Virtus Saunderton Data Centre Campus

Air Quality Assessment

Air Quality Report

Prepared for: **Bryden Wood Technology Limited**

Prepared by: Ramboll UK Limited
Arkwright House,
Parsonage Gardens,
Manchester, M3 2LF
United Kingdom
+44 (0)20 7394 3700

Document Control

Project Name:	Virtus - Saunderton	**Revision:**	P06
Project No:	24027 (Bryden Wood Technology Limited) 162TG_T11066 (Ramboll UK Ltd)	**Status:**	S4
Document No:	24027-TEM-ZZZ-ZZ-RP-Y-0002		

Date:	**Purpose of Issue**	**Rev:**	**Author:**	**Reviewer:**	**Approver:**
04/09/2024	Stage 2 – Suitable for review and comment	P01	Daniel Mullick	Harry Porter	Dr Xiangyu Sheng
17/01/2025	Stage 3 – Suitable for review and comment	P02	Zayn Dubois Gafar	Daniel Mullick	Dr Xiangyu Sheng
03/02/2025	Stage 3 – Suitable for review and comment	P03	Zayn Dubois Gafar	Daniel Mullick	Dr Xiangyu Sheng
31/03/2025	Stage 3 – Suitable for Stage Approval	P04	Daniel Mullick	-	-
26/01/2026	Stage 3 Update – Suitable for review and comment	P05	Zayn Dubois Gafar	Callum Hayles	Dr Xiangyu Sheng
22/04/2026	Stage 3 Update – Suitable for review and comment	P06	Zayn Dubois Gafar	Callum Hayles	Dr Xiangyu Sheng

Contents

1 Introduction

Ramboll UK Limited (previously Temple Group Limited) has undertaken an air quality assessment for a proposed development at the Saunderton Data Centre, within the jurisdiction of Buckinghamshire Council (BC). The site plan is shown in **Figure 1.1** below; and a site location plan in **Figure A.1** in Appendix A. The site is not located in an air quality management area.

The Applicant seeks an Environmental Permit for the operation of a data centre, which will incorporate a back-up electricity generation capacity consisting of diesel fuelled generators and associated fuel storage to ensure continuity of electricity supply and operation in the event of an emergency where the normal electrical supply to the site is interrupted. The site will have 57 diesel generators. It is understood that the plant that will be used to provide the backup generator capacity comprises banks of diesel fired compression ignition engines located adjacent to the buildings that make up the data centres. The operation of the generators will be limited to testing and emergency situations when there is demand for power in the event of a mains electricity failure.

Emissions from the diesel generators could have an impact on local air quality. The main air pollutants of concern are oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) and consequently detailed dispersion modelling has been undertaken to assess the impact of emissions to air from generators on air quality in the area surrounding the Site.

Figure 1.1: Site Plan

2 Policy, Guidance and Assessment Thresholds

2.1 Air Quality Assessment Thresholds

This air quality assessment has considered compliance with the air quality objectives (AQOs) prescribed in the 'Air emissions risk assessment for your environmental permit' (Department for Environment, Food and Rural Affairs (Defra) and Environment Agency (2024)) guidance ('the AERA guidance') as follows:

- Air Quality Objectives, derived from the Air Quality (England) Regulations 2000 as amended;
- Air Quality Standards, derived from the emissions limit values in the Ambient Air Quality Directive (2008/50/EC) and which were transposed into English and Welsh law as air quality standards (AQSs) via the Air Quality Standards Regulations 2010[1];
- Critical levels and Environmental Assessment Levels, derived from the 'Air emissions risk assessment for your environmental permit' ((EA) and (Defra), 2025) ('the AERA guidance');
- Critical loads, obtained from the Air Pollution Information System website; and
- Acute Exposure Guideline Levels (AEGL). There are three tiers, depending on the severity of potential impacts.

The AQOs, AQSs and EALs are outlined in **Table 2.1**, below. The AEGLs and critical loads have been presented in the assessment tables in **Section 4**.

[1] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (as amended).

Table 2.1: Air quality thresholds relevant to the assessment

Pollutant (location applicable at)	Threshold Level	Type of Threshold	Measured as
NO (nitrogen monoxide)	4400 µg/m^3	EAL	1-hour mean
	310 µg/m^3	EAL	Annual mean
NO_2 (human receptors)	200 µg/m^3, not to be exceeded more than 18 times per year	AQO	1-hour mean
	40 µg/m^3	AQO	Annual mean
PM_{10} (human receptors)	50 µg/m^3, not to be exceeded more than 35 times per year	AQO	24-hour mean
	40 µg/m^3	AQO	Annual mean
$PM_{2.5}$ (human receptors)	20 µg/m^3	AQS	Annual mean
NOx (ecological receptors)	30 µg/m^3	AQS	Annual mean
	75 µg/m^3	Critical level	24-hour mean

2.2 Technical Standards and Guidance

This assessment has been prepared in accordance with the AERA guidance and refers to the following guidance documents:

- The Specified Generators: Dispersion Modelling Assessment ((EA) and Natural Resources Wales, 2023); and
- The Environmental Permitting: Air Dispersion Modelling Reports guidance (EA and Defra, 2024).

Local Air Quality Management Technical Guidance ('TG22')

TG22[2] includes guidance for local authorities to assess and, where required, deliver improvements in air quality within their jurisdiction. It also explains the locations where AQOs should and should not be applied at human receptor locations, which has been used in this assessment, and is outlined further in **Table 2.2**, below.

[2] Department for Environment, Food and Rural Affairs, 2022. *Part IV of the Environment Act 1995 as amended by the Environment Act 2021: Local Air Quality Management: Technical Guidance (TG22).* London: Crown.

Table 2.2: Examples of where the air quality objectives should apply, as per TG22

Averaging Period Objectives	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 etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties (not at peripheries or front gardens unless exposure is likely there).	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and: 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expect to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Environment Agency Emissions from Specified Generator Guidance

The assessment has principally been carried out following the EA Emissions from specified generators [Version 1] guidance [3] and the referenced guidance therein.

[3] Environment Agency, 2023. *Emissions from specified generators guidance*.

For dispersion modelling purposes it is assumed that the generators will be operational all year round.

Guidance provided by the EA provides a methodology to assess the probability of exceedances of the hourly mean AQO. The hypergeometric probability distribution test provides an estimate of the probability of breaching the AQO given random use of the generators for a total number of operating hours per year. **Table 2.3** shows how the calculated probabilities are judged by the EA.

Table 2.3: Probability Significance for hourly mean AQO

Averaging Period Objectives	Objectives should apply at
1%	Indicates exceedance is highly unlikely
5%	Indicates that exceedance is unlikely provided generator lifetime is less than 20 years
>5%	Indicates potential for exceedance

The annual mean pollutant concentrations are calculated on the assumption that all of the generators will operate continuously in an emergency for a worst-case 72-hour timeframe.

3 Air Quality Assessment Method

3.1 Air Quality Assessment Model Set Up

The atmospheric dispersion model ADMS-Roads (v5.1.0.2) was used for quantifying the impact of emissions from the generators on NOx, NO_2 and particulate matter concentrations. ADMS-Roads uses detailed information regarding the pollutant releases, building effects and local meteorological conditions to predict pollutant concentrations at specific locations and areas as selected by the user and is approved by the EA for regulatory applications.

3.2 Scenarios Modelled

It is understood that Virtus will undertake routine testing and servicing will take place at the following intervals:

- **Virtus Test 1:** representative of a 15 minute “switch on” offload test; to be carried out on monthly basis in eleven months of the year. In reality this will be limited to approximately 5 minutes;
- **Virtus Test 2:** representative of a full service onload test consisting of an initial 20 minutes at 100% load immediately followed by 120 minutes at 100% load; to be carried out once per year in the 12th month of the year. Virtus have indicated that up to three generators may operate at any one time.

It is understood that the generators will operate for a period of time equal to or less than the time taken to complete each annual full service onload test. As such, an additional scenario has not been presented to account for commissioning and decommissioning.

The generators will also operate when power outages may arise.

It is understood that the EA expect for a theoretical failure in mains electricity lasting 72 hours to be tested.

Aside from the routine monthly testing or emergency power generation, none of the generators will be operated for any purpose.

The likelihood of generators being used in an emergency scenario is an exceptionally rare event given Virtus currently has a 99.94% operational record, where unplanned emergency use over the last three years across their nine sites equates to 0.06% of the total operational time.

Based on this information, the following scenarios have been modelled:

- **Scenario 1 (S1) – Emergency Scenario:** All generators modelled and factored to operate for 72 hours per annum at 100% output;

- **Scenario 2 (S2) – Routine annual testing:** One generator has been modelled and factored to operate for three hours per annum at 100% load, which represents the greatest emissions rate; and
- **Scenario 3 (S3) – Routine monthly testing:** To simulate Virtus Test 2, three generators have been modelled to and factored to operate simultaneously for 11 hours per annum at 100% load. This load reflects a conservative assumption in the absence of data from the manufacturers indicating emissions rates for off-load tests.

In relation to routine testing (**S2** and **S3**), the order in which generators will be tested during the monthly testing is unknown. Multiple generators could be tested within a single hour. Offsite impacts from the use of generators that are located close to each other will be very similar, although impacts at individual receptors from generators at different ends of the banks are expected to differ. To assess the impact from sequential testing, the impacts from one generator (at the extreme ends of each bank but towards the outside of the site, closest to receptors) has been modelled at eight different stack locations.

It should be noted that due to the limited operating time on any given day for the testing scenarios, assessment of daily average concentrations is not considered to be applicable and has therefore been screened out of the assessment. The maximum number of consecutive testing hours is understood to be 2.3 hours.

3.3 Discharge Conditions and Emission Rates

A total of 57 high power density diesel generator sets are proposed for installation across the Site. Of this total, 7 Baudouin generators are proposed for installation on building LON15; two have a power rating of 2.8 MW (engine model: 16M55G6D2/5), whilst the other 5 have a power rating of 2.4 MW (engine model: 12M55G10D2/5).

The other 50 generator sets proposed for installation on buildings LON16, LON17 and LON18 are 2.4MW Baudouin generators (engine model: 16M55G3000/5). All proposed generators are certified to the US EPA Tier II standard and therefore meet the minimum requirement for Best Available Techniques (BAT). No selective catalytic reduction has been recommended.

Each flue will discharge vertically without a cowl serving to impede dispersion.

A summary of the flue parameters and emissions to air used in the dispersion modelling (per generator) is provided in **Table 3.1** - **Table 3.3**. **Figure A.1** and **Figure A.2** in **Appendix A** shows the locations of the generator flues.

Table 3.1: Flue parameters & emissions used in the modelling for the Baudouin (16M55G6D2/5) 2.8 MW generators

Parameter (for each generator)	S1	S2	S3
Stack Height above ground level (m)	11 in blocks F15 – F17; 15.98 in block F18		
Location of flues	F17: 480851.53, 198555.06; F21: 480790.76, 198515.32.		
Output duct stack diameter (m)	3.27		
Stack exit velocity (m/s)	8.99		
Efflux temperature (°C)	492.6		
Engine power (BKW)	3302 (100% load)		
NO_x emissions (g/s)	7.25		
PM_{10}/ $PM_{2.5}$ emissions (g/s)	0.009		
Diurnal profile	1	0.5 (daily profile), as testing and servicing limited to 12 hours per day. This approach agreed with Air Quality Modelling and Assessment Unit (A. Rizzo, Pers. Comm., 2024).	1

Table 3.2: Flue parameters & emissions used in the modelling for the Baudouin (12M55G10D2/5) 2.4MW generators

Parameter (for each generator)	S1	S2	S3
Stack Height above ground level (m)	11 in blocks F15 – F17; 15.98 in block F18		
Location of flues	F18, 480848.44, 198559.79 F19, 480845.40, 198564.46 F20, 480842.31, 198568.91 F22, 480787.76, 198519.90 F23, 480784.63, 198524.63 F24, 480745.14, 198485.60		
Output duct stack diameter (m)	3.27		
Stack exit velocity (m/s)	6.65		
Efflux temperature (°C)	493		

Parameter (for each generator)	S1	S2	S3
Engine power (BKW)	2701 (100% load)		
NO_x emissions (g/s)	6.98		
PM_{10}/ $PM_{2.5}$ emissions (g/s)	0.008		
Diurnal profile	1	0.5 (daily profile), as testing and servicing limited to 12 hours per day. This approach agreed with Air Quality Modelling and Assessment Unit (A. Rizzo, Pers. Comm., 2024).	1

Table 3.3: Flue parameters & emissions used in the modelling for the Baudouin (16M55G3000/5) 2.4MW generators

Parameter (for each generator)	S1	S2	S3
Stack Height above ground level (m)	11 in blocks F15 – F17; 15.98 in block F18		
Location of flues	Flue 1, 480927.95, 198438.36 Flue 2, 480924.73, 198442.95 Flue 3, 480921.69, 198447.66 Flue 4, 480918.70, 198452.37 Flue 5, 480874.00, 198520.59 Flue 6, 480871.05, 198525.19 Flue 7, 480867.87, 198529.90 Flue 8, 480864.92, 198534.56 Flue 9, 480866.83, 198398.73 Flue 10, 480864.03, 198403.27 Flue 11, 480860.90, 198407.81 Flue 12, 480857.92, 198412.49 Flue 13, 480813.23, 198480.84 Flue 14, 480810.26, 198485.42 F15, 480807.17, 198490.07 F16, 480804.08, 198494.65 F25, 480742.10, 198490.18		

Parameter (for each generator)	S1	S2	S3
	F26, 480739.10, 198494.76 F27, 480700.16, 198554.23 F28, 480697.24, 198558.99 F29, 480694.19, 198563.56 F30, 480633.30, 198523.80 F31, 480636.37, 198519.11 F32, 480639.43, 198514.31 F33, 480678.26, 198455.12 F34, 480681.36, 198450.36 F35, 480684.32, 198445.67 F37, 480818.98, 198366.98 F39, 480815.91, 198371.77 F41, 480812.89, 198376.36 F45, 480758.97, 198458.65 F47, 480755.84, 198463.18 F49, 480763.41, 198330.88 F51, 480760.39, 198335.48 F53, 480757.20, 198340.14 F55, 480703.55, 198422.25 F57, 480700.68, 198426.90 F50, 480760.90, 198329.04 F52, 480757.58, 198333.63 F54, 480754.71, 198338.42 F56, 480700.74, 198420.40 F58, 480697.93, 198425.18 F38, 480821.53, 198368.83 F40, 480818.55, 198373.49 F42, 480815.44, 198378.10 F46, 480761.76, 198460.09 F48, 480758.80, 198464.94 F62, 480751.63, 198343.00 F60, 480812.43, 198382.73		
Output duct stack diameter (m)	3.27		
Stack exit velocity (m/s)	7.11		

Parameter (for each generator)	S1	S2	S3
Efflux temperature (°C)	588		
Engine power (BKW)	2500 (100% load)		
NO_x emissions (g/s)	4.65		
PM_{10}/ $PM_{2.5}$ emissions (g/s)	0.083		
Diurnal profile	1	0.5 (daily profile), as testing and servicing limited to 12 hours per day. This approach agreed with Air Quality Modelling and Assessment Unit (A. Rizzo, Pers. Comm., 2024).	1

As the generators do not provide emissions rates for both PM_{10} and $PM_{2.5}$, it is assumed that 100% of PM_{10} emissions are $PM_{2.5}$. Compliance with the 24-hour mean AQO has not been assessed since the generators will operate for less than 35 days per annum, save for extreme emergency circumstances. Therefore, this AQO is expected to be complied with.

3.4 Meteorological Data

Meteorological data, including wind speed and direction, is used by the model to determine pollutant dispersion. 2020 to 2024 data from the London Heathrow Airport meteorological site were used in the dispersion model. Wind roses for each year of meteorological data used are provided **Figures A.3** to **A.7** in **Appendix A**.

3.5 Buildings

ADMS takes into account the effects of building downwash on pollutants. A summary of the buildings included within the model set up are summarised in **Table 3.4** and their positions shown on **Figure A.1** and **Figure A.2** in **Appendix A**.

Table 3.4: Buildings included in the dispersion modelling

Building	Shape	Height (m)	Length (m)	Width (m)	Angle (°)
L15	Rectangular	9.90	63.20	107.99	146.23
L16	Rectangular	9.90	116.57	108.15	147.09
L17	Rectangular	9.90	107.44	96.58	236.49
L18	Rectangular	14.90	117.87	109.63	146.56

Substation	Rectangular	6.63	24.75	107.35	147
Office	Rectangular	9.04	12.28	47.49	147

3.6 Assessment Receptors

Sensitive existing human receptors were selected at a range of locations representative of relevant exposure (see **Table 2.2**), including at locations where sources of combustion were considered to have the greatest impact.

The AERA guidance indicates that the following ecological receptors should be included:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs) and Ancient Woodland within 2km of the installation.

Natural England's Multi-Agency Geographic Information for the Countryside (MAGIC) website[4] and a data search of Local Wildlife Sites were used to identify the closest point(s) of each designated ecological sites within these screening distances.

The existing receptors included are shown in **Table 3.5** below and are presented in **Figure A.1** and **Figure A.2** in **Appendix A**.

Table 3.5: Sensitive Receptor Locations

Receptor ID	Receptor Name	X coordinates	Y coordinates	Height (m)
1	Hearnton Wood Ancient Woodland and LWS	481270	197557	0
2	Chilterns Beechwoods SAC	481958	198177	0
3	Chilterns Beechwoods SAC	482223	198470	0
4	Chilterns Beechwoods SAC	482205	198658	0
5	Chilterns Beechwoods SAC	482245	198848	0
6	Chilterns Beechwoods SAC	482334	199006	0
7	Chilterns Beechwoods SAC	482166	198333	0
8	Munts Wood Ancient Woodland	481632	198741	0
9	Munts Wood Ancient Woodland	481598	198884	0
10	Munts Wood Ancient Woodland	481551	198978	0
11	Munts Wood Ancient Woodland	481477	199020	0

[4] Natural England. Available at: http://magic.defra.gov.uk/MagicMap.aspx

Receptor ID	Receptor Name	X coordinates	Y coordinates	Height (m)
12	Munts Wood Ancient Woodland	481382	199107	0
13	Munts Wood Ancient Woodland	481312	199183	0
14	Munts Wood Ancient Woodland	481277	199288	0
15	Munts Wood Ancient Woodland	481218	199419	0
16	Unnamed Ancient Woodland to southwest	479835	197059	0
17	Unnamed Ancient Woodland to southwest	479950	196936	0
18	Unnamed Ancient Woodland to southwest	480018	196859	0
19	Yoesden Wood Ancient Woodland	479123	197750	0
20	Lodge Hill SSSI	479142	199299	0
21	Neighbours Wood Ancient Woodland	479035	199161	0
22	Unnamed Ancient Woodland to southwest	481035	196497	0
23	Unnamed Ancient Woodland to southwest	479650	196793	0
24	Unnamed Ancient Woodland to southwest	479395	196975	0
25	Chilterns Beechwoods SAC	482420	202077	0
26	Chiltern's Beechwoods SAC	481843	203030	0
28	Chilterns Beechwoods SAC	482780	205519	0
29	Chilterns Beechwoods SAC	482921	205352	0
30	Chilterns Beechwoods SAC	476744	197898	0
31	Widdenton Park Wood SSSI	481709	192063	0
32	Moorend Common SSSI	480119	190915	0
33	Turville Hill SSSI	476971	191535	0
34	Chilterns Beechwoods SAC	482058	186619	0
35	Chilterns Beechwoods SAC	485723	185379	0
EG01	Residential Garden	480795	198666	1.5
EG02	Residential Garden	480619	198541	1.5
EG03	Residential Garden	480878	198687	1.5
EG04	Residential Garden	481003	198911	1.5
ER01	Residence	480789	198680	1.5
ER02	Residence	480605	198557	1.5

Receptor ID	Receptor Name	X coordinates	Y coordinates	Height (m)
ER03	Residence	480869	198721	1.5
ER04	Residence	481037	199008	1.5
ER05	Residence	481084	198743	1.5
ER06	Residence	481184	198403	1.5
ER07	Residence	481222	198438	1.5
36	Slough Hill LWS	480638	198314	0
37	Slough Hill LWS 2	480673	198254	0
38	Slough Hill LWS 3	480707	198202	0
39	Slough Hill LWS 4	480728	198172	0
39	Slough Hill LWS 4	480758	198127	0
40	Bradenham LWS	481298	198382	0
10	Munts Wood Ancient Woodland	481710	198680	0
41	Chawley Manor Farm Fields & Horseshoe Field LWS	480239	197017	0
42	Slough Bottom Farm	481264	197553	0
43	Munt's Wood and Bank LWS 1	481623	198731	0
44	Munt's Wood and Bank LWS 2	481582	198881	0
45	Munt's Wood and Bank LWS 3	481541	198966	0
46	Munt's Wood and Bank LWS 4	481468	199012	0
47	Munt's Wood and Bank LWS 5	481377	199104	0
48	Munt's Wood and Bank LWS 6	481304	199178	0
49	Yoesden Wood and Bank LWS	479020	198000	0
50	Yoesden Wood and Bank LWS	478880	198300	0
51	Yoesden Wood and Bank LWS	479030	197940	0
52	Yoesden Wood and Bank LWS	479120	197750	0
53	Neighbour's Wood LWS	479090	199240	0
54	Rout's Green Chalk Bank LWS	479240	198880	0
55	Saunderton Railway LWS	480520	200460	0
56	Bacombe and Coombe Hills SSSI	484595	206186	0
59	Chinnor Hill SSSI	476656	200233	0

Receptor ID	Receptor Name	X coordinates	Y coordinates	Height (m)
60	Frieth Meadows SSSI	479860	190627	0
61	Millfield Wood SSSI	486785	195256	0
62	Lodge Hill SSSI	479536	199718	0
63	Swain's Wood SSSI	474178	192125	0
64	Aston Rowant Cutting SSSI	473959	196743	0
65	Shirburn Hill SSSI	472904	196497	0
66	Aston Rowant Woods SSSI	476734	197898	0
67	Bradenham Woods, Park Wood & The Coppice SSSI	481959	198178	0
68	Bacombe and Coombe Hills SSSI	484587	206191	0
69	Grangelands & Pulpit Hill SSSI	482779	204660	0
70	Naphill Common SSSI	483438	196970	0
71	Windsor Hill SSSI	482411	202087	0
72	Wormsley Chalk Banks SSSI	473804	195845	0

3.7 Surface Roughness and Terrain

Since terrain around the Site appears to exceed a 10% gradient in places, the ADMS complex terrain module has been used. A digital terrain file covering all the receptors was produced from Ordnance Survey data.

A surface roughness of 0.4 was applied at both the dispersion and meteorological site, owing to the rural environs around the Site and low-rise buildings in the vicinity of Heathrow Airport.

A minimum Monin-Obukhov length of 10 metres was used across the dispersion modelling study area, as a conservative approach.

3.8 Assessment of NOx and NO_2 concentrations

To obtain a predicted environmental concentration (PEC) has been calculated by adding the process contribution (PC) and background pollutant concentrations, derived from other sources. The maximum concentration from any generator modelled and across any of the five meteorological years has been assessed.

Background concentrations of sub-annual mean concentrations were doubled. This enables comparison to the relevant AQO for each scenario.

Ambient NOx concentrations were predicted through dispersion modelling. Concentrations of NO_2 shown in the results section assume, as outlined in the AERA:

- 70% conversion from NOx to NO_2 to calculate annual mean concentrations; and
- 35% conversion from NOx to NO_2, to calculate sub-annual mean concentrations (and 15% for receptor locations situated within 500m of the generator flues).

The annual mean pollutant concentrations were calculated using the following method:

- Summing the number of hours per year allocated for **S1** or **S3** for Emergency Operation and Testing per generator and diving this by 8,760;
- Multiplying this by the modelled NOx, NO, NO_2 or PM_{10} concentration, excluding the background; and
- Adding this to the background concentration for 2026 (the year during which the first generators are anticipated to be commissioned) for the 1km^2 grid within which each receptor is located, derived from the 2021 base year UK-AIR background maps in most instances. At those receptors considered roadside (ER05 and ER07), concentrations measured at nearby roadside monitor W59 during 2023 (according to the Buckinghamshire Council Air Quality Annual Status Report 2024) were applied. The NOx to NO_2 calculator was used to estimate NOx concentrations based on this NO_2 value at receptor 40.

Given the intermittent and unknown pattern of operation of the generators, the number of hours upon which the hourly mean NO_2 concentrations breached the AQO was calculated by statistical analysis using a hypergeometric probability distribution function and multiplied by 2.5 to provide a safety buffer. This accords with the process described in the EA's guidance on dispersion modelling for specified generators. For the assessment of short-term effects calculated using the cumulative hypergeometric distribution, the EA's guidance on undertaking dispersion modelling for specified generators states that where the probability is:

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

The statistical likelihood of exceedance of the AQO if all hours of testing were to occur at each generator location individually was then considered using the hypergeometric distribution function.

Dispersion modelling uses hourly sequential meteorological data and as such, concentrations cannot be predicted on a sub-hourly basis. Thus to estimate compliance with the sub-hourly AEGLs, the following formula has been used:

- Hourly concentration * (60 minutes per hour / time period measured) ^ 0.2.

This formula is derived from the Workbook of Atmospheric Dispersion Estimates[5].

To calculate the nutrient nitrogen deposition at the ecological receptors, the annual mean nitrogen deposition concentration was converted from the annual mean NO_2 using the method outlined in EA (2014) guidance. The PC was compared to the nitrogen critical load. The critical loads applied were habitat-specific and obtained from the Air Pollution Information System (APIS) website.

To calculate the acid deposition, the annual mean nitrogen deposition concentration was converted from the annual mean NO_2 PC using the method outlined in EA (2014) Guidance. The PC was compared to the critical load function.

NO concentrations (both background and PC) were calculated by subtracting the NO_2 concentrations from the NOx concentrations for a specific averaging period, since most NOx which is not converted to NO_2 will be NO.

3.9 Significance Criteria

With regard to the significance of predicted long term impacts, the EA's Guidance for undertaking air emissions risk assessments in support of environmental permit applications says that PCs can be screened out as insignificant at human receptors and at designated ecological sites (in relation to compliance with critical levels) if one of the following criteria is met:

- the long-term PC is less than 1% of the long-term environmental standard; or
- the short-term PC is less than 10% of a short-term environmental standard.

Where impacts cannot be screened out against these criteria, an impact has then been screened by determining whether the applicable AQO is complied with; where it is, impacts are considered insignificant. Impacts are considered significant where neither of these criteria are met.

Emissions that affect designated ecological sites in relation to compliance with critical loads (for nutrient nitrogen or acid deposition) are insignificant if the long-term PC is less than 1% of the critical load at a national or internationally designated site, or 100% at a locally designated site.

[5] Turner, 1970. *Workbook of Atmospheric Dispersion Estimates.*

4 Assessment Results

4.1 Human Receptors

Annual Mean NO_2 and PM_{10} Concentrations

Table 4.2 and **Table 4.3** below presents the maximum annual mean PCs and PECs for NO_2 at the human receptors for the emergency scenario (S1) and testing scenario (S3). It should be noted that S3 has been presented as the worst-case out of the two testing scenarios. The results show that in terms of annual mean NO_2 PC will exceed the screening threshold of 1% of the long-term environmental standard, although as the annual mean AQO is not breached at any receptor location, the increase is not considered significant. For PM_{10}, neither the screening threshold of 1% of the long-term environmental standard or annual mean AQO is breached at any receptor location, therefore the increase is not considered significant.

Table 4.2: Maximum annual NO_2 and PM_{10} concentrations for emergency scenario (S1)

Receptor ID	Nitrogen Dioxide (NO_2)				Particulate Matter (PM_{10} and $PM_{2.5}$)			
	Max. PC (µg/m³)	PC as a % of the AQO	Background (µg/m³)	PEC (µg/m³)	Max. PC (µg/m³)	PC as a % of the AQO	Background (µg/m³)	PEC (µg/m³)
ER01	1.50	3.74	6.01	7.51	0.03	0.16	12.29	12.32
ER02	0.59	1.48	6.01	6.61	0.01	0.07	12.29	12.31
ER03	1.53	3.83	6.01	7.54	0.03	0.15	12.29	12.32
ER04	0.60	1.51	6.05	6.66	0.01	0.06	12.99	13.00
ER05	1.10	2.75	31.70	32.80	0.02	0.11	13.17	13.19
ER06	0.73	1.84	6.29	7.02	0.02	0.09	13.17	13.19
ER07	0.75	1.89	31.70	32.45	0.02	0.09	13.17	13.19

Table 4.3: Maximum annual NO_2 and PM_{10} concentrations for testing scenario (S3)

Receptor ID	Nitrogen Dioxide (NO_2)				Particulate Matter (PM_{10} and $PM_{2.5}$)			
	Max. PC (µg/m³)	PC as a % of the AQO	Background (µg/m³)	PEC (µg/m³)	Max. PC (µg/m³)	PC as a % of the AQO	Background (µg/m³)	PEC (µg/m³)
ER01	0.45	1.13	6.01	6.47	0.03	0.16	12.29	12.32
ER02	0.28	0.70	6.01	6.29	0.01	0.07	12.29	12.31
ER03	0.43	1.07	6.01	6.44	0.03	0.15	12.29	12.32
ER04	0.13	0.32	6.05	6.18	0.01	0.06	12.99	13.00
ER05	0.26	0.64	31.70	31.96	0.02	0.11	13.17	13.19
ER06	0.13	0.34	6.29	6.42	0.02	0.09	13.17	13.19
ER07	0.14	0.35	31.70	31.84	0.02	0.09	13.17	13.19

Short Term NO_2 Concentrations

Table 4.4 – **Table 4.6** present the results of the short-term NO_2 concentrations at human receptors due to emissions from the modelled generators for the emergency scenario (**S1**), as well as for in **S2** and **S3**, representing testing.

The tables also show the AEGLs would not be breached; hence significant impacts relating to the AEGLs being breached are not expected.

Table 4.4: Maximum NO_2 concentration for comparison to the AEGLs for S1

Receptor ID	AEGL: 100th percentile PEC for NO_2 ($\mu g/m^3$)				
	8-Hourly Mean	4-Hourly Mean	1-Hourly Mean	30-minute Mean	10-minute Mean
EG01	399	431	482	553	690
EG02	454	504	579	665	828
EG03	422	441	457	525	654
EG04	162	168	176	202	251
ER01	397	420	488	560	698
ER02	416	488	510	586	716
ER03	352	368	390	448	558
ER04	125	132	139	159	198
ER05	206	214	225	259	322
ER06	213	219	234	269	335
ER07	188	201	211	243	302
AEGL-1	**940**	**940**	**940**	**940**	**940**
AEGL-2	**12596**	**15416**	**22560**	**28200**	**37600**
AEGL-3	**20680**	**26320**	**37600**	**47000**	**63920**

For the emergency scenario (S1), a hypergeometric distribution calculation has also been undertaken to determine the emergency operation to determine the probability of exceeding the 1-hour mean NO_2 objective. For 72 hours of continuous operation, the probability of exceeding the objective was found to be 38.9% following the hypergeometric distribution analyses. Given that the probability is greater than 5%, this indicates potential for exceedance.

However, the likelihood of emergency generators being required for extended periods of time is limited. This is both noting Virtus' 99.94% mains power operational record and the frequency and duration of power outages recorded by the National Grid making all-generator operation over a 24-hour period unlikely.

Table 4.5: Maximum NO_2 concentration for comparison to the AEGLs for S2

Receptor ID	AEGL: 100th percentile PEC for NO_2 ($\mu g/m^3$)				
	8-Hourly Mean	4-Hourly Mean	1-Hourly Mean	30-minute Mean	10-minute Mean

EG01	24	35	53	61	70
EG02	40	43	50	58	66
EG03	18	18	19	22	25
EG04	3	4	4	5	5
ER01	21	22	29	33	38
ER02	31	38	44	51	58
ER03	13	14	14	16	19
ER04	2	3	3	4	4
ER05	5	5	6	6	7
ER06	4	4	5	5	6
ER07	3	4	4	5	6
AEGL-1	**940**	**940**	**940**	**940**	**940**
AEGL-2	**12596**	**15416**	**22560**	**28200**	**37600**
AEGL-3	**20680**	**26320**	**37600**	**47000**	**63920**

Table 4.6: Maximum NO_2 concentration for comparison to the AEGLs for S3

Receptor ID	AEGL: 100th percentile PEC for NO_2 ($\mu g/m^3$)				
	8-Hourly Mean	4-Hourly Mean	1-Hourly Mean	30-minute Mean	10-minute Mean
EG01	132	159	243	279	348
EG02	231	245	278	319	398
EG03	99	104	109	125	156
EG04	20	22	23	26	33
ER01	119	128	157	181	225
ER02	180	221	235	270	337
ER03	75	77	80	92	115
ER04	14	16	17	20	24
ER05	28	30	76	37	46
ER06	23	23	26	30	37
ER07	20	21	24	28	35
AEGL-1	**940**	**940**	**940**	**940**	**940**
AEGL-2	**12596**	**15416**	**22560**	**28200**	**37600**
AEGL-3	**20680**	**26320**	**37600**	**47000**	**63920**

Annual and Hourly Mean Nitrogen Monoxide (NO) Concentrations

Table 4.7 – Table 4.8 below presents the maximum annual mean PCs and PECs for NO at the human receptors for the emergency scenario (S1) and testing scenario (S3). A factor of 1.86 has been applied to NO_2 PC to obtain the NO PC. This conversion factor is derived from the assumption that 35% of NO_x is NO_2 for short term concentrations, in accordance with the EA's Specified Generator Dispersion Modelling Assessment Guidance. It should be noted that S3 has been presented as the worst-case out of the two testing scenarios. The results show that in terms of annual mean NO PC will not exceed the screening threshold of 1% of the long-term environmental standard at any

of the modelled human receptors. Additionally, the annual mean AQO is not breached at any receptor location. Therefore, the increase is not considered significant.

Table 4.7: Maximum annual mean NO concentrations for emergency scenario (S1)

Receptor ID	Annual Mean Nitrogen Monoxide (NO)			
	Max. PC (µg/m^3)	PC as a % of the AQO	Background (µg/m^3)	PEC (µg/m^3)
ER01	2.78	0.90	1.58	4.36
ER02	1.10	0.36	1.58	2.69
ER03	2.84	0.92	1.58	4.43
ER04	1.12	0.36	1.67	2.79
ER05	2.04	0.66	1.58	3.63
ER06	1.36	0.44	1.58	2.95
ER07	1.40	0.45	1.58	2.98

Table 4.8: Maximum annual mean NO concentrations for testing scenario (S3)

Receptor ID	Annual Mean Nitrogen Monoxide (NO)			
	Max. PC (µg/m^3)	PC as a % of the AQO	Background (µg/m^3)	PEC (µg/m^3)
ER01	0.84	0.27	1.58	2.42
ER02	0.52	0.17	1.58	2.10
ER03	0.80	0.26	1.58	2.38
ER04	0.24	0.08	1.67	1.91
ER05	0.48	0.15	1.58	2.06
ER06	0.25	0.08	1.58	1.83
ER07	0.26	0.08	1.58	1.84

Table 4.9 below presents the maximum hourly mean PCs and PECs for NO at the human receptors for each modelled scenario. The results show that in terms of hourly mean NO PC will exceed the screening threshold of 10% of the short-term environmental standard at the majority of modelled human receptors, although the hourly mean AQO is not breached at any receptor location. Therefore, the increase is not considered significant.

Table 4.9: Maximum hourly mean NO concentrations for human receptors

Receptor ID	Hourly Mean NO S1			Hourly Mean NO S2			Hourly Mean NO S3		
	Max. PC (µg/m^3)	PC as a % of the AQO	PEC (µg/m^3)	Max. PC (µg/m^3)	PC as a % of the AQO	PEC (µg/m^3)	Max. PC (µg/m^3)	PC as a % of the AQO	PEC (µg/m^3)
ER01	894.86	20.34	898.02	98.4	2.2	98.4	451.52	10.26	454.68
ER02	1074.84	24.43	1078.01	93.4	255.9	93.4	515.89	11.72	519.05
ER03	849.24	19.30	852.41	35.3	96.7	35.3	202.54	4.60	205.71

ER04	326.37	7.42	329.71	7.6	20.9	7.6	42.45	0.96	45.79
ER05	905.62	20.58	908.79	53.3	146.1	53.3	291.94	6.64	295.11
ER06	946.93	21.52	950.10	82.2	225.3	82.2	437.32	9.94	440.49
ER07	723.90	16.45	727.06	26.6	73.0	26.6	149.47	3.40	152.63

4.2 Ecological Receptors

Table 4.10 presents the annual NOx concentrations for the emergency scenario (S1). The results indicate that for ecological receptors 36-40 (Slough Hill and Bradenham Local Wildlife Sites), the long-term PC is greater than 1% of the long-term environmental standard and the PEC is also greater than the standard. However, since these sites are Local Wildlife Site, the PC may reach 100% of the EAL before it cannot be screened out. The PC is lower than 1% of the long-term environmental standard at all other modelled ecological receptors.

Based on these results, the impacts of changes in annual mean NOx concentrations are insignificant at all assessed receptor locations.

Table 4.10: Maximum annual mean NOx concentrations at ecological receptors for emergency scenario (S1)

Receptor ID	Annual mean NOx			
	Max. PC NOx (µg/m^3)	PC as a % of the AQO	Background NOx (µg/m^3)	PEC NOx (µg/m^3)
1	0.11	0.35	7.89	7.99
2	0.17	0.55	7.96	8.13
3	0.20	0.66	8.15	8.35
4	0.21	0.72	8.15	8.37
5	0.21	0.69	8.15	8.36
6	0.18	0.60	7.69	7.87
7	0.18	0.61	8.15	8.34
8	0.45	1.51	7.96	8.41
9	0.43	1.45	7.96	8.39
10	0.43	1.44	7.96	8.39
11	0.47	1.56	7.65	8.12
12	0.49	1.62	7.65	8.14
13	0.49	1.62	7.65	8.14
14	0.44	1.46	7.65	8.09
15	0.38	1.28	7.65	8.03
16	0.09	0.31	7.57	7.67
17	0.09	0.31	7.62	7.71
18	0.09	0.30	7.61	7.70
19	0.07	0.23	7.57	7.64
20	0.04	0.13	7.38	7.42
21	0.04	0.13	7.38	7.42
22	0.07	0.22	7.68	7.74
23	0.08	0.26	7.62	7.70

Receptor ID	Annual mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
24	0.07	0.24	7.62	7.69
25	0.07	0.24	7.41	7.48
26	0.05	0.18	7.91	7.96
28	0.03	0.11	7.68	7.71
29	0.04	0.12	7.68	7.71
30	0.03	0.11	7.79	7.83
31	0.03	0.11	10.17	10.20
32	0.03	0.11	8.10	8.13
33	0.03	0.09	7.42	7.44
34	0.02	0.07	8.97	8.99
35	0.02	0.08	11.87	11.89
36	0.68	2.28	7.60	8.28
37	0.67	2.25	7.60	8.27
38	0.68	2.28	7.60	8.28
39	0.62	2.06	7.60	8.21
39	0.62	2.06	7.60	8.21
40	0.72	2.40	54.12	54.84
10	0.43	1.44	7.96	8.39
41	0.10	0.35	7.59	7.70
42	0.11	0.35	7.89	7.99
43	0.46	1.54	7.96	8.42
44	0.45	1.49	7.96	8.41
45	0.44	1.48	7.96	8.41
46	0.48	1.59	7.65	8.13
47	0.49	1.64	7.65	8.14
48	0.49	1.64	7.65	8.14
49	0.06	0.22	7.45	7.52
50	0.07	0.22	7.43	7.50
51	0.06	0.22	7.57	7.64
52	0.07	0.23	7.57	7.64
53	0.04	0.13	7.38	7.42
54	0.05	0.18	7.45	7.51
55	0.10	0.34	7.83	7.93
56	0.04	0.12	7.39	7.43
57	0.07	0.25	7.68	7.75
58	0.02	0.07	7.50	7.52
59	0.02	0.07	7.47	7.49
60	0.03	0.11	7.98	8.01
61	0.02	0.07	9.27	9.29
62	0.06	0.19	7.38	7.44
63	0.02	0.06	6.94	6.95
64	0.02	0.06	9.04	9.06
65	0.02	0.05	8.62	8.63

Receptor ID	Annual mean NOx			
	Max. PC NOx (μg/m³)	PC as a % of the AQO	Background NOx (μg/m³)	PEC NOx (μg/m³)
66	0.03	0.11	7.79	7.83
67	0.17	0.56	7.96	8.13
68	0.04	0.12	7.39	7.43
69	0.04	0.13	7.54	7.58
70	0.04	0.13	8.15	8.19
71	0.07	0.24	7.41	7.48
72	0.02	0.06	7.19	7.21

Table 4.11 presents the annual NOx concentrations for the worse-case testing scenario (S3). The results indicate that for ecological receptors, the long-term PC is lower than 1% of the long-term environmental standard at all modelled receptors.

Based on these results, the impacts of changes in annual mean NOx concentrations is insignificant at all assessed receptor locations.

Table 4.11: Maximum annual mean NOx concentrations at ecological receptors for testing scenario (S3)

Receptor ID	Annual mean NOx			
	Max. PC NOx (μg/m³)	PC as a % of the AQO	Background NOx (μg/m³)	PEC NOx (μg/m³)
1	0.02	0.05	7.89	0.02
2	0.02	0.07	7.96	0.02
3	0.03	0.10	8.15	0.03
4	0.03	0.11	8.15	0.03
5	0.03	0.11	8.15	0.03
6	0.03	0.10	7.69	0.03
7	0.03	0.09	8.15	0.03
8	0.08	0.26	7.96	0.08
9	0.08	0.26	7.96	0.08
10	0.08	0.26	7.96	0.08
11	0.09	0.28	7.65	0.09
12	0.09	0.30	7.65	0.09
13	0.09	0.30	7.65	0.09
14	0.08	0.27	7.65	0.08
15	0.07	0.23	7.65	0.07
16	0.01	0.05	7.57	0.01
17	0.01	0.05	7.62	0.01
18	0.01	0.04	7.61	0.01
19	0.01	0.04	7.57	0.01
20	0.01	0.02	7.38	0.01
21	0.01	0.02	7.38	0.01
22	0.01	0.03	7.68	0.01
23	0.01	0.04	7.62	0.01

Receptor ID	Annual mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
24	0.01	0.04	7.62	0.01
25	0.01	0.04	7.41	0.01
26	0.01	0.03	7.91	0.01
28	0.01	0.02	7.68	0.01
29	0.01	0.02	7.68	0.01
30	0.00	0.02	7.79	0.00
31	0.00	0.02	10.17	0.00
32	0.01	0.02	8.10	0.01
33	0.00	0.01	7.42	0.00
34	0.00	0.01	8.97	0.00
35	0.00	0.01	11.87	0.00
36	0.11	0.38	7.60	0.11
37	0.11	0.36	7.60	0.11
38	0.16	0.53	7.60	0.16
39	0.14	0.45	7.60	0.14
39	0.14	0.45	7.60	0.14
40	0.11	0.38	54.12	0.11
10	0.08	0.26	7.96	0.08
41	0.02	0.05	7.59	0.02
42	0.02	0.05	7.89	0.02
43	0.08	0.27	7.96	0.08
44	0.08	0.27	7.96	0.08
45	0.08	0.27	7.96	0.08
46	0.09	0.29	7.65	0.09
47	0.09	0.30	7.65	0.09
48	0.09	0.31	7.65	0.09
49	0.01	0.03	7.45	0.01
50	0.01	0.03	7.43	0.01
51	0.01	0.03	7.57	0.01
52	0.01	0.04	7.57	0.01
53	0.01	0.02	7.38	0.01
54	0.01	0.03	7.45	0.01
55	0.02	0.05	7.83	0.02
56	0.01	0.02	7.39	0.01
57	0.01	0.04	7.68	0.01
58	0.00	0.01	7.50	0.00
59	0.00	0.01	7.47	0.00
60	0.00	0.02	7.98	0.00
61	0.00	0.01	9.27	0.00
62	0.01	0.03	7.38	0.01
63	0.00	0.01	6.94	0.00
64	0.00	0.01	9.04	0.00
65	0.00	0.01	8.62	0.00

Receptor ID	Annual mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
66	0.00	0.02	7.79	0.00
67	0.02	0.07	7.96	0.02
68	0.01	0.02	7.39	0.01
69	0.01	0.02	7.54	0.01
70	0.01	0.02	8.15	0.01
71	0.01	0.04	7.41	0.01
72	0.00	0.01	7.19	0.00

Table 4.12 presents the daily NOx concentrations for the emergency scenario (S1). Whilst the PEC for NOx breached the EAL at the majority of modelled receptor locations in S1, the likelihood of emergency generators being required for extended periods of time is limited. This is both noting Virtus' 99.94% mains power operational record and the frequency and duration of power outages recorded by the National Grid making all-generator operation over a 24-hour period unlikely.

Table 4.12: Maximum daily mean NOx concentrations at ecological receptors for S1

Receptor ID	Daily mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
1	298.82	398.42	15.77	314.59
2	194.76	259.68	15.92	210.68
3	208.09	277.45	16.31	224.40
4	209.18	278.91	16.31	225.49
5	189.68	252.90	16.31	205.99
6	165.94	221.26	15.38	181.32
7	179.67	239.56	16.31	195.98
8	436.94	582.59	15.92	452.86
9	352.84	470.45	15.92	368.76
10	352.84	470.45	15.92	368.76
11	392.25	523.01	15.30	407.55
12	394.06	525.42	15.30	409.36
13	403.57	538.09	15.30	418.87
14	377.70	503.60	15.30	393.00
15	316.00	421.33	15.30	331.30
16	185.94	247.91	15.15	201.08
17	175.75	234.33	15.24	190.99
18	179.36	239.15	15.23	194.59
19	139.83	186.43	15.15	154.97
20	128.21	170.94	14.76	142.97
21	86.08	114.78	14.76	100.85
22	164.63	219.50	15.36	179.98

Receptor ID	Daily mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
23	148.95	198.60	15.24	164.19
24	122.44	163.25	15.24	137.68
25	56.92	75.90	14.82	71.74
26	49.86	66.48	15.81	65.67
28	33.68	44.91	15.36	49.04
29	37.73	50.30	15.36	53.08
30	63.46	84.61	15.59	79.05
31	54.08	72.11	20.34	74.43
32	65.92	87.89	16.20	82.11
33	28.12	37.49	14.84	42.96
34	37.13	49.50	17.93	55.06
35	65.31	87.07	23.74	89.05
36	1570.14	2093.52	15.19	1585.33
37	1734.04	2312.05	15.19	1749.23
38	1797.03	2396.04	15.19	1812.22
39	1770.83	2361.11	15.19	1786.02
39	1386.74	1848.99	15.19	1401.93
40	794.66	1059.54	108.24	902.90
10	388.72	518.29	15.92	404.64
41	209.71	279.61	15.18	224.89
42	301.10	401.47	15.77	316.88
43	447.51	596.69	15.92	463.44
44	362.97	483.96	15.92	378.89
45	361.67	482.23	15.92	377.60
46	400.57	534.10	15.30	415.87
47	398.61	531.48	15.30	413.91
48	411.61	548.81	15.30	426.91
49	128.58	171.44	14.91	143.48
50	149.38	199.17	14.86	164.24
51	130.16	173.55	15.15	145.31
52	139.49	185.98	15.15	154.63
53	110.49	147.31	14.76	125.25
54	135.62	180.83	14.91	150.53
55	136.61	182.15	15.66	152.27
56	43.08	57.44	14.79	57.87
57	122.77	163.69	15.36	138.12
58	84.20	112.26	14.99	99.19
59	119.90	159.87	14.93	134.84
60	58.94	78.59	15.96	74.90
61	28.53	38.04	18.53	47.06
62	133.56	178.08	14.76	148.32
63	28.35	37.80	13.87	42.22

Receptor ID	Daily mean NOx			
	Max. PC NOx (µg/m³)	PC as a % of the AQO	Background NOx (µg/m³)	PEC NOx (µg/m³)
64	41.04	54.72	18.09	59.12
65	35.83	47.78	17.23	53.06
66	63.51	84.68	15.59	79.10
67	194.88	259.83	15.92	210.80
68	43.17	57.56	14.79	57.96
69	40.95	54.59	15.09	56.03
70	68.94	91.92	16.31	85.25
71	56.75	75.67	14.82	71.57
72	39.94	53.26	14.38	54.32

Nutrient Nitrogen and Acid Deposition

Table 4.14 presents the process contributions for nutrient nitrogen and acid deposition for the emergency scenario (S1). The critical load which was applied at the habitat type assessed and the percentage of either the minimum nitrogen critical load (for nutrient nitrogen deposition) or the critical load function (for acid deposition) are also presented. The critical load function did not exceed 1% at any of the assessed receptor locations for either nutrient nitrogen deposition or acid deposition. Consequently, no significant effects relating to nutrient nitrogen or acid deposition have been identified for the emergency scenario (S1).

Table 4.14: Nutrient Nitrogen and Acid Deposition for Emergency Scenario (S1)

Receptor ID	Nutrient Nitrogen Deposition			Acid Deposition		
	PC (kgN/ha/yr)	Lower Critical Load (CLMin) (kgN/ha/yr)	PC as % of CLMin	PC Acid Deposition (kg/ha/yr)	CLMax (kgN/ ha/yr)	PC as % of Critical Load Functio n
1	0.02	10	0.21	0.00	11.14	0.01
2	0.03	10	0.33	0.00	8.68	0.03
3	0.04	10	0.40	0.00	8.68	0.03
4	0.04	10	0.43	0.00	8.68	0.04
5	0.04	10	0.42	0.00	8.68	0.03
6	0.04	10	0.37	0.00	8.68	0.03
7	0.04	10	0.37	0.00	8.68	0.03
8	0.09	10	0.91	0.01	11.14	0.06
9	0.09	10	0.87	0.01	11.14	0.06
10	0.09	10	0.87	0.01	11.14	0.06
11	0.09	10	0.94	0.01	11.14	0.06

12	0.10	10	0.98	0.01	11.14	0.06
13	0.10	10	0.98	0.01	11.14	0.06
14	0.09	10	0.88	0.01	11.14	0.06
15	0.08	10	0.77	0.01	11.14	0.05
16	0.02	10	0.19	0.00	11.17	0.01
17	0.02	10	0.19	0.00	11.16	0.01
18	0.02	10	0.18	0.00	11.14	0.01
19	0.01	10	0.14	0.00	11.17	0.01
20	0.01	15	0.05	0.00	11.18	0.01
21	0.01	15	0.05	0.00	11.18	0.01
22	0.01	10	0.13	0.00	11.14	0.01
23	0.02	10	0.16	0.00	11.16	0.01
24	0.01	10	0.15	0.00	11.16	0.01
25	0.01	10	0.15	0.00	8.68	0.01
28	0.01	10	0.07	0.00	8.68	0.01
29	0.01	10	0.07	0.00	8.68	0.01
30	0.01	10	0.06	0.00	8.68	0.01
31	0.01	10	0.06	0.00	11.04	0.00
32	0.01	10	0.07	0.00	2.00	0.02
33	0.00	10	0.03	0.00	4.86	0.00
34	0.00	10	0.04	0.00	8.68	0.00
35	0.00	10	0.05	0.00	8.68	0.00
36	0.07	10	0.69	0.00	4.86	0.10
37	0.07	10	0.68	0.00	4.86	0.10
38	0.07	10	0.69	0.00	4.86	0.10
39	0.06	10	0.62	0.00	4.86	0.09
39	0.05	10	0.51	0.00	4.86	0.07
40	0.07	10	0.73	0.01	4.86	0.11
10	0.08	10	0.82	0.01	11.14	0.05
41	0.01	10	0.11	0.00	4.86	0.02
42	0.01	10	0.11	0.00	4.86	0.02
43	0.09	10	0.93	0.01	11.14	0.06
44	0.09	10	0.90	0.01	11.14	0.06
45	0.09	10	0.89	0.01	11.14	0.06
46	0.10	10	0.96	0.01	11.14	0.06
47	0.10	10	0.99	0.01	11.14	0.06
48	0.10	10	0.99	0.01	11.14	0.06
49	0.01	10	0.13	0.00	11.17	0.01
50	0.01	10	0.07	0.00	4.86	0.01
51	0.01	10	0.13	0.00	11.17	0.01
52	0.01	10	0.14	0.00	11.17	0.01
53	0.01	15	0.05	0.00	11.18	0.01
54	0.01	10	0.05	0.00	4.37	0.01
55	0.01	10	0.10	0.00	4.37	0.02
56	0.00	10	0.04	0.00	4.86	0.01
59	0.00	10	0.05	0.00	10.96	0.00
60	0.00	10	0.03	0.00	4.86	0.00

61	0.00	10	0.02	0.00	4.86	0.00
62	0.01	10	0.06	0.00	4.86	0.01
63	0.00	10	0.02	0.00	4.86	0.00
65	0.00	10	0.01	0.00	4.86	0.00
66	0.00	10	0.02	0.00	4.86	0.00
67	0.01	10	0.06	0.00	1.91	0.02
68	0.03	10	0.34	0.00	4.86	0.05
69	0.00	10	0.04	0.00	4.86	0.01
70	0.00	10	0.04	0.00	4.86	0.01
71	0.01	10	0.08	0.00	11.13	0.01
72	0.01	10	0.07	0.00	4.86	0.01

Table 4.15 presents the process contributions for nutrient nitrogen and acid deposition for the worse-case testing scenario. The critical load which was applied at the habitat type assessed and the percentage of either the minimum nitrogen critical load (for nutrient nitrogen deposition) or the critical load function (for acid deposition) are also presented. The critical load function did not exceed 1% at any of the assessed receptor locations for either nutrient nitrogen deposition or acid deposition. Consequently, no significant effects relating to nutrient nitrogen or acid deposition have been identified for the testing scenario (S3).

Table 4.15: Nutrient Nitrogen and Acid Deposition for Testing Scenario (S3)

Receptor ID	Nutrient Nitrogen Deposition			Acid Deposition		
	PC (kgN/ha/yr)	Lower Critical Load (CLMin) (kgN/ha/yr)	PC as % of CLMin	PC Acid Deposition (kg/ha/yr)	CLMax (kgN/ ha/yr)	PC as % of Critical Load Function
1	0.00	10	0.03	0.00	11.14	0.00
2	0.00	10	0.04	0.00	8.68	0.00
3	0.01	10	0.06	0.00	8.68	0.00
4	0.01	10	0.07	0.00	8.68	0.01
5	0.01	10	0.07	0.00	8.68	0.01
6	0.01	10	0.06	0.00	8.68	0.00
7	0.01	10	0.05	0.00	8.68	0.00
8	0.02	10	0.16	0.00	11.14	0.01
9	0.02	10	0.16	0.00	11.14	0.01
10	0.02	10	0.16	0.00	11.14	0.01
11	0.02	10	0.17	0.00	11.14	0.01
12	0.02	10	0.18	0.00	11.14	0.01
13	0.02	10	0.18	0.00	11.14	0.01
14	0.02	10	0.16	0.00	11.14	0.01
15	0.01	10	0.14	0.00	11.14	0.01
16	0.00	10	0.03	0.00	11.17	0.00
17	0.00	10	0.03	0.00	11.16	0.00
18	0.00	10	0.03	0.00	11.14	0.00

19	0.00	10	0.02	0.00	11.17	0.00
20	0.00	15	0.01	0.00	11.18	0.00
21	0.00	15	0.01	0.00	11.18	0.00
22	0.00	10	0.02	0.00	11.14	0.00
23	0.00	10	0.02	0.00	11.16	0.00
24	0.00	10	0.02	0.00	11.16	0.00
25	0.00	10	0.02	0.00	8.68	0.00
28	0.00	10	0.01	0.00	8.68	0.00
29	0.00	10	0.01	0.00	8.68	0.00
30	0.00	10	0.01	0.00	8.68	0.00
31	0.00	10	0.01	0.00	11.04	0.00
32	0.00	10	0.01	0.00	2.00	0.00
33	0.00	10	0.00	0.00	4.86	0.00
34	0.00	10	0.01	0.00	8.68	0.00
35	0.00	10	0.01	0.00	8.68	0.00
36	0.01	10	0.11	0.00	4.86	0.02
37	0.01	10	0.11	0.00	4.86	0.02
38	0.02	10	0.16	0.00	4.86	0.02
39	0.01	10	0.14	0.00	4.86	0.02
39	0.01	10	0.09	0.00	4.86	0.01
40	0.01	10	0.11	0.00	4.86	0.02
10	0.01	10	0.14	0.00	11.14	0.01
41	0.00	10	0.02	0.00	4.86	0.00
42	0.00	10	0.02	0.00	4.86	0.00
43	0.02	10	0.16	0.00	11.14	0.01
44	0.02	10	0.16	0.00	11.14	0.01
45	0.02	10	0.16	0.00	11.14	0.01
46	0.02	10	0.18	0.00	11.14	0.01
47	0.02	10	0.18	0.00	11.14	0.01
48	0.02	10	0.19	0.00	11.14	0.01
49	0.00	10	0.02	0.00	11.17	0.00
50	0.00	10	0.01	0.00	4.86	0.00
51	0.00	10	0.02	0.00	11.17	0.00
52	0.00	10	0.02	0.00	11.17	0.00
53	0.00	15	0.01	0.00	11.18	0.00
54	0.00	10	0.01	0.00	4.37	0.00
55	0.00	10	0.02	0.00	4.37	0.00
56	0.00	10	0.01	0.00	4.86	0.00
59	0.00	10	0.01	0.00	10.96	0.00
60	0.00	10	0.00	0.00	4.86	0.00
61	0.00	10	0.00	0.00	4.86	0.00
62	0.00	10	0.01	0.00	4.86	0.00
63	0.00	10	0.00	0.00	4.86	0.00
65	0.00	10	0.00	0.00	4.86	0.00
66	0.00	10	0.01	0.00	1.91	0.00
67	0.00	10	0.04	0.00	4.86	0.01
68	0.00	10	0.01	0.00	4.86	0.00

69	0.00	10	0.01	0.00	4.86	0.00
70	0.00	10	0.01	0.00	11.13	0.00
71	0.00	10	0.01	0.00	4.86	0.00
72	0.00	10	0.01	0.00	4.86	0.00

5 Discussion and Conclusions

An assessment of emissions from the proposed diesel generators at the Virtus Saunderton Data Centre Campus, covering emergency operation and routine testing, has been undertaken in line with EA guidance. As identified in **Section 4**, none of the AQOs were breached at any of the modelled receptor locations in any of the modelled scenarios, except for the daily NOx AQO for the emergency scenario.

A summary of the assessment findings is presented below.

Human Receptors

Emergency Scenario

- Hypergeometric probability analysis indicates that for 72 hours of continuous operation, the probability of exceeding the objective was found to be greater than 5%. However, given Virtus' 99.94% mains power operational record, limited on site fuel storage and the rarity of prolonged grid outages, sustained multi day emergency operation is not considered a realistic scenario, and therefore the exceedances do not pose a significant environmental risk.
- Annual mean and short-term NO_2 and PM_{10} concentrations comply with all applicable AQOs.
- Process contributions exceed screening thresholds in places, but PECs remain compliant and impacts are not significant.

Routine Testing Scenarios

- Annual mean and short-term pollutant concentrations also comply with all applicable AQOs.
- Process contributions exceed screening thresholds in some cases; however, PECs remain comfortably below the relevant objectives and impacts are therefore not significant.
- Emissions from routine testing are minor compared with emergency operation, and no exceedances of any AQO are predicted.

Ecological Receptors

Emergency Scenario

- Long-term NOx process contributions exceed 1% of the critical level at several receptor locations; however, PECs remain comfortably below the relevant objectives and impacts are therefore not significant. Additionally, where the process contributions exceed 1% at locally designated sites, the EA's 100% screening threshold applies; below which effects are screened out as insignificant.

- Daily NOx PECs exceed relevant thresholds; however, these exceedances are driven largely by background concentrations and the highly conservative 72-hour all-generator emergency assumption.
- Given Virtus' 99.94% mains power operational record, limited on-site fuel storage and the rarity of prolonged grid outages, sustained multi-day emergency operation is not considered a realistic scenario, and therefore the exceedances do not pose a significant environmental risk.

Routine Testing Scenarios

- Process contributions for NOx, nutrient nitrogen deposition and acid deposition remain below the relevant 1%/100% significance thresholds at all designated ecological sites.
- No exceedances of critical levels or critical loads are predicted, and routine testing impacts are therefore not significant.

Across all plausible operational scenarios; including both emergency operation and routine testing no breaches of the applicable AQOs are predicted for human or ecological receptors. The proposed generators are therefore considered to have an acceptable environmental impact, and no additional mitigation is required to ensure compliance with EA permitting requirements.

Appendix A Figures

Figure A.1: Emissions sources, buildings and receptors included in the air dispersion modelling assessment – vicinity of the data centre

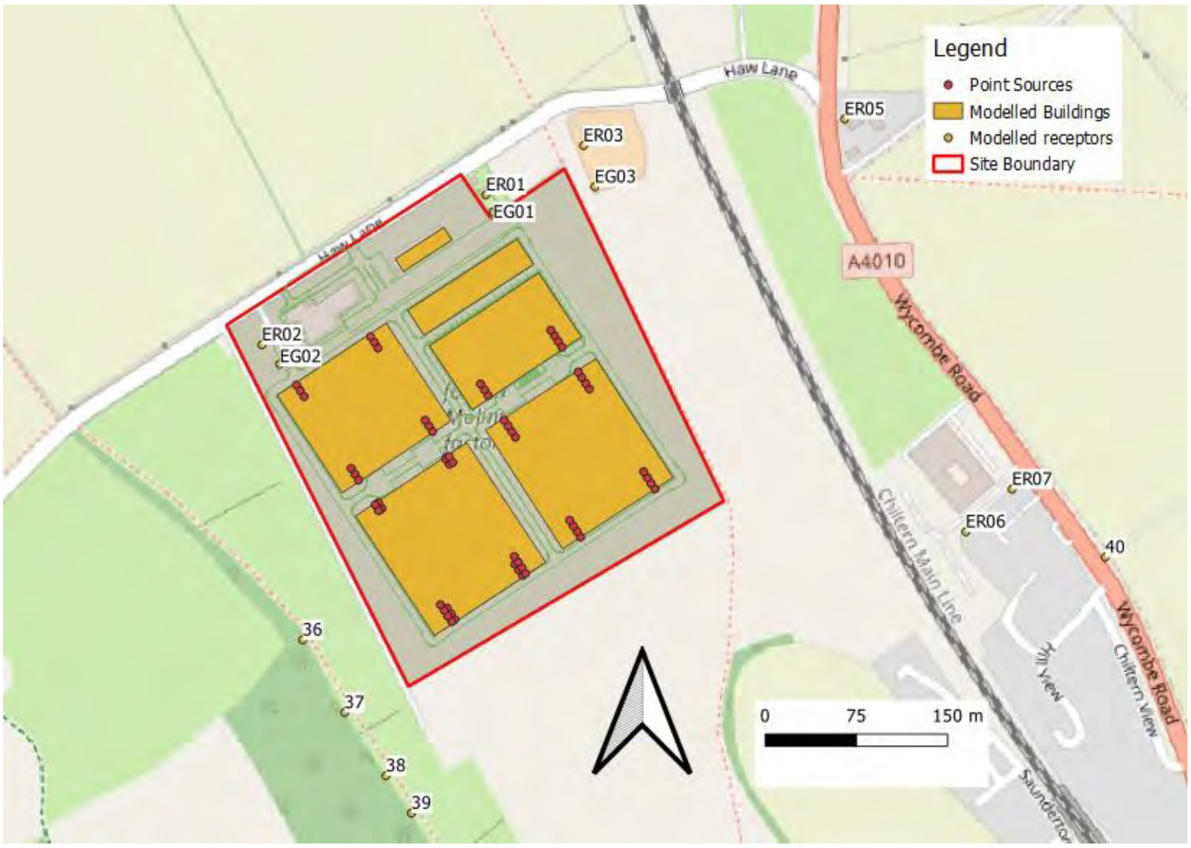
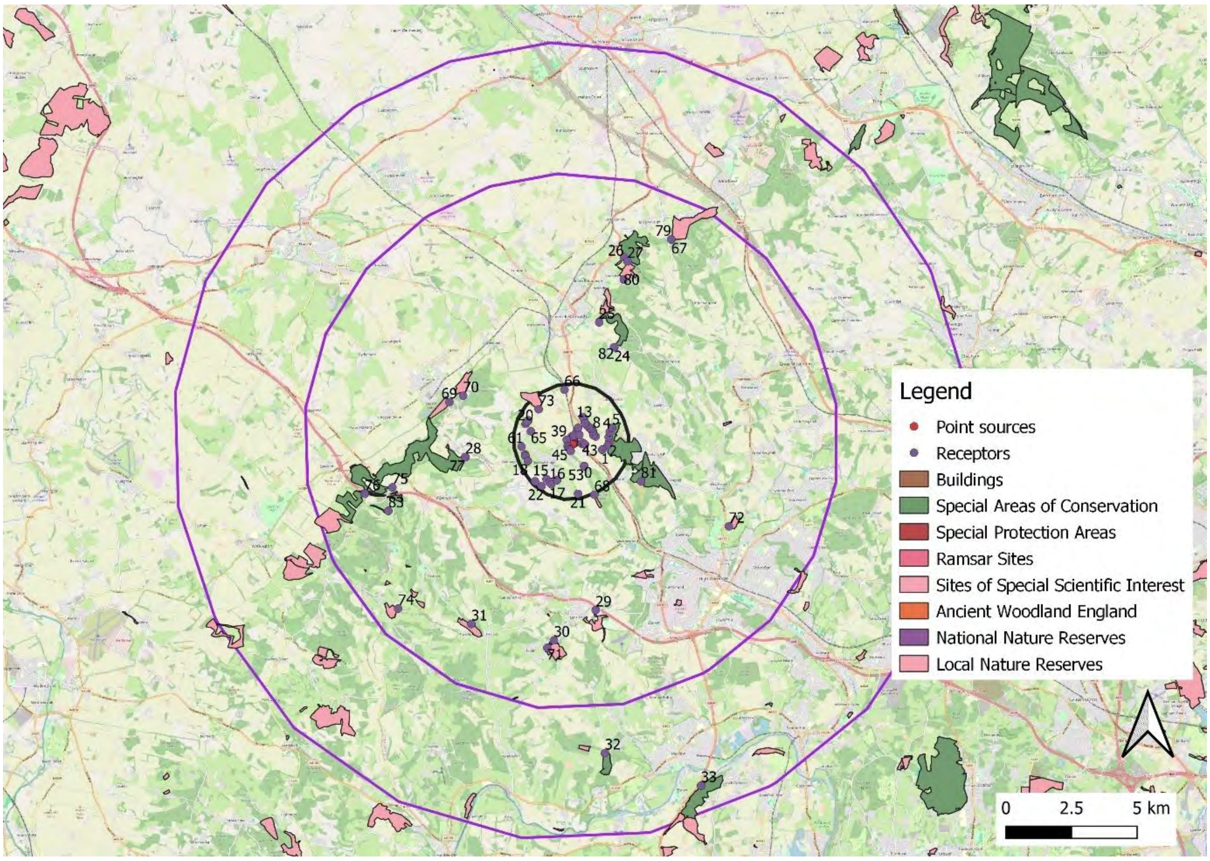


Figure A.2: Emissions sources, buildings and receptors included in the air dispersion modelling assessment – wider area



Buffers: 2km, 10km and 15km.

Figure A.3: Heathrow Airport Meteorological Station Windrose (2020)

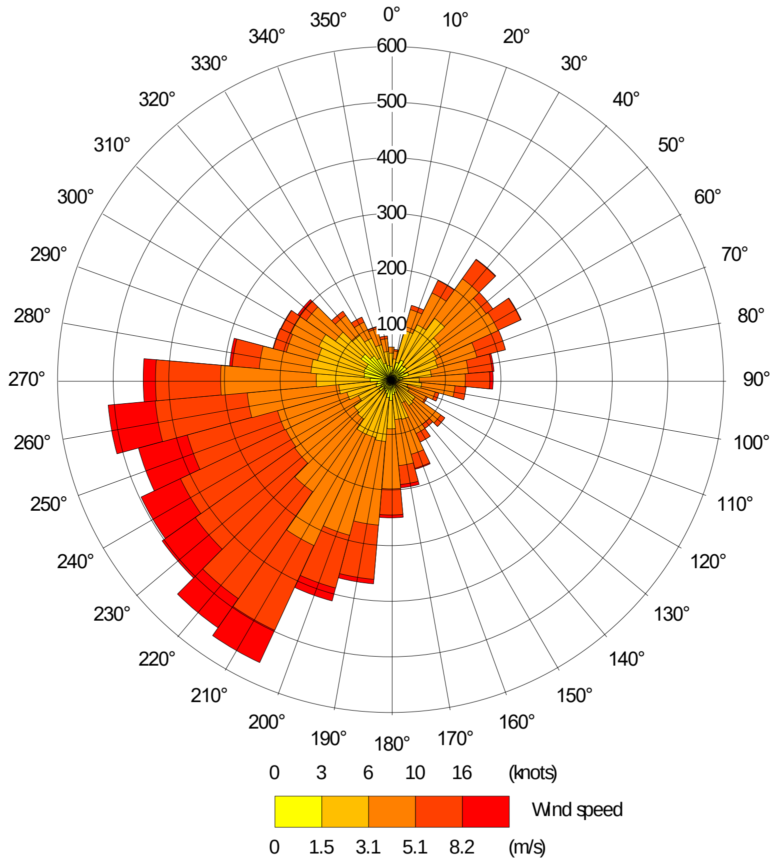


Figure A.4: Heathrow Airport Meteorological Station Windrose (2021)

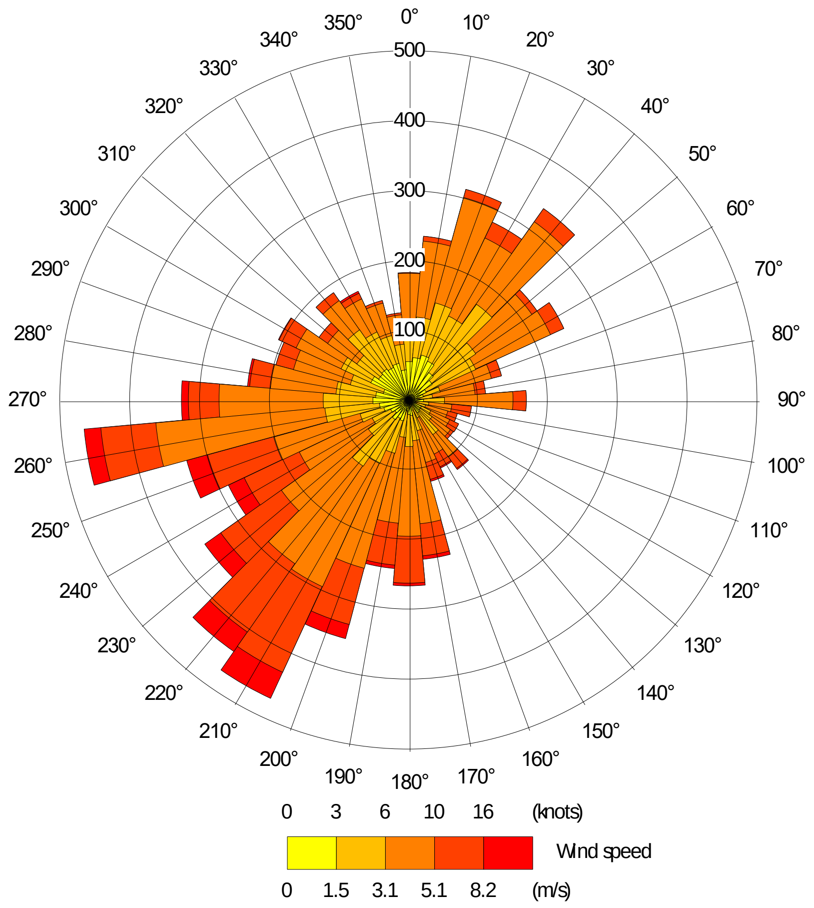


Figure A.5: Heathrow Airport Meteorological Station Windrose (2022)

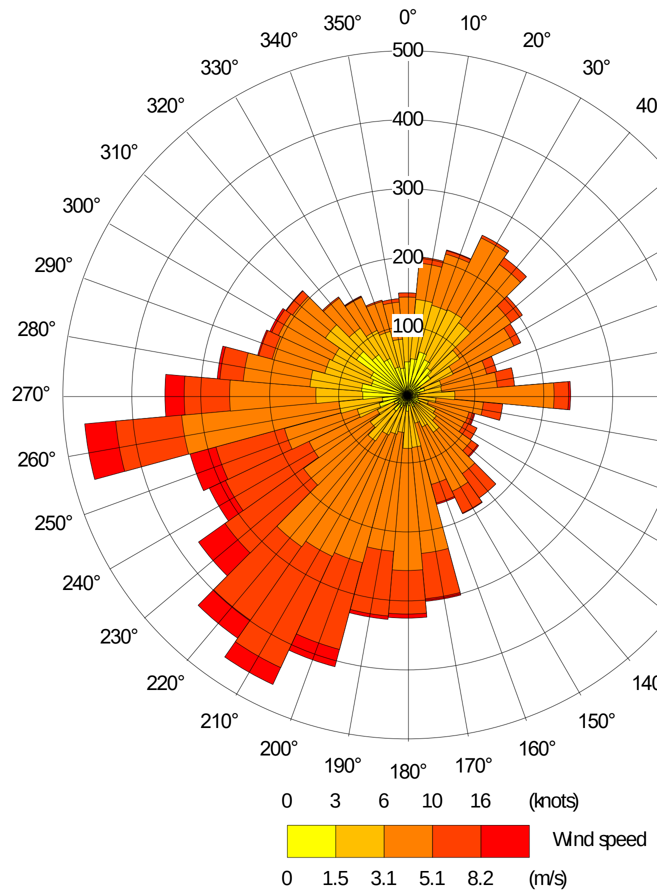


Figure A.6: Heathrow Airport Meteorological Station Windrose (2023)

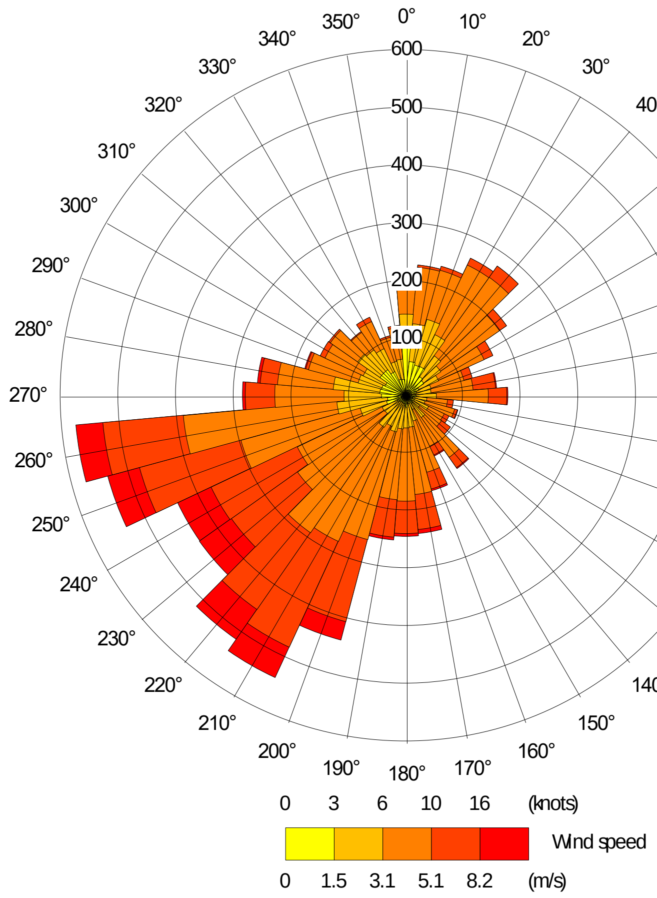
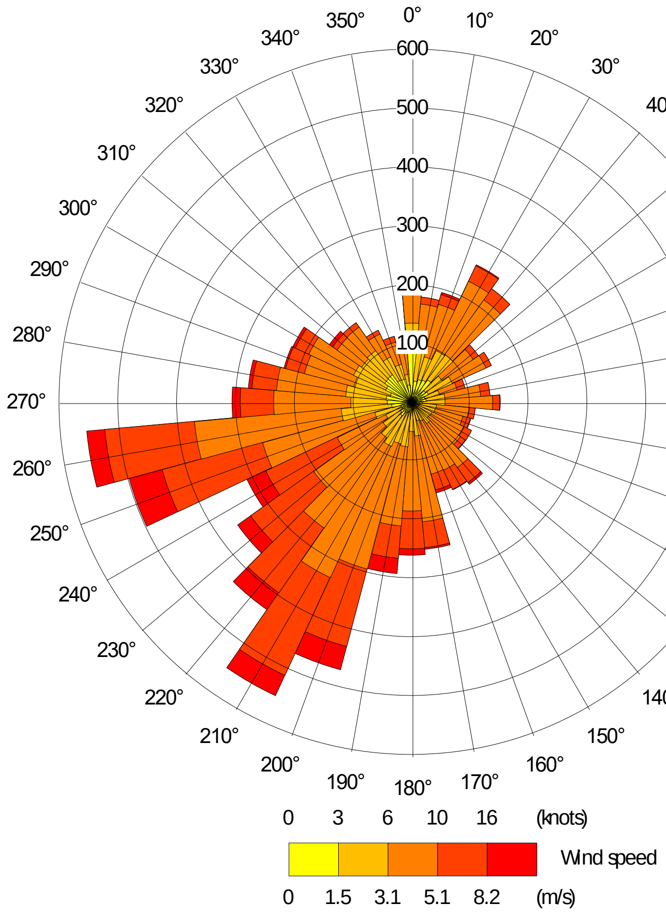


Figure A.7: Heathrow Airport Meteorological Station Windrose (2024)



Manchester
Arkwright House,
Parsonage Gardens,
Manchester, M3 2LF
United Kingdom
+44 (0)20 7394 3700
ramboll.com