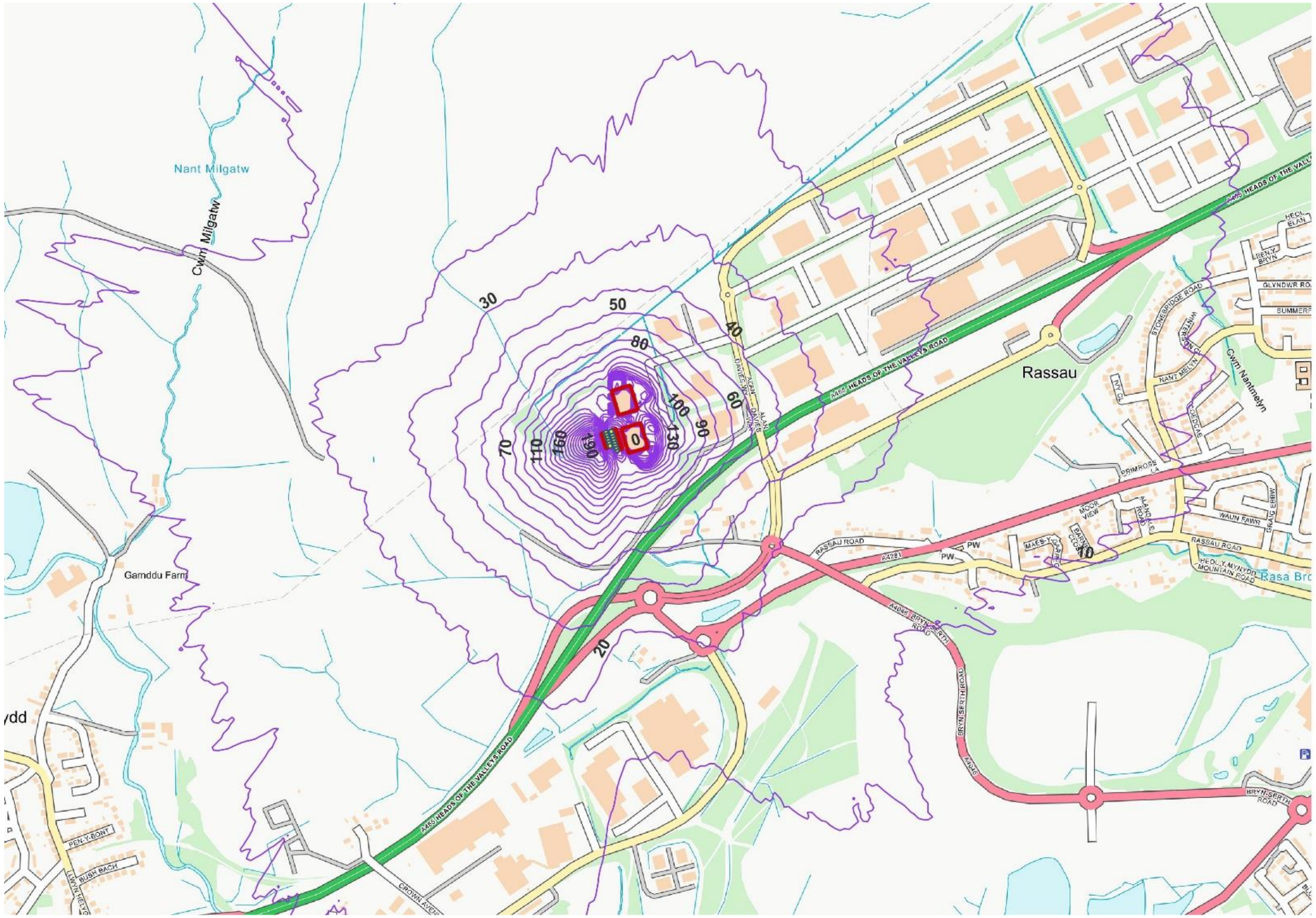


Figure 5.2: 99.79th Percentile Hourly-Mean NO_2 Process Contributions ($\mu g.m^{-3}$)



Significance of Effects

5.5 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. This assessment has therefore used professional judgement to establish the significance of the effects of the development.

5.6 The impacts at sensitive 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 Conclusions

6.1 This report details the air quality assessment undertaken to accompany the permit application for the natural-gas powered generators at Rassau Industrial Estate, Ebbw Vale.

6.2 The assessment covers an evaluation of the impacts on the local area of NO_2 emissions from the generators operating for up to 7,000 hours a year.

6.3 Detailed atmospheric dispersion modelling has been undertaken to predict contributions from the stacks. Modelling has been undertaken using five years of hourly sequential meteorological data. Concentrations have been predicted at selected sensitive receptors and compared with the relevant long and short-term AQS objectives.

6.4 The results show that the predicted concentrations associated with operations at the site are below the relevant air quality standards and the impacts can be screened out as insignificant.

6.5 Using professional judgement, the resulting air quality effect of the generators is considered to be ‘not significant’ overall.

Appendices

Appendix A: Assessment of Ecological Impacts

A.1 The NRW guidance on 'Screening for protected conservations areas' 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 (LNR)) within 2 km of the proposed development.

A.2 As such, the assessment considers the impact of the emitted NO_x concentrations, nutrient nitrogen deposition and acid deposition at the following designated sites:

- Sirhowy Hill Woodlands and Cardiff Pons LNR;
- Mynydd Llangynidr SSSI;
- Mynydd Llangatwg/ Usk Bat sites SAC/SSSi; and
- Ancient Woodland.

Approach

A.3 Concentrations of NOx have been predicted using the same model as used in the assessment of impacts at human-health receptors. Modelling has been undertaken for the nearest points of each nature conservation site to the Application Site. The receptor points have been modelled at ground level.

Critical Levels

A.4 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. The total PCs and, if appropriate, PECs of NOx have been calculated for comparison with the relevant critical level. Background concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [11].

Critical Loads

A.5 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. Nutrient nitrogen deposition and acid deposition are considered in this Appendix.

Critical Loads – Nutrient N Deposition

A.6 Percentage contributions to nutrient nitrogen deposition have been derived from the modelled NOx concentrations. 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 of 0.003 $m.s^{-1}$ for forests/tall habitats and 0.0015 $m.s^{-1}$ for grassland/short 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 NOx.
- 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

A.7 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. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

A.8 Wet deposition in the near field is not significant compared with dry deposition for N [12] and therefore for the purposes of this assessment, wet deposition has not been considered.

A.9 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

A.10 Maximum PCs and PECs of NO_x and N/acid deposition have been compared against the relevant critical levels/loads for the relevant habitat type/interest feature. The Environment Agency guidelines [13] 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."

A.11 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."

A.12 For local nature sites i.e. LNRs and ancient woodlands, 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

A.13 The ambient NO_x concentrations and existing deposition rates have been obtained from APIS. The highest deposition rates have been obtained taking into account the various habitats across the sites. The lowest critical loads for nitrogen deposition and acid deposition have been also obtained from APIS [14].

A.14 The maximum predicted annual-mean NO_x and daily-mean NOx concentrations are compared with the critical level in Tables A1, A2 and A3. The maximum predicted nutrient N deposition rates are compared with the critical load in Table A4. The maximum predicted acid deposition rates are compared with the critical load function in Table A5.

Table A.1 Predicted Annual Mean NOx Concentrations at Designated Sites

Designated Site	Annual Mean CL ($\mu g.m^{-3}$)	AC ($\mu g.m^{-3}$) Background	Annual Mean NOx PC ($\mu g.m^{-3}$)	PC/CL (%)	PEC ($\mu g.m^{-3}$)	PEC/Critical Level (%)
Ancient Woodland	30	9.20	1.02	3	10.22	34
Sirhowy Hill Woodlands and Cardiff Pons LNR	30	9.70	0.46	2	10.16	34
Mynydd Llangynidr SSSI	30	6.41	0.74	2	7.15	24
Mynydd Llangatwg/ Usk Bat Sites SAC/ SSSI	30	8.32	0.56	2	8.89	30

Note:

Consistent with the Institute of Air Quality Management’s “A guide to the assessment of air quality impacts on designated nature conservation sites” [15], the PC as a % of the CL has been rounded to the nearest integer.

A.15 As the annual mean NO_x concentration is over 1% of the critical level value, the impacts cannot be screened out at the PC stage. The PEC was calculated along with the PEC/ critical level percentage.

A.16 Table A.1 shows that the PEC/ CL percentage for all ecological sites are less than 70% and can therefore be screened out.

Table A.1 Predicted Daily Mean NOx Concentrations at Designated Sites

Designated Site	Daily Mean CL ($\mu g.m^{-3}$)	AC ($\mu g.m^{-3}$) Background	Daily Mean NOx PC ($\mu g.m^{-3}$)	PC/CL (%)	PEC ($\mu g.m^{-3}$)	PEC/ CL (%)
Ancient Woodland	75	18.40	23.60	31	42.00	56
Sirhowy Hill Woodlands and Cardiff Pons LNR	75	19.40	9.04	12	28.44	38
Mynydd Llangynidr SSSI	75	12.83	10.29	14	23.11	31
Mynydd Llangatwg/ Usk Bat Sites SAC/ SSSI	75	16.66	6.09	8	22.74	30

Table A.3 Predicted Nutrient N Deposition at Designated Sites

Designated Site	CL (kgN.ha^{-1}.yr^{-1})	PC (kgN.ha^{-1}.yr^{-1})	PC/CL (%)
Ancient Woodland	10	0.21	2
Sirhowy Hill Woodlands and Cardiff Pons LNR	10	0.09	1
Mynydd Llangynidr SSSI	5	0.07	1
Mynydd Llangatwg/ Usk Bat Sites SAC/ SSSI	5	0.06	1

Note:

Critical loads (CLs) for nutrient nitrogen deposition are provided as a range. In this case, the lower limit of the CL range has been used in the assessment.

Consistent with the Institute of Air Quality Management's "A guide to the assessment of air quality impacts on designated nature conservation sites" [15], the PC as a % of the CL has been rounded to the nearest integer.

Table A.4 Predicted Acid Deposition at Designated Sites

Designated Site	CLMax S (keq.ha^{-1}.yr^{-1})	CL Min N (keq.ha^{-1}.yr^{-1})	CL Max N (keq.ha^{-1}.yr^{-1})	PC (keq.ha^{-1}.yr^{-1})	PC/CL (%)
Ancient Woodland	0.80	0.50	2.80	0.015	1
Sirhowy Hill Woodlands and Cardiff Pons LNR	0.801	0.321	0.967	0.007	1
Mynydd Llangynidr SSSI	0.80	0.32	0.97	0.005	1
Mynydd Llangatwg/ Usk Bat Sites SAC/ SSSI	0.66	0.32	0.98	0.004	0

Note:

CLF = Critical Load Function. Consistent with the Institute of Air Quality Management's "A guide to the assessment of air quality impacts on designated nature conservation sites" [15], the PC as a % of the CL has been rounded to the nearest integer.

Annual-mean NOx

A.17 The annual-mean NO_X PCs exceed 1% of the critical level and the impacts cannot be screened out as insignificant at this stage. However, the maximum annual-mean NO_X PEC does not exceed 100% of the critical level and the impacts can be screened out as insignificant.

Daily-mean NOx

A.18 The maximum daily-mean NO_X PCs exceed 10% of the critical level and the impacts cannot be screened out as insignificant at this stage. However, the maximum daily-mean NO_X PEC does not exceed 100% of the critical level and the impacts can be screened out as insignificant.

Nutrient N and Acid Deposition

A.19 The maximum nitrogen and acid deposition PCs do not exceed 1% of the critical load at the SAC or SSSI and the impacts can be screened out as insignificant. For local nature sites i.e the LNR and ancient woodland, the PCs do not exceed 100% of the critical load and the impacts can be screened out as insignificant.

References

1 Defra, 2010, The Air Quality Standards Regulations.

2 The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020

3 HMSO (1995) Environment Act 1995

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

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

6 OPSI (2016) The Environmental Permitting (England and Wales) Regulations 2016

7 Defra, 2022, Local Air Quality Management Technical Guidance, 2022 (LAQM.TG22)

8 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

9 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

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

11 Air Pollution Information Systems, www.apis.ac.uk

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

13 Air emissions risk assessment for your environmental permit

14 Data downloaded from APIS January 2024

15 IAQM, 2020. A guide to the assessment of air quality impacts on designated nature conservation sites