Air Quality Assessment

DP3442QV - Hayes Data Centre Emergency Back-up Generation Facility

Bulls Bridge Industrial Estate, North Hyde Gardens, Hayes, UB3 4DG

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Executive Summary

Phlorum Ltd has been commissioned by HDR to undertake an air quality assessment (AQA) on behalf of Amazon Data Services UK Ltd (the operator) to support the Environmental Permit application (ref: DP3442QV) to operate the Hayes Data Centre Emergency Back-up Generation Facility.

The application site is located within the London Borough of Hillingdon's Air Quality Management Area and is located in close proximity to a Greater London Authority Air Quality Focus Area. This assessment evaluates the impacts on local air quality of the associated standby generators (SBG) emissions during testing, maintenance, and unplanned emergency use.

This report assesses the likely significant effects of the proposed development on the environment in respect to air quality. Air quality studies are concerned with the presence of airborne pollutants in the atmosphere. The main pollutants of concern for local air quality are oxides of nitrogen (NOx) including nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$).

Impacts from the proposed SBGs were predicted to be insignificant at all relevant modelled receptor locations, when assessed against all relevant long-term and short-term UK Air Quality Standards, in any normal grid failure or testing scenarios.

As such, and acknowledging the conservative methodology applied to the assessment, the proposed development's impacts were not anticipated to have an overall significant effect on local air quality.

1. Introduction

1.1 Phlorum Ltd has been commissioned by HDR to undertake an air quality assessment (AQA) on behalf of the legal operator to support the Environmental Permit application (ref: DP3442QV) to operate the Hayes Data Centre Emergency Back-up Generation Facility. The Data Centre is located in Bulls Bridge Industrial Estate, North Hyde Gardens, Hayes, UB3 4DG ("the site"). The National Grid Reference for the centre of the site is TQ 10514 79252. A site location plan is included in Figure 1.

1.2 This air quality assessment pertains to one of three data centres to be constructed (see site plan overleaf). At the time of writing the other two data centres are due to be under the control of a separate operator and are likely to be covered under separate environmental permit(s).

1.3 The site is located in the administrative boundaries of the London Borough of Hillingdon (LBH). LBH has declared one Air Quality Management Area (AQMA) that covers the southern two thirds of the Borough. This AQMA was declared in 2003 due to exceedances of the UK Air Quality Standard (AQS) for annual mean nitrogen dioxide (NO_2). The application site is located within this AQMA. The application site is also located in close proximity to a Greater London Authority (GLA) Air Quality Focus Area (AQFA). As a result, during the planning process, the London Borough of Hillingdon (LBH) required that abatement be implemented to achieve a NOx emissions limit of 95mg.m^{-3} (at 5% O_2). In response to this planning requirement, the operator has made significant investment in NOx abatement technology in the form of Selective Catalytic Reduction (SCR) to achieve this limit imposed by LBH.

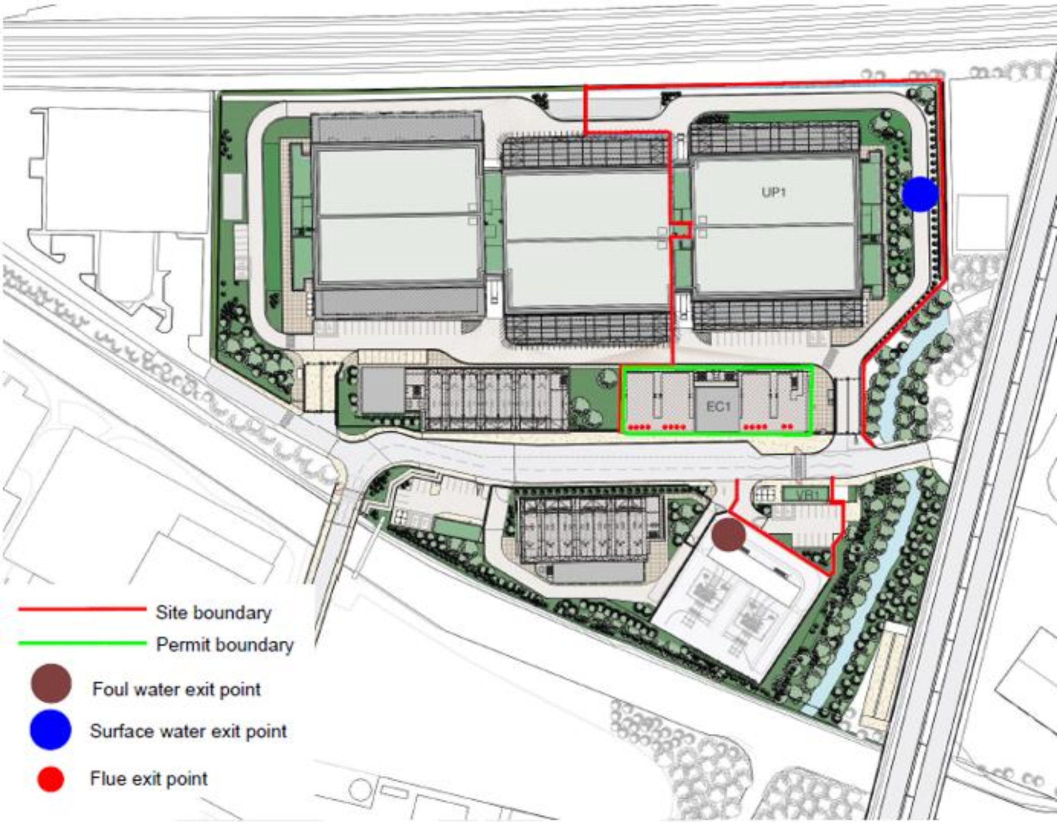
1.4 Land-use in the vicinity of the site is primarily industrial/commercial as shown in Figure 3; however, residential land-use can be found in close proximity to the application site along Nestlé Avenue, North Hyde Gardens and North Hyde Road.

1.5 The main pollution sources in the vicinity of the application site are from vehicles travelling on the local road network, primarily the A312. Heathrow Airport is also a significant contributor to regional air pollution.

1.6 The key source of air emissions associated with the application are the 14-no. 3.2MWe Rolls Royce MTU DS4000 emergency back-up diesel generators (See Figure 3). SBGs provide power in the event of an emergency power failure/ grid power outage. In an emergency, only 12 of the generators would be required to carry the site's electrical load, with 2 providing redundancy to the system. The generators are to be fitted with SCR technology to reduce NO_X emissions concentrations to 95mg.m^{-3} (5% O_2). SCR has been employed given the proximity to the AQMA and AQFA for this specific scenario and does not represent Best Available Techniques (BAT) for general Datacentre developments.

1.7 The chance of a major grid failure occurring during the proposed development's operational lifetime is very low due to the site benefitting from a highly reliable direct connection to the national grid (99.999605% availability). As such, the principal emissions associated with the use of SBGs occur during routine testing and maintenance.

1.8 This air quality assessment nevertheless evaluates the impacts of the SBG emissions during testing, maintenance, and unplanned emergency use on local air quality.



2. Policy Context

The UK Air Quality Strategy

2.1 The UK Air Quality Strategy (UKAQS)[1] sets "air quality standard" (AQS) concentrations for a number of key pollutants that are to be achieved at sensitive receptor locations across the UK by corresponding "air quality objective" (AQO) dates. The sensitive locations at which the standards and objectives apply are those where the population are reasonably expected to be exposed to said pollutants over the particular averaging period.

2.2 For those objectives to which an annual mean standard applies, the most common sensitive receptor locations used to compare concentrations against the standards are areas of residential housing. It is reasonable to expect that people living in their homes could be exposed to pollutants over such a period of time.

2.3 Schools and children's playgrounds are also often used as sensitive locations for comparison with annual mean objectives due to the increased sensitivity of young people to the effects of pollution (regardless of whether or not their exposure to the pollution could be over an annual period). For shorter averaging periods of between 15 minutes, 1 hour or 1 day, the sensitive receptor location can be anywhere where the public could be exposed to the pollutant over these shorter periods of time.

2.4 The objectives adopted in the UK are based on the Air Quality (England) Regulations 2000[2], as amended, for the purpose of Local Air Quality Management (LAQM). These Air Quality Regulations have been adopted into UK law from the limit values required by European Union Daughter Directives on air quality. The UKAQS for $PM_{2.5}$ was recently amended as part of The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[3].

2.5 The Environment Agency also provides further environmental assessment levels (EALs) for additional pollutants[4], which are not included in the UKAQS.

2.6 A summary of the AQSs and EALs relevant to this assessment are included in Table 2.1, below.

1 Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) July 2007.
2 The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043.
3 The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020
4 Environment Agency & Defra (2022) https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions

Table 2.1 UK Air Quality Standards

Pollutant	Averaging Period	Air quality standard (µg.m^{-3})	Air quality objective	Objective: to be achieved by
Nitrogen dioxide (NO_2)	1 hour	200	200 µg.m^{-3} not to be exceeded more than 18 times a year	31 December 2005
	Annual	40	40 µg.m^{-3}	31 December 2005
Particulate Matter (PM_{10})	24 hour	50	50 µg.m^{-3} not to be exceeded more than 35 times a year	31 December 2004
	Annual	40	40 µg.m^{-3}	31 December 2004
Particulate Matter ($PM_{2.5}$)	Annual	20	20 µg.m^{-3}	1 January 2020
Sulphur Dioxide	15-minute	266	Not to be exceeded more than 35 times per calendar year	1 January 2005
	1 hour	350	Not to be exceeded more than 24 times per calendar year	1 January 2005
	24-hour	125	Not to be exceeded more than 3 times per calendar year	1 January 2005
Carbon Monoxide	Maximum daily running 8-hour mean	10,000	-	1 January 2005
	Maximum 1-hour	30,000	-	1 January 2005
Benzene	Maximum 1 hour	195	-	1 January 2005
	Annual	5	-	1 January 2005
Note: For the purposes of this assessment, it has been assumed that 100% of hydrocarbons are emitted as benzene. This is a highly conservative and precautionary approach.				

Ecological Standards

2.7 There are two categories of pollutants that are typically the subject of assessments for ecological designated sites. These are pollutants that have an effect on vegetation/habitats in (1) a gaseous form, assessed against critical levels, and (2) those which have an impact through deposition, assessed against critical loads.

Critical Levels

2.8 Critical levels represent the maximum concentrations of pollutants in air for the protection of vegetation. These have been adopted by, amongst others, the European Union and the United Nations Economic Commission for Europe (UNECE) and are used as regulatory standards. These critical levels are summarised in Table 2.2.

Table 2.2 Critical Levels

Pollutant	Averaging Period Critical Level	Averaging Period Critical Level
Oxides of nitrogen (NO_X)	24 Hour maximum mean	75/ 200 µg.m^{-3}*
	Annual	30 µg.m^{-3}
Ammonia (NH_3)	Annual	1 µg.m^{-3} (for lichens and bryophytes)
	Annual	3 µg.m^{-3}
Sulphur dioxide (SO_2)	Annual	10 µg.m^{-3} (for lichens and bryophytes)
	Annual	20 µg.m^{-3}
*The critical level is generally considered to be 75µg.m^{-3}; but this only applies where there are high concentrations of SO_2 and ozone, which is not generally the current situation in the UK.		

Critical Loads

2.9 Critical loads represent estimates of exposure to one or more pollutants below which significant effects are not known to occur, according to present knowledge. Whilst critical levels relate to the concentration of pollutants in air, critical loads relate to a quantity of a pollutant being deposited onto a habitat/ ecosystem.

2.10 Air Pollution Information System (APIS)[5]. provides critical loads for nitrogen deposition (leading to eutrophication) and acid deposition (leading to acidification). Critical loads for nitrogen deposition are in units of kilogrammes of nitrogen per hectare per year (kg N/ha/year) and vary with habitat sensitivity. Site specific critical loads are discussed later in this report.

2.11 Ammonia was not considered when calculating nitrogen deposition as the SCR system only starts dosing urea when the temperature sensor in the exhaust gas reaches >280°C, meaning there will be no significant “ammonia slip”.

5 Available at www.apis.ac.uk

3. Assessment Methodology

Guidance

3.1 The London Local Air Quality Management Technical Guidance (LLAQM.TG (19))[6] and Local Air Quality Management Technical Guidance (LAQM.TG (16))[7] were followed in carrying out this assessment.

3.2 The latest Environmental Protection UK (EPUK) & IAQM guidance on 'Planning for Air Quality'[8] was also referred to for the impact assessment. The criteria used to describe the impact at individual receptors were derived from this guidance, and have been included in Appendix A.

3.3 For the assessment of emissions from the SBGs, Defra's guidance on assessing air emissions for environmental permitting[9] and the Environment Agency's guidance on assessing impacts on limited hour operations[10] has also been followed. The EA's guidance on specified generators[11] and their Data Centre FAQ headline approach guidance[12] to aide permit applications for data centres has also been reviewed.

Baseline

3.4 The baseline air quality conditions in the vicinity of the site are established through the compilation and review of appropriately sourced background concentration estimates and local monitoring data.

3.5 Defra provides estimated background concentrations of the UKAQS pollutants at the UK Air Information Resource (UK-AIR) website[13]. These estimates are produced using detailed modelling tools and are presented as concentrations at central 1km^2 National Grid square locations across the UK. At the time of writing, the most recent background maps were from August 2020 and based on monitoring data from 2018.

6 Mayor of London (2019). Part IV of the Environment Act 1995, Environment (Northern Ireland) Order 2002 Part III, London Local Air Quality Management, Technical Guidance (LLAQM. TG(19)).
7 Defra. 2021. Part IV of the Environment Act 1995, Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management, Technical Guidance LAQM. TG(16).
8 EPUK & IAQM. (2017). Land-Use Planning & Development Control: Planning For Air Quality.
9 Defra (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-riskassessment-for-your-environmental-permit
10 Air Quality Modelling & Assessment Unit (AQMAU). (2016). Diesel generator short term NO_2 impact assessment.
11 Environment Agency (2019) Specified generators: dispersion modelling assessment
12 Environment Agency (2018) Data Centre FAQ Headline Approach
13 Defra: UK-AIR. www.uk-air.defra.gov.uk

3.6 Being background concentrations, the UK-AIR data are intended to represent a homogenous mixture of all emissions sources within the general area of a particular grid square location. Concentrations of pollutants at various sensitive receptor locations can, therefore, be calculated by modelling the emissions from a nearby pollution source, such as a busy road, and then adding this to the appropriate UK-AIR background datum.

3.7 LBH's automatic and non-automatic monitoring data are also considered an appropriate source for establishing baseline air quality; the most recent available data from LBH's air quality annual status report for 2019 [14] have been reviewed and included within the assessment.

3.8 The London Atmospheric Emissions Inventory (LAEI) also provides modelled ground level concentrations of annual mean NO_2, PM_{10} and $PM_{2.5}$ at 20m grid resolution across Greater London, for 2016[15] and 2019[16]. This data has also been reviewed and incorporated into the assessment.

Assessment of Impacts

Generator Emissions

3.9 The key pollutant emissions associated with the SBGs are NO_X, PM_{10}, $PM_{2.5}$, SO_2, CO and hydrocarbons (as benzene).

ADMS-5 Generator Assessment

3.10 Dispersion modelling was undertaken using ADMS-5.2 (version: 5.2.2.0), which is produced by Cambridge Environmental Research Consultants (CERC). ADMS-5.2 is a short-range dispersion model that simulates a wide range of buoyant and passive releases to the atmosphere. It is a "new generation" dispersion model, which uses a skewed Gaussian Concentration distribution to calculate dispersion under convective conditions.

14 LBH (2020) 2019 Air Quality Annual Status Report
15 London Atmospheric Emissions Inventory (LAEI). (2016). https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2016
16 London Atmospheric Emissions Inventory (LAEI). (2022). https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019

Model Input Data

Meteorological Data and Surface Characteristics

3.11 Detailed, hourly sequential, meteorological data are used by the model to determine pollutant transportation and levels of dilution by the wind and vertical air movements. Meteorological data used in the model were obtained from London Heathrow Airport as it was considered to provide the most representative data of similar conditions to the site. Five years (2015- 2019) of meteorological data were used in this assessment. Meteorological data were provided by ADM Ltd.

3.12 The surface roughness applied to the dispersion and meteorological site was 1.5m and 0.5m, respectively. The Minimum Monin-Obukhov length is used to help describe the stability of the atmosphere. In urban areas where there are multiple sources of heat, the air is less stable. For this model, a Minimum Monin-Obukhov length of 100m was used, which is representative of a "large conurbation" such as London.

Buildings & Terrain

3.13 Buildings can have significant effects on the dispersion of pollutants and can increase ground level concentrations. The Energy Centre buildings as well as the data centre buildings were included in the model. The building details, alongside a summary of other model inputs, are included in Appendix B.

3.14 Terrain can influence the dispersion of pollutants in the local area. However, ADMS-5 user guidance[17] suggests terrain effects should only be modelled where the gradient exceeds 1:10. The local area is flat and as such, the impact of complex terrain has not been modelled.

Emission Parameters

3.15 The assessment has been carried out assuming that the fuel type for all generators would be <u>diesel</u>.

3.16 The SBG emission parameters (e.g. volumetric flow rate, exhaust temperature) were derived from the manufacturers genset data sheet (MTU 20V4000 DS4000) and its associated engine emissions data sheet (20V4000G94LF).

3.17 The flue gas is also to be treated by SCR and the manufacturers have warranted that an emission concentration of $95mg.NO_X.Nm^{-3}$ ($5\% \ O_2$) is to be achieved.

17 ADMS 5.2 User Guide

3.18 As the SCR system is only effective after temperatures reach 280°C, there is a period after start-up where emissions from the generators would be unabated. It is understood that this period should last less than 20 minutes and that the generator manufacturers are required to specify equipment that can achieve this. The manufacturers have also suggested that with load steps (i.e., running at higher load initially), the SCR system could warm-up in less than 15 minutes. As such, if running at full load (as has been modelled), the SCR system warm up time would likely be far quicker than 20 mins. However, for the purposes of this assessment, we have conservatively assumed a warm up time of 20 minutes, from engine start, will occur where emissions are unabated.

3.19 A summary of the emission parameters is included in Table 3.1 below. The X,Y coordinates for each stack are included in the model inputs in Appendix B. Their locations are also displayed in Figure 3. The emissions data (DS4000 20V4000G94LF) sheet at measured O_2 is provided in Appendix C.

Table 3.1: Model Inputs for Generators

Parameter	Unit	Emissions per generator at 100% load	Emissions per generator at 25% load
Power	KW	3307	827
Stack(s) height	m	23	23
Stack(s) diameter	m	0.7	0.7
Exhaust gas temperature	°C	482	403
Exhaust Volumetric Flow (actual)	$m^3.s^{-1}$	11.9	2.97 *
Exhaust Volumetric Flow (dry, 5% O_2)	$Nm^3.s^{-1}$	2.57	0.74
NO_X emission rate (unabated concentration of 2362 $mg.Nm^{-3}$ and 1375 $mg.Nm^{-3}$ at 100% and 25% loads, respectively)	g/s	6.063	1.011
NO_X emission rate (concentration post SCR not to exceed 95 $mg.Nm^{-3}$ (5% O_2))	g/s	0.244	0.070
PM_{10} and $PM_{2.5}$ emission rate **	g/s	0.018	0.041
CO emission rate	g/s	0.276	0.322
Hydrocarbons (benzene) emission rate	g/s	0.0459	0.037
SO_2 emission rate	g/s	0.0028	0.001

*estimated assuming moisture content of 14% in exhaust gas
** It has been assumed that 100% of the PM is emitted as both PM_{10} and $PM_{2.5}$

Modelled Scenario

3.20 The applicant's testing schedule is summarised in Table 3.2 below.

Table 3.2: Annual Testing Schedule

Generator Test Frequency	Description	Load Profile	Individual Test Duration	Total hours of operation, per generator
Fortnightly test	Testing each generator separately at 25% load for 0.5 hour every two weeks per year. *The quarterly and bi-annual tests would supersede the requirement for 6 fortnightly tests.*	25%	30 mins	10
Quarterly Test	Testing each generator separately at 25% load for 1 hour each quarter.	25%	1 hour	4
Bi-annual test	Testing each generator separately at 100% load for 1.5 hours, twice a year.	100%	1.5 hours	3

3.21 Considering that that the bi-annual test occurs at different loads to the fortnightly and quarterly tests, two separate testing models were required. A breakdown of the modelled scenarios is provided below:

3.22 Modelling has been undertaken for the following scenarios:

- **Testing Scenario 1**: 'Fortnightly and Quarterly Test' scenario accounting for 14 hours of operation per year, per generator, at 25% load. Tested individually.
- **Testing Scenario 2**: 'Bi-Annual Test' scenario accounting for 3 hours of operation per year, per generator, at 100% load. Tested individually.
- **Emergency Scenario**: 72-hour grid failure event, with all generators running concurrently at 100% load.

3.23 For NO_x, modelled emission rates were time-weighted for each of the three modelled scenarios, acknowledging that emission rates vary dependant on the proportion of time SBGs spent without effective SCR operation (the first 20 minutes of every run). The time-weighted NO_x emissions modelled for each of the scenarios are listed below:

- Testing Scenario 1: 0.697 g $NO_X.s^{-1}$
- Testing Scenario 2: 1.536 g $NO_X.s^{-1}$
- Emergency Scenario: 0.325 g $NO_X.s^{-1}$

Planning Conditions

3.24 At the time of writing, the generator and SCR specification has been confirmed and fixed but the proposed data centre is still progressing through planning with LBH.

Model Outputs

NO_X to NO_2 Conversion

3.25 Following Environment Agency guidance[18], it has been assumed that 70% of NO_X converts to NO_2 over the long-term (i.e. annual average) and that 35% converts to NO_2 in the short-term (i.e. hourly averaging periods); these are worst-case conversion rates that assume that significant proportions of emitted NO_X converts to NO_2 in a relatively short space and time.

3.26 Environment Agency guidance[10] suggests that within 500m, NO_X to NO_2 conversion can be as low as 15% in the short-term. As such, the use of a 35% short-term conversion rate is conservative.

Modelling of long term and short term emissions

3.27 With regard to short-term impacts, it is normal to assess the 1-hour mean NO_2 objective by considering the 99.79th percentile of 1-hour mean concentrations, which represents the 19th highest concentration in a year (8760 hours). However, when there are far fewer hours of operation in a year, this is an unrealistic worst-case approach and consideration should be given to the limited hours of operation through the use of hypergeometric distribution statistics. However, for this assessment, it was assumed that the generators would run all year around, as part of each scenario. This is an extreme 'worst-case' approach which does not consider the likelihood of worst-case meteorological conditions coinciding with operation.

3.28 To calculate the long-term process contribution, the modelled output, which is based on the model running for every hour in the year, was scaled down to account for the actual number of SBGs operating at one time and the hours per year of operation, for each scenario.

Model Domain and Receptors

3.29 Discrete model receptors were positioned at the façades of discrete receptors closest to the source of pollution (i.e. the proposed stack positions and relevant roads), in all directions.

3.30 All receptors were modelled at "breathing height", which is by convention 1.5m above ground level, plus the relevant floor height, if receptors are at elevated floor levels. Details of existing receptors are included in Table 3.3.

Table 3.3: Modelled Receptors.

ID	Location/Description	Height (m)	UK Grid Reference	
			X	Y

18 Environment Agency. Conversion Ratios For NO_X and NO_2. Available at: https://webarchive.nationalarchives.gov.uk/20140328232919/http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf

R1	Proposed Commercial Unit: Nestle Sie	1.5, 4.5	510328.41	179200.16
R2	Proposed Commercial Unit: Nestle Sie	1.5, 4.5	510204.25	179266.75
R3	Proposed Residential Unit: Nestle Sie	1.5, 4.5, 23, 30, 35	510144.94	179311.31
R4	Proposed Residential Unit: Nestle Sie	5, 4.5, 23, 30, 35	510093.25	179262.39
R5	Guru Nanak School	1.5, 4.5	511216.62	180007.59
R6	Commercial Unit	1.5, 4.5	510346.91	179446.55
R7	Hillingdon Mosque	1.5, 4.5	510237.28	179460.62
R8	Commercial Unit – Tarmac Site	1.5, 4.5	510561.12	179467.86
R9	Commercial Unit	1.5, 4.5	510609.69	179172.95
R10	Commercial Unit	1.5, 4.5	510684.16	179316.38
R11	Residential Dwelling – Copperdale Rd	1.5, 4.5	510336.75	179714.72
R12	Residential Dwelling – Chalfont Rd	1.5, 4.5	510015.84	179619.09
R13	Proposed Commercial Unit: Nestle Sie	1.5, 4.5	510253.31	179055.80
R14	Residential Dwelling – Nestle Avenue	1.5, 4.5	510273.88	178955.31
R15	Residential Dwelling – Nestle Avenue	1.5, 4.5	510099.69	179023.25
R16	Residential Dwelling – Brent Road	1.5, 4.5	511169.41	179247.81
R17	Residential Dwelling – Brent Road	1.5, 4.5	511164.28	179114.12
R18	Proposed Residential Unit: Nestle Sie	5, 4.5, 23, 30, 35	510172.16	179143.77
R19	Proposed Development – Reception	1.5, 4.5	510515.81	179230.41

Note: Grid references are indicative as the model layout is based on Ordnance Survey based mapping which does not accurately portray the width or position of roads.

3.31 All modelled receptors are shown in Figure 3 with model inputs included in Appendix B.

3.32 A grid of receptor points was also modelled to predict the pattern of dispersion of pollutants across the local area at 1.5m and 23m. The modelled grids originated at UK Grid Reference 509520, 178520, with 98 × 90 (20m spacing) and were used to produce the contour plots shown in Figures 4-8.

Ecological Impacts

3.33 Environment Agency guidance sets out that the assessment must consider all Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites within 10km of the application site, and all Sites of Special Scientific Interest (SSSI) and local nature sites within 2km.

3.34 Table 3.4, below, provides a summary of all ecological sites that meet the above criteria.

Table 3.4: Ecological Sites

	Site Name	Distance to Site (km)	Designation	X	Y	Critical Loads (N)

2	South West London Waterbodies	7.205	SPA	505363	174127	*10
11	Richmond Park	9.739	SAC	518540	173833	Broadleaved deciduous woodland 10 - 20
12	Priority Orchard	1.1	Priority Orchard	510068	178240	Broadleaved deciduous woodland 10 - 20
13	Priority Woodland	0.2	Priority Woodland	510659	179432	Broadleaved deciduous woodland 10 - 20
14	Priority Woodland	0.1	Priority Woodland	510527	179122	Broadleaved deciduous woodland 10 - 20
15	Priority Woodland	0.4	Priority Woodland	510125	179080	Broadleaved deciduous woodland 10 - 20

Note: *No Critical Load has been assigned to meso/eutrophic systems in the South West London Waterbodies SPA. These systems are often P limited (or N/P co-limiting), therefore decisions should be taken at a site-specific level. It was assumed that the habitat would have the same lower critical load as other habitats in the vicinity.

3.35 The assessment of ecological sites is included in Appendix D of this document.

Deposition Velocities

3.36 The deposition rates for NO_X were based on Air Quality Technical Advisory Group guidance[19]. The deposition rates for forest habitats are as follows:

- NO_X = 0.003m.s^{-1}

3.37 Nitrogen deposition rates were calculated from concentrations using standard mathematical and chemical methods.

Significance of Impacts

3.38 The significance of impacts from the proposed energy centre is determined in terms of criteria set out in Defra's 'Air emissions risk assessment for your environmental permit'[9] *and* EPUK and IAQM's 'Planning for air quality'[8]. The significance of impacts is considered both in terms of the:

[19] Air Quality Advisory Group, 2014, AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.

- **Process Contribution (PC):** the impact of direct, additional emissions associated with the new processes only, and
- **Predicted Environmental Concentration (PEC):** the impact associated with combined PC and existing background pollutant concentrations.

3.39 Defra's guidance advocates that when undertaking detailed modelling, the PC can be considered *insignificant* if:

- the long-term PC at a sensitive receptor is <1% of the long term AQS; and
- the short-term PC a sensitive receptor is <10% of the short term AQS.

3.40 If the above criteria are exceeded, significant impacts can be screened out if:

- the short-term PC is less than 20% of the short term environmental standards minus twice the long term background concentration
- the long-term PEC is less than 70% of the long term environmental standards

3.41 The EA, however, provide no guidance (at detailed modelling stage) to determine whether the PC is *significant*, or whether the PEC is significant or not.

3.42 Joint EPUK & IAQM guidance provides impact descriptors that also offer a means to communicate the numerical output of detailed modelling. The impact descriptor used to describe the change in long term average concentrations is derived from both the magnitude of change at a sensitive receptor and the ambient concentration at that receptor. The impact can either be '*adverse*' or '*beneficial*' and be described as '*negligible*', '*slight*', '*moderate*' or '*substantial*. These descriptors are summarised In Appendix A.

3.43 The impact descriptors described in Appendix A are intended for application at a series of individual receptors. The assessment of overall significance is, however, based on professional judgement and the reasons for reaching an overall significance must be clear, set out logically and will take into consideration factors such as:

- the existing and future air quality in the absence of the development.
- the extent of current and future population exposure to the impacts;
- the spatial and temporal extent of any impacts; and
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts.

3.44 Regarding short term impacts, total percentile concentrations (PEC) at locations of relevant exposure below the AQS/AQO were considered "not significant". This is considered a sufficiently robust criterion given the conservative inputs (e.g. the use of LAEI 2016 as a background and worst-case NO_X to NO_2 conversion rates).

Ecological Significance

3.45 The EA provides different screening criteria for assessing changes in pollution concentrations depending on the sensitivity of the habitat.

3.46 For SPAs, SACs, Ramsar sites or SSSI changes can be considered insignificant if:

- the short term PC is less than 10% of the short term environmental standard for protected conservation areas
- the long term PC is less than 1% of the long term environmental standard for protected conservation areas

3.47 EA guidance provides the following commentary if the standards above are exceeded:

"If you do not meet these requirements you need to calculate the PEC and check the PEC against the standard for protected conservation areas.

You do not need to calculate PEC for short term targets.

If your short term PC exceeds the screening criteria of 10%, you need to do detailed modelling.

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 do not need to assess them any further.

"If your PEC is greater than 70% of the long term environmental standard, you need to do detailed modelling.

3.48 For Local Nature sites changes can be considered insignificant if:

- the short term PC is less than 100% of the short term environmental standard for protected conservation areas
- the long term PC is less than 100% of the long term environmental standard for protected conservation areas

Model Uncertainty

3.49 There are a number of inherent uncertainties associated with the modelling process, including:

- Model uncertainty – due to model formulations;
- Data uncertainty – due to inaccuracies in input data, including emissions estimates, background estimates and meteorology; and
- Variability – randomness of measurements used.

3.50 Using a validated air quality model such as ADMS-5.2 reduces the modelling uncertainty.

3.51 The choices of the practitioner throughout the air quality assessment process are also essential to the management of uncertainty, including the decision to bias the predicted impact towards a worst-case estimate or a central estimate. This assessment has used inputs tending towards 'worst-case', where appropriate, to provide a conservative and robust approach.

3.52 Table 3.5 below summarises the approach to minimising the uncertainty in the conclusions drawn.

Table 3.5: Summary of conservative methods used in assessment

Source of uncertainty	Approach	Comments
Future Background/ Baseline Concentrations	It has been assumed that there will be no improvement in baseline conditions from the 2016 LAEI predictions. Furthermore 2001 predictions for SO_2, benzene and CO have been used.	Given the measures being undertaken across London to reduce emissions since 2001 and 2016 (e.g. the LEZ and ULEZ), these inputs are considered to be highly conservative.
Hours of operation vs discrete hours where operation could take place.	It was assumed for the purposes of calculating short-term impacts associated with fortnightly testing that the individual generators would operate for the full hour, as opposed to just 30 mins. As such, each generator was run in a separate hour to maximise the number of potential exceedances of the short term AQS.	If generator testing occurs in discrete 1-hour periods (i.e., not back-to-back in the same hour), there is a greater number of hours where the AQO for NO_X could be exceeded than if assuming back-to-back operation. This assumption effectively doubles the total operational time for short-term impacts for fortnightly testing.
Meteorological Data	Heathrow Airport is located 3.5km southwest of the application site and, therefore, conditions will be similar but not exactly the same. As such, the model has been run with 5 years of meteorological data to account for potential differences in meteorology between the two sites. The maximum concentration from 5 years' worth of data, at each receptor or gird point was used in analysis.	This is the recommended approach for Environmental Permitting.
Surface roughness + Minimum Monin Obukhov length	Sensitivity testing exploring the impact of surface roughness ranging between 1.5m or 1.0m and MO between 30m and 100m was undertaken. 1.5m SR	Environmental Permitting guidance recommends carrying out sensitivity tests to explore the impact of varying uncertain parameters.

	and 100m was chosen due to most conservative outputs.	
Length of possible Grid Failure	An Emergency Grid Failure scenario has been modelled in which the failure lasts a full 72-hour period.	Noting the reliability of the grid (99.999605% availability), grid failures are highly unlikely. As such, it is reasonable to consider a 72-hour outage to be a highly conservative modelling assumption.

4. Baseline

4.1 This chapter is intended to establish prevailing air quality conditions in the vicinity of the application site.

UK-AIR Background Pollution

4.2 The UK-AIR predicted background pollution concentrations for NO_2, PM_{10} and $PM_{2.5}$ for 2018 to 2024 are presented in Table 4.1. These data were taken from the central grid square location closest to the application site (i.e. grid reference: 510500, 179500).

Table 4.1: 2018 to 2024 background concentrations of pollutants at the application site.

Pollutant	Predicted annual mean background concentration ($\mu g.m^{-3}$)						
	2018	2019	2020	2021	2022	2023	2024
NO_2	29.4	28.2	26.7	26.0	25.1	24.5	23.8
PM_{10}	17.9	17.4	17.0	16.8	16.6	16.4	16.2
$PM_{2.5}$	11.9	11.6	11.3	11.1	11.0	10.8	10.7

4.3 The data in Table 4.1 show that annual mean background concentrations of NO_2, PM_{10} and $PM_{2.5}$, in the vicinity of the application site between 2018 and 2024, were predicted to be below their respective AQSs. The data show that in 2021, NO_2, PM_{10} and $PM_{2.5}$ concentrations were predicted to be below their AQSs by 35%, 58% and 57% respectively. As such, annual mean background concentrations are likely to be well below the respective AQSs at the application site.

4.4 Concentrations of all pollutants were predicted to decline each year. These reductions are principally due to the forecast effect of the roll out of cleaner vehicles, but also due to UK national and international plans to reduce emissions across all sectors.

4.5 UK-AIR also provides predictions for benzene, SO_2 and CO, for 2001. These are summarised below for the UK-AIR grid square which contains the application site.

- benzene: 0.603 $\mu g.m^{-3}$
- SO_2: 6.1 $\mu g.m^{-3}$
- CO: 406 $\mu g.m^{-3}$

London Atmospheric Emissions Inventory

4.6 The London Atmospheric Emissions Inventory (LAEI)[15] provides modelled ground level concentrations of annual mean NO_2, PM_{10} and $PM_{2.5}$ at 20m grid resolution across Greater London, for 2016 and 2019.

4.7 Predicted concentrations of NO_2, in the vicinity of the site, are predicted to exceed the 40ug.m^{-3} AQS adjacent to major roads, and the rail line to the north of the application site. However, concentrations of PM_{10} and $PM_{2.5}$ are generally predicted to be below their respective long-term (annual) AQSs across the entire domain.

4.8 The LAEI predicted pollution concentrations for NO_2, PM_{10} and $PM_{2.5}$ for 2016 and 2019 are presented in Table 4.2. These data were taken from the locations relevant to the receptors in Table 3.3.

Table 4.2: 2016 to 2019 LAEI predictions for pollutants at the location of sensitive receptors.

Pollutant	Predicted annual mean concentration (µg.m^{-3})					
	NO_2		PM_{10}		$PM_{2.5}$	
	2016	2019	2016	2019	2016	2019
R1	36	29	22	16	13	11
R2	35	29	22	16	14	11
R3	36	29	22	16	14	11
R4	35	29	22	16	13	11
R5	34	27	22	16	13	11
R6	37	29	22	16	14	11
R7	36	29	22	16	14	11
R8	38	31	22	17	14	11
R9	**42**	**42**	24	21	14	12
R10	39	33	22	18	14	11
R11	36	29	22	17	13	11
R12	35	29	22	17	13	11
R13	35	29	22	16	13	11
R14	36	30	22	17	13	11
R15	36	30	22	16	13	11
R16	36	29	22	16	13	11
R17	35	29	22	16	13	11
R18	35	29	22	16	13	11
R19	38	32	22	17	14	11

Note: ***Bold** denotes exceedance of the annual mean AQS.

4.9 The data in Table 4.2 show that annual mean background concentrations of NO_2, PM_{10} and $PM_{2.5}$, in the vicinity of local receptors in 2016 and 2019, were generally predicted to be below their respective AQSs.

4.10 The data show that at receptor R9, baseline concentrations are predicted to exceed 40µg.m^{-3}; however, R9 is not a location where the annual mean AQS applies, being a commercial building.

4.11 The data show a significant drop in predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at most locations between 2016 and 2019.

London Borough of Hillingdon Monitoring Data

4.12 Air quality monitoring is considered an appropriate source of data for the purposes of describing baseline air quality.

Automatic Monitoring

4.13 LBH currently undertakes automatic (continuous) monitoring at 11 sites across the Borough. The most recent available data for NO_2, PM_{10} and $PM_{2.5}$ from the monitoring sites located within 2.5km of the application site are included in Tables 4.3, 4.4 and 4.5, respectively.

Table 4.3: NO_2 monitoring data from LBH automatic monitors

Monitor	Type	Distance from the application site (km)	NO_2 annual mean concentration (µg.m^{-3})				
			2015	2016	2017	2018	2019
HIL5	R	0.1	**46.2**	**45.9**	**47.0**	**43.0**	**41.0**
HI3	R	2.1	34.5	**41.9**	35.0	35.0	33.0
HRL	A / UB	2.3	32.0	34.0	32.0	30.0	31.0

Note: "R" = Roadside; "A" = Airport; "UB" = Urban Background. Exceedances of long-term AQS shown in **Bold**.

4.14 The data in Table 4.3 show that between 2015 and 2019 and within 2.5km of the application site, annual mean concentrations of NO_2 at roadside sites often exceeded the 40µg.m^{-3} AQS. The highest concentration in 2019 was measured at HIL5, which is located within 100m of the application site; a concentration 2.5% above the 40µg.m^{-3} AQS was recorded. Being a roadside location, this site is not considered to be representative of background conditions across the application site; it does, however, provide an indication of roadside concentrations of NO_2 across the AQFA.

4.15 The automatic monitor HRL, which is located at a background location, recorded concentrations consistently below the 40µg.m^{-3} AQS between 2015 and 2019. In 2019, a concentration 22.5% below the AQS was recorded. Given this site is located over 2km from the application, and in very close proximity to Heathrow Airport, it is not considered to be overly representative of background conditions across the application site.

4.16 There is evidence of a downward trend in measured NO_2 in the above table; this trend is particularly evident at HIL5, the closest monitor to the application site.

4.17 Table 4.4 includes the most recent annual mean PM_{10} results from the automatic monitoring sites stationed in LBH.

Table 4.4: PM_{10} monitoring data from the LBH automatic monitors

Monitor	Type	Distance from the application site (km)	PM_{10} annual mean concentration ($\mu g.m^{-3}$)				
			2015	2016	2017	2018	2019
HIL5	R	0.1	28.0	28.0	27.0	30.0	28.0
HI3	R	2.1	21.0	20.0	19.0	24.0	24.0
HRL	A / UB	2.3	16.0	15.0	15.0	15.0	15.0

Note: "R" = Roadside; "A" = Airport; "UB" = Urban Background. Exceedances of short-term AQS shown in **Bold and Underlined.**

4.18 The data in Table 4.4 shows that annual mean PM_{10} concentrations have been well below the $40\mu g.m^{-3}$ AQS at all sites, between 2015 and 2019, within 2.5km of the site.

4.19 The highest concentration in 2019 was measured at HIL5, where a concentration 30% below the $40\mu g.m^{-3}$ AQS was recorded. No exceedance of the short-term AQO was recorded between 2015 and 2019.

4.20 There is no strong evidence of a downward trend in measured PM_{10}, in the vicinity of the application site.

4.21 Table 4.5 includes the most recent annual mean $PM_{2.5}$ results from the automatic monitoring sites stationed in LBH.

Table 4.5: $PM_{2.5}$ monitoring data from the LBH automatic monitors

Monitor	Type	Distance from the application site (km)	$PM_{2.5}$ annual mean concentration ($\mu g.m^{-3}$)				
			2015	2016	2017	2018	2019
HRL	A / UB	2.3	10.0	10.0	9.0	9.0	10.0

Note: "A"= Airport; "UB" = Urban Background.

4.22 The data in Table 4.5 shows that annual mean $PM_{2.5}$ concentrations have been well below the $25\mu g.m^{-3}$ AQS at HRL, between 2015 and 2019. In 2019, a concentration 60% below the $25\mu g.m^{-3}$ AQS was recorded.

Non-Automatic Monitoring

4.23 LBH operates an extensive non-automatic, NO_2 diffusion tube monitoring network across the area. The most recent available monitoring data for diffusion tubes located within 2.5km of the application site are included in Table 4.6.

Table 4.6: Monitoring data from LBH NO_2 diffusion tubes

Monitor	Type	Distance from the application site (km)	NO_2 annual mean concentration ($\mu g.m^{-3}$)				
			2015	2016	2017	2018	2019
HD55/ HILL07	R	0.4	35.7	34.7	**43.3**	37.7	36.9
HD202/ HILL17	UB	0.4	26.7	26.1	32.7	31.0	31.6
HD203/HILL18	R	0.6	**41.9**	**40.9**	**49.0**	38.5	37.4
HD302/ HILL27	R	0.8	30.7	30.8	33.8	32.5	33.2
HD56/ HILL08	R	0.6	31.4	32.1	33.4	33.9	33.9
HD214/ HILL26	R	1.0	**43.7**	**42.1**	**51.5**	**42.0**	**40.0**
HD402/ HILL28	R	1.0	32.1	32.3	35.7	31.7	31.7
HD208	UB	1.4	27.3	28.9	27.3	30.8	26.5
HD57/ HILL09	R	2.0	35.6	35.5	39.4	37.2	24.1
HD213/ HILL25	UB	2.5	37.0	37.4	**45.6**	39.3	38.7

Note: "R" = roadside; "UB" = urban background. **Bold** denotes exceedance of the AQS.

4.24 The data in Table 4.6 indicates that annual mean NO_2 concentrations in the vicinity of the application site were generally below the 40$\mu g.m^{-3}$ AQS, with only 4 of the 10 closest tubes exceeding the AQS in recent years.

4.25 The highest concentration in Table 4.6 was measured at HD214/HILL26, in 2017; where a concentration 28.7% above the AQS was recorded. HD214/HILL26 is located over 1km from the application site, adjacent to the M4 motorway, and is, therefore, not considered to be representative of conditions at the application site.

4.26 The closest diffusion tube to the application site, HD55/ HILL07, is located within the AQFA. Concentrations at this location, in 2017, exceeded the 40µg.m^{-3} AQS; however, in all other years concentrations were below the AQS. This site, alongside the automatic monitor HIL5, is considered to be largely representative of roadside concentrations within the AQFA.

4.27 The nearest background monitor to the application site is located approximately 400m to the north (HD202/HILL17). The most recent result from 2019 was below the AQS by 21.0%. This value is also similar to the UK-AIR prediction for the application site in Table 4.1. The results from this monitor are considered to be largely representative of background conditions at the application site.

Summary of Background Data used in Modelling

4.28 For the purposes of dispersion modelling assessments, it is important that the choice of background site captures all pollutant sources that are not being modelled, but does not capture any sources being modelled, which could result in double-counting emissions from road sources in the study area.

4.29 As roads were not included in the model, it is important that background concentrations used to derive the PEC include their contribution. As such, UK-AIR data and LBH monitoring at 'background' locations, which represent general air quality (i.e. away from any major emission sources, including roads) are not considered appropriate.

4.30 All background concentrations used in this assessment were derived from LAEI predictions (for 2016). This dataset provides predictions for the Greater London at a 20m x 20m resolution, considering all emission sources.

4.31 No future improvement in baseline concentrations beyond 2016 was assumed. This is a highly conservative approach, considering that, on average, the LAEI predicts a 6.5 µg.m^{-3} improvement in NO_2 concentrations at modelled receptor locations by 2019. Beyond 2019, the policies being undertaken across London to reduce pollution across all sources (e.g. the ULEZ) are anticipated to further reduce concentrations.

4.32 It was agreed with LBH's AQ officer during consultations associated with the permitted development, in 2020, that this approach would negate the need to take detailed assessment of any other local committed development (e.g. The *Nestle Site* or any another local data centre).

4.33 A summary of the background concentrations used in the modelling assessment are set out in Table 4.7 below.

Table 4.7: Background concentrations used in this assessment

Pollutant	Concentration ($\mu g.m^{-3}$)		Data Source
	Long-term	Short-term*	
NO_2	34-42	68-84	LAEI (2016)
PM_{10}	22-24	44-48	LAEI (2016)
$PM_{2.5}$	13-15	-	LAEI (2016)

Note: *Short-term background concentrations are assumed to be twice long-term concentrations. Concentrations are given as a range of values (above), as background concentrations differ at receptors locations as they are in different grid squares.

4.34 The use of LAEI (2016) estimates to represent NO_2, PM_{10} and $PM_{2.5}$ background concentrations was agreed to be an appropriately conservative approach during conversations with LBH for the Planning Application. Table 4.7 highlights that NO_2 concentrations in particular are potentially already in exceedance of the AQSs without this development. It is for this reason that the operator has incorporated SCR into the design, to reduce NO_X emissions from the development as much as practically possible.

5. Assessment of Impacts

5.1 The proposed development's predicted impact on air quality under normal testing and maintenance, and under an emergency operation, is presented below.

5.2 For the assessment of annual mean impacts, the outputs of Testing Scenario 1 and Testing Scenario 2 are combined, to reflect the combined impact of all testing and maintenance on local air quality.

5.3 For short term impacts, the results for Testing Scenarios 1 and 2 are presented separately, as the different types of generator testing would not occur within the same hour. The long and short-term impacts associated with an emergency grid failure are also presented separately.

Long Term Impacts

Testing and Maintenance (Scenarios 1 and 2)

5.4 Table 5.1 below shows the predicted impact of the proposed development on annual mean NO_2, PM_{10}, $PM_{2.5}$ and benzene. The annual mean AQSs for each of these pollutants are 40 $\mu g.m^{-3}$, 40 $\mu g.m^{-3}$, 20 $\mu g.m^{-3}$ and 5 $\mu g.m^{-3}$, respectively.

Table 5.1: Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene

Receptor Point	Annual Mean Concentration				
	PC ($\mu g.m^{-3}$)	% AQS	PEC ($\mu g.m^{-3}$)	% AQS	Potentially Significant
			NO_2		
R1	0.03	0.1%	36.03	90.1%	No
R2	0.02	0.0%	35.02	87.5%	No
R3	0.01	0.0%	36.01	90.0%	No
R4	0.01	0.0%	35.01	87.5%	No
R5	0.01	0.0%	34.01	85.0%	No
R6	0.03	0.1%	37.03	92.6%	No
R7	0.02	0.0%	36.02	90.0%	No
R8	0.08	0.2%	38.08	95.2%	No
R9	0.07	0.2%	42.07	105.2%	No
R10	0.09	0.2%	39.09	97.7%	No
R11	0.01	0.0%	36.01	90.0%	No
R12	0.01	0.0%	35.01	87.5%	No
R13	0.02	0.1%	35.02	87.6%	No
R14	0.02	0.0%	36.02	90.0%	No
R15	0.01	0.0%	36.01	90.0%	No
R16	0.01	0.0%	36.01	90.0%	No
R17	0.01	0.0%	35.01	87.5%	No
R18	0.02	0.0%	35.02	87.5%	No
R19	0.20	0.5%	38.20	95.5%	No

			PM_{10}		
R1	0.00	0.0%	22.00	55.0%	No
R2	0.00	0.0%	22.00	55.0%	No
R3	0.00	0.0%	22.00	55.0%	No
R4	0.00	0.0%	22.00	55.0%	No
R5	0.00	0.0%	22.00	55.0%	No
R6	0.00	0.0%	22.00	55.0%	No
R7	0.00	0.0%	22.00	55.0%	No
R8	0.00	0.0%	22.00	55.0%	No
R9	0.00	0.0%	24.00	60.0%	No
R10	0.01	0.0%	22.01	55.0%	No
R11	0.00	0.0%	22.00	55.0%	No
R12	0.00	0.0%	22.00	55.0%	No
R13	0.00	0.0%	22.00	55.0%	No
R14	0.00	0.0%	22.00	55.0%	No
R15	0.00	0.0%	22.00	55.0%	No
R16	0.00	0.0%	22.00	55.0%	No
R17	0.00	0.0%	22.00	55.0%	No
R18	0.00	0.0%	22.00	55.0%	No
R19	0.01	0.0%	22.01	55.0%	No
			$PM_{2.5}$		
R1	0.00	0.0%	13.00	32.5%	No
R2	0.00	0.0%	14.00	35.0%	No
R3	0.00	0.0%	14.00	35.0%	No
R4	0.00	0.0%	13.00	32.5%	No
R5	0.00	0.0%	13.00	32.5%	No
R6	0.00	0.0%	14.00	35.0%	No
R7	0.00	0.0%	14.00	35.0%	No
R8	0.00	0.0%	14.00	35.0%	No
R9	0.00	0.0%	14.00	35.0%	No
R10	0.01	0.0%	14.01	35.0%	No
R11	0.00	0.0%	13.00	32.5%	No
R12	0.00	0.0%	13.00	32.5%	No
R13	0.00	0.0%	13.00	32.5%	No
R14	0.00	0.0%	13.00	32.5%	No
R15	0.00	0.0%	13.00	32.5%	No
R16	0.00	0.0%	13.00	32.5%	No
R17	0.00	0.0%	13.00	32.5%	No
R18	0.00	0.0%	13.00	32.5%	No
R19	0.01	0.1%	14.01	35.0%	No
			Benzene		
R1	0.00	0.0%	0.61	12.1%	No
R2	0.00	0.0%	0.60	12.1%	No
R3	0.00	0.0%	0.60	12.1%	No
R4	0.00	0.0%	0.60	12.1%	No
R5	0.00	0.0%	0.60	12.1%	No
R6	0.00	0.0%	0.61	12.1%	No
R7	0.00	0.0%	0.60	12.1%	No
R8	0.00	0.1%	0.61	12.1%	No
R9	0.00	0.1%	0.61	12.2%	No

R10	0.01	0.1%	0.61	12.2%	No
R11	0.00	0.0%	0.60	12.1%	No
R12	0.00	0.0%	0.60	12.1%	No
R13	0.00	0.0%	0.60	12.1%	No
R14	0.00	0.0%	0.60	12.1%	No
R15	0.00	0.0%	0.60	12.1%	No
R16	0.00	0.0%	0.60	12.1%	No
R17	0.00	0.0%	0.60	12.1%	No
R18	0.00	0.0%	0.60	12.1%	No
R19	0.01	0.3%	0.62	12.3%	No

5.5 As shown in Table 5.1, annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene are all modelled to be below the relevant annual mean AQSs at all locations of relevant exposure.

5.6 The data in Table 5.1 show that annual mean PCs of NO_2, PM_{10}, $PM_{2.5}$ and benzene are all anticipated to be less than the 1% screening criterion at all discrete receptors in the vicinity of the site.

5.7 All increases in annual mean NO_2, PM_{10}, $PM_{2.5}$ and benzene would be considered 'negligible' with reference to EPUK and IAQM's impact descriptors, which considers both the PC and the PEC.

5.8 Considering the above, emissions associated with maintenance and testing would not have a significant impact on annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene. Therefore, long-term impacts from maintenance and testing can be screened out.

Emergency Operation

5.9 Table 5.2 below shows the predicted impact of the proposed development on annual mean NO_2, PM_{10}, $PM_{2.5}$ and benzene. The annual mean AQSs for each of these pollutants are 40 $\mu g.m^{-3}$, 40 $\mu g.m^{-3}$, 20 $\mu g.m^{-3}$ and 5 $\mu g.m^{-3}$, respectively.

Table 5.2: Predicted annual mean concentrations of NO_2, PM_{10} $PM_{2.5}$ and benzene

Receptor Point	Annual Mean Concentration				
	PC ($\mu g.m^{-3}$)	% AQS	PEC ($\mu g.m^{-3}$)	% AQS	Potentially significant
NO_2					
R1	0.03	0.1%	36.03	90.1%	No
R2	0.02	0.0%	35.02	87.5%	No
R3	0.01	0.0%	36.01	90.0%	No
R4	0.01	0.0%	35.01	87.5%	No
R5	0.01	0.0%	34.01	85.0%	No
R6	0.02	0.1%	37.02	92.6%	No
R7	0.02	0.0%	36.02	90.0%	No
R8	0.07	0.2%	38.07	95.2%	No
R9	0.07	0.2%	42.07	105.2%	No
R10	0.09	0.2%	39.09	97.7%	No

R11	0.01	0.0%	36.01	90.0%	No
R12	0.01	0.0%	35.01	87.5%	No
R13	0.02	0.1%	35.02	87.6%	No
R14	0.02	0.1%	36.02	90.1%	No
R15	0.01	0.0%	36.01	90.0%	No
R16	0.02	0.0%	36.02	90.0%	No
R17	0.01	0.0%	35.01	87.5%	No
R18	0.02	0.0%	35.02	87.5%	No
R19	0.21	0.5%	38.21	95.5%	No
PM_{10}					
R1	0.02	0.0%	22.02	55.0%	No
R2	0.00	0.0%	22.00	55.0%	No
R3	0.00	0.0%	22.00	55.0%	No
R4	0.00	0.0%	22.00	55.0%	No
R5	0.00	0.0%	22.00	55.0%	No
R6	0.00	0.0%	22.00	55.0%	No
R7	0.00	0.0%	22.00	55.0%	No
R8	0.01	0.0%	22.01	55.0%	No
R9	0.01	0.0%	24.01	60.0%	No
R10	0.01	0.0%	24.01	60.0%	No
R11	0.01	0.0%	22.01	55.0%	No
R12	0.00	0.0%	22.00	55.0%	No
R13	0.00	0.0%	22.00	55.0%	No
R14	0.00	0.0%	22.00	55.0%	No
R15	0.00	0.0%	22.00	55.0%	No
R16	0.00	0.0%	22.00	55.0%	No
R17	0.00	0.0%	22.00	55.0%	No
R18	0.00	0.0%	22.00	55.0%	No
R19	0.02	0.0%	22.02	55.0%	No
$PM_{2.5}$					
R1	0.00	0.0%	13.00	65.0%	No
R2	0.00	0.0%	14.00	70.0%	No
R3	0.00	0.0%	14.00	70.0%	No
R4	0.00	0.0%	13.00	65.0%	No
R5	0.00	0.0%	13.00	65.0%	No
R6	0.00	0.0%	14.00	70.0%	No
R7	0.00	0.0%	14.00	70.0%	No
R8	0.01	0.0%	14.01	70.0%	No
R9	0.01	0.0%	14.01	70.0%	No
R10	0.01	0.0%	14.01	70.0%	No
R11	0.00	0.0%	13.00	65.0%	No
R12	0.00	0.0%	13.00	65.0%	No
R13	0.00	0.0%	13.00	65.0%	No
R14	0.00	0.0%	13.00	65.0%	No
R15	0.00	0.0%	13.00	65.0%	No
R16	0.00	0.0%	13.00	65.0%	No
R17	0.00	0.0%	13.00	65.0%	No
R18	0.00	0.0%	13.00	65.0%	No
R19	0.02	0.1%	14.02	70.1%	No
Benzene					

R1	0.01	0.1%	0.61	12.2%	No
R2	0.00	0.1%	0.61	12.1%	No
R3	0.00	0.1%	0.61	12.1%	No
R4	0.00	0.1%	0.61	12.1%	No
R5	0.00	0.0%	0.60	12.1%	No
R6	0.00	0.1%	0.61	12.2%	No
R7	0.00	0.1%	0.61	12.1%	No
R8	0.01	0.3%	0.62	12.3%	No
R9	0.01	0.3%	0.62	12.3%	No
R10	0.02	0.4%	0.62	12.4%	No
R11	0.00	0.0%	0.61	12.1%	No
R12	0.00	0.0%	0.60	12.1%	No
R13	0.01	0.1%	0.61	12.2%	No
R14	0.00	0.1%	0.61	12.1%	No
R15	0.00	0.1%	0.61	12.1%	No
R16	0.00	0.1%	0.61	12.1%	No
R17	0.00	0.1%	0.61	12.1%	No
R18	0.00	0.1%	0.61	12.1%	No
R19	0.04	0.8%	0.64	12.9%	No

5.10 As shown in Table 5.2, annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene are all modelled to be below the relevant annual mean AQSs at all locations of relevant exposure even with a prolonged grid failure.

5.11 The data in Table 5.2 show that annual mean PCs of NO_2, PM_{10}, $PM_{2.5}$ and benzene are all anticipated to be less than the 1% screening criterion at all discrete receptors in the vicinity of the site.

5.12 All increases in annual mean NO_2, PM_{10}, $PM_{2.5}$ and benzene would be considered 'negligible' with reference to EPUK and IAQM's impact descriptors, which considers both the PC and the PEC.

5.13 Considering the above, emissions associated with a prolonged grid failure would not have a significant impact on annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene. Therefore, long-term impacts from a 72-hour prolonged grid failure can be screened out.

Short Term Impacts

Testing and Maintenance Scenario 1 (Fortnightly and Quarterly Testing)

5.14 Table 5.3 below shows the predicted impact of the proposed development, with reference to the hourly mean AQO for NO_2.

Table 5.3: Predicted percentile mean concentrations of NO_2

Receptor Point	99.79 Percentile Hourly Mean NO_2					
	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS	PC % of (AQS – 2* background)	Potentially Significant
R1	5.24	2.6%	77.24	38.6%	4.1%	No
R2	2.53	1.3%	74.53	37.3%	2.0%	No
R3	10.03	5.0%	82.03	41.0%	7.8%	No
R4	3.54	1.8%	75.54	37.8%	2.8%	No
R5	0.66	0.3%	72.66	36.3%	0.5%	No
R6	19.77	9.9%	91.77	45.9%	15.4%	No
R7	3.15	1.6%	75.15	37.6%	2.5%	No
R8	3.42	1.7%	75.42	37.7%	2.7%	No
R9	13.35	6.7%	85.35	42.7%	10.4%	No
R10	4.94	2.5%	76.94	38.5%	3.9%	No
R11	1.50	0.7%	73.50	36.7%	1.2%	No
R12	1.54	0.8%	73.54	36.8%	1.2%	No
R13	2.70	1.3%	74.70	37.3%	2.1%	No
R14	2.16	1.1%	74.16	37.1%	1.7%	No
R15	1.69	0.8%	73.69	36.8%	1.3%	No
R16	1.06	0.5%	73.06	36.5%	0.8%	No
R17	1.30	0.7%	73.30	36.7%	1.0%	No
R18	2.16	1.1%	74.16	37.1%	1.7%	No
R19	21.81	**10.9%**	93.81	46.9%	17.0%	No

5.15 The data in Table 5.3 show that the hourly percentile mean PC of NO_2 is greater than the 10% screening criterion at one receptor (R19). However, the PEC is less than the relevant AQO at all discrete modelled receptors and the second screening stage criterion is not exceeded.

5.16 Given that these results are based on the overly conservative assumption that testing and maintenance scenario would occur in every hour of the year, the short-term impacts as a result of Testing Scenario 1 are not considered to be significant. Therefore, short-term NO_2 impacts from maintenance and testing of Scenario 1 can be screened out.

SO_2

5.17 Table 5.4 below shows the predicted impact of the facility under Testing Scenario 1, with reference to the 15-minute mean, 1-hour mean and 24-hour mean AQO for SO_2.

Table 5.4: Predicted percentile mean concentrations of SO_2

Receptor Point	15-minute mean SO_2				1 hour mean SO_2				24 hour mean SO_2			
	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS
R1	0.08	0.0%	12.28	4.6%	0.07	0.0%	12.27	6.1%	0.03	0.0%	12.23	9.8%
R2	0.04	0.0%	12.24	4.6%	0.04	0.0%	12.24	6.1%	0.02	0.0%	12.22	9.8%
R3	0.19	0.1%	12.39	4.7%	0.14	0.0%	12.34	6.2%	0.06	0.0%	12.26	9.8%
R4	0.07	0.0%	12.27	4.6%	0.05	0.0%	12.25	6.1%	0.02	0.0%	12.22	9.8%
R5	0.01	0.0%	12.21	4.6%	0.01	0.0%	12.21	6.1%	0.00	0.0%	12.20	9.8%
R6	0.17	0.1%	12.37	4.7%	0.15	0.0%	12.35	6.2%	0.04	0.0%	12.24	9.8%
R7	0.05	0.0%	12.25	4.6%	0.05	0.0%	12.25	6.1%	0.02	0.0%	12.22	9.8%
R8	0.05	0.0%	12.25	4.6%	0.05	0.0%	12.25	6.1%	0.04	0.0%	12.24	9.8%
R9	0.22	0.1%	12.42	4.7%	0.19	0.1%	12.39	6.2%	0.07	0.1%	12.27	9.8%
R10	0.08	0.0%	12.28	4.6%	0.07	0.0%	12.27	6.1%	0.04	0.0%	12.24	9.8%
R11	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R12	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R13	0.05	0.0%	12.25	4.6%	0.04	0.0%	12.24	6.1%	0.02	0.0%	12.22	9.8%
R14	0.04	0.0%	12.24	4.6%	0.03	0.0%	12.23	6.1%	0.02	0.0%	12.22	9.8%
R15	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R16	0.02	0.0%	12.22	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R17	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R18	0.04	0.0%	12.24	4.6%	0.03	0.0%	12.23	6.1%	0.02	0.0%	12.22	9.8%
R19	0.20	0.1%	12.40	4.7%	0.20	0.1%	12.40	6.2%	0.15	0.1%	12.35	9.9%

5.18 At no location of relevant exposure is an annual mean concentration of SO_2, predicted to exceed the relevant AQS.

5.19 The data in Table 5.4 show that all increases in short term increases in SO_2 are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.20 As such, significant short-term impacts on SO_2 as a result of maintenance and Testing Scenario 1 are not anticipated. Therefore, short-term SO_2 impacts from maintenance and testing of Scenario 1 can be screened out.

CO

5.21 Table 5.5 below shows the predicted impact of the facility under Testing Scenario 1, with reference to the 1-hour mean and 8-hour rolling daily maximum mean AQOs for CO.

Table 5.5: Predicted percentile mean concentrations of CO

Receptor Point	8-hour maximum daily rolling mean				1-hour maximum mean			
	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS
R1	6.32	0.1%	818.32	8.2%	8.72	0.0%	820.72	2.7%
R2	3.50	0.0%	815.50	8.2%	4.10	0.0%	816.10	2.7%
R3	11.44	0.1%	823.44	8.2%	18.65	0.1%	830.65	2.8%
R4	4.56	0.0%	816.56	8.2%	6.54	0.0%	818.54	2.7%

R5	0.67	0.0%	812.67	8.1%	1.11	0.0%	813.11	2.7%
R6	4.54	0.0%	816.54	8.2%	5.13	0.0%	817.13	2.7%
R7	4.17	0.0%	816.17	8.2%	5.05	0.0%	817.05	2.7%
R8	4.67	0.0%	816.67	8.2%	5.23	0.0%	817.23	2.7%
R9	14.78	0.1%	826.78	8.3%	25.11	0.1%	837.11	2.8%
R10	6.22	0.1%	818.22	8.2%	7.56	0.0%	819.56	2.7%
R11	1.82	0.0%	813.82	8.1%	2.74	0.0%	814.74	2.7%
R12	1.91	0.0%	813.91	8.1%	2.54	0.0%	814.54	2.7%
R13	3.58	0.0%	815.58	8.2%	4.26	0.0%	816.26	2.7%
R14	2.81	0.0%	814.81	8.1%	3.51	0.0%	815.51	2.7%
R15	2.08	0.0%	814.08	8.1%	2.63	0.0%	814.63	2.7%
R16	1.39	0.0%	813.39	8.1%	1.70	0.0%	813.70	2.7%
R17	1.46	0.0%	813.46	8.1%	1.96	0.0%	813.96	2.7%
R18	2.86	0.0%	814.86	8.1%	3.48	0.0%	815.48	2.7%
R19	18.82	0.2%	830.82	8.3%	21.06	0.1%	833.06	2.8%

5.22 At no location of relevant exposure is a short-term concentration of CO predicted to exceed the relevant AQS.

5.23 The data in Table 5.5 show that all short term increases in CO are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.24 As such, significant short-term impacts on CO as a result of maintenance and Testing Scenario 1 are not anticipated. Therefore, short-term CO impacts from maintenance and testing of Scenario 1 can be screened out.

Daily maximum mean PM_{10}

5.25 Table 5.6 below shows the predicted impact of the proposed development, with reference to the 90.41st percentile (i.e., the 36th worst day in the year) daily maximum mean AQO for PM_{10} (50μgm^{-3} not to be exceeded more than 35 days in a year).

Table 5.6: Predicted percentile mean concentrations of PM_{10} (for comparison with daily maximum mean AQO)

Receptor Point	90.41st daily maximum Mean PM_{10}			
	PC (μg.m^{-3})	PC % of AQS	PEC (μg.m^{-3})	PEC % of AQS
R1	0.48	1.0%	44.48	89%
R2	0.23	0.5%	44.23	88%
R3	0.65	1.3%	44.65	89%
R4	0.25	0.5%	44.25	88%
R5	0.04	0.1%	44.04	88%
R6	0.29	0.6%	44.29	89%
R7	0.19	0.4%	44.19	88%
R8	0.48	1.0%	44.48	89%
R9	0.87	1.7%	44.87	90%
R10	0.72	1.4%	44.72	89%
R11	0.10	0.2%	44.10	88%

R12	0.06	0.1%	44.06	88%
R13	0.35	0.7%	44.35	89%
R14	0.26	0.5%	44.26	89%
R15	0.14	0.3%	44.14	88%
R16	0.10	0.2%	44.10	88%
R17	0.08	0.2%	44.08	88%
R18	0.21	0.4%	44.21	88%
R19	1.79	3.6%	45.79	92%

5.26 At no location is the daily maximum mean concentration of PM_{10} predicted to exceed the relevant AQS.

5.27 The data in Table 5.6 show that all short term increases in PM_{10} are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.28 As such, significant short-term impacts on PM_{10} as a result of maintenance and Testing Scenario 1 are not anticipated. Therefore, short-term PM_{10} impacts from maintenance and testing of Scenario 1 can be screened out.

Testing and Maintenance Scenario 2 (Bi-Annual Testing)

5.29 Table 5.7 below shows the predicted impact of the proposed development, with reference to the hourly mean AQO for NO_2.

Table 5.7: Predicted percentile mean concentrations of NO_2

Receptor Point	99.79 Percentile Hourly Mean NO_2				
	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC % of (AQS – 2* background)
R1	5.24	2.6%	77.24	38.6%	4.1%
R2	2.65	1.3%	74.65	37.3%	2.1%
R3	10.03	5.0%	82.03	41.0%	7.8%
R4	4.04	2.0%	76.04	38.0%	3.2%
R5	0.67	0.3%	72.67	36.3%	0.5%
R6	3.45	1.7%	75.45	37.7%	2.7%
R7	3.15	1.6%	75.15	37.6%	2.5%
R8	3.42	1.7%	75.42	37.7%	2.7%
R9	13.63	6.8%	85.63	42.8%	10.7%
R10	4.94	2.5%	76.94	38.5%	3.9%
R11	1.56	0.8%	73.56	36.8%	1.2%
R12	1.54	0.8%	73.54	36.8%	1.2%
R13	2.71	1.4%	74.71	37.4%	2.1%
R14	2.18	1.1%	74.18	37.1%	1.7%
R15	1.69	0.8%	73.69	36.8%	1.3%
R16	1.07	0.5%	73.07	36.5%	0.8%
R17	1.31	0.7%	73.31	36.7%	1.0%
R18	2.18	1.1%	74.18	37.1%	1.7%
R19	13.75	6.9%	85.75	42.9%	10.7%

5.30 The data in Table 5.7 show that the hourly percentile mean PC of NO_2 is less than the 10% screening criterion at all receptors. Furthermore, the PEC is less than the AQS at all receptors.

5.31 Given that these results are based on the overly conservative assumption that testing and maintenance scenario would occur in every hour of the year, the short-term impacts as a result of Testing Scenario 2 are not considered to be significant. Therefore, short-term NO_2 impacts from maintenance and testing of Scenario 2 can be screened out.

SO_2

5.32 Table 5.8 below shows the predicted impact of the facility under Testing Scenario 2, with reference to the 15-minute mean, 1-hour mean and 24-hour mean AQO for SO_2.

Table 5.8: Predicted percentile mean concentrations of SO_2

Receptor Point	15-minute mean SO_2				1 hour mean SO_2				24 hour mean SO_2			
	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS
R1	0.08	0.0%	12.28	4.6%	0.07	0.0%	12.27	6.1%	0.05	0.0%	12.25	9.8%
R2	0.04	0.0%	12.24	4.6%	0.04	0.0%	12.24	6.1%	0.02	0.0%	12.22	9.8%
R3	0.19	0.1%	12.39	4.7%	0.14	0.0%	12.34	6.2%	0.08	0.1%	12.28	9.8%

R4	0.07	0.0%	12.27	4.6%	0.06	0.0%	12.26	6.1%	0.03	0.0%	12.23	9.8%
R5	0.01	0.0%	12.21	4.6%	0.01	0.0%	12.21	6.1%	0.00	0.0%	12.20	9.8%
R6	0.05	0.0%	12.25	4.6%	0.05	0.0%	12.25	6.1%	0.03	0.0%	12.23	9.8%
R7	0.05	0.0%	12.25	4.6%	0.05	0.0%	12.25	6.1%	0.02	0.0%	12.22	9.8%
R8	0.05	0.0%	12.25	4.6%	0.05	0.0%	12.25	6.1%	0.04	0.0%	12.24	9.8%
R9	0.22	0.1%	12.42	4.7%	0.19	0.1%	12.39	6.2%	0.07	0.1%	12.27	9.8%
R10	0.08	0.0%	12.28	4.6%	0.07	0.0%	12.27	6.1%	0.05	0.0%	12.25	9.8%
R11	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R12	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R13	0.05	0.0%	12.25	4.6%	0.04	0.0%	12.24	6.1%	0.03	0.0%	12.23	9.8%
R14	0.04	0.0%	12.24	4.6%	0.03	0.0%	12.23	6.1%	0.02	0.0%	12.22	9.8%
R15	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R16	0.02	0.0%	12.22	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R17	0.03	0.0%	12.23	4.6%	0.02	0.0%	12.22	6.1%	0.01	0.0%	12.21	9.8%
R18	0.04	0.0%	12.24	4.6%	0.03	0.0%	12.23	6.1%	0.02	0.0%	12.22	9.8%
R19	0.20	0.1%	12.40	4.7%	0.20	0.1%	12.40	6.2%	0.15	0.1%	12.35	9.9%

5.33 At no location of relevant exposure is a short-term mean concentration of SO_2, predicted to exceed the relevant AQS.

5.34 The data in Table 5.8 show that all short term increases in SO_2 are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.35 As such, significant short-term impacts on SO_2 as a result of maintenance and Testing Scenario 2 are not anticipated. Therefore, short-term SO_2 impacts from maintenance and testing of Scenario 2 can be screened out.

CO

5.36 Table 5.9 below shows the predicted impact of the facility under Testing Scenario 2, with reference to the 1-hour mean and 8-hour rolling daily maximum mean AQOs for CO.

Table 5.9: Predicted percentile mean concentrations of CO

Receptor Point	8-hour maximum daily rolling mean				1-hour maximum mean			
	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS
R1	6.32	0.1%	818.32	8.2%	8.72	0.0%	820.72	2.7%
R2	3.50	0.0%	815.50	8.2%	4.10	0.0%	816.10	2.7%
R3	11.44	0.1%	823.44	8.2%	18.65	0.1%	830.65	2.8%
R4	4.56	0.0%	816.56	8.2%	6.54	0.0%	818.54	2.7%
R5	0.67	0.0%	812.67	8.1%	1.11	0.0%	813.11	2.7%
R6	4.54	0.0%	816.54	8.2%	5.13	0.0%	817.13	2.7%
R7	4.17	0.0%	816.17	8.2%	5.05	0.0%	817.05	2.7%
R8	4.67	0.0%	816.67	8.2%	5.23	0.0%	817.23	2.7%
R9	14.78	0.1%	826.78	8.3%	25.11	0.1%	837.11	2.8%
R10	6.22	0.1%	818.22	8.2%	7.56	0.0%	819.56	2.7%
R11	1.82	0.0%	813.82	8.1%	2.74	0.0%	814.74	2.7%

R12	1.91	0.0%	813.91	8.1%	2.54	0.0%	814.54	2.7%
R13	3.58	0.0%	815.58	8.2%	4.26	0.0%	816.26	2.7%
R14	2.81	0.0%	814.81	8.1%	3.51	0.0%	815.51	2.7%
R15	2.08	0.0%	814.08	8.1%	2.63	0.0%	814.63	2.7%
R16	1.39	0.0%	813.39	8.1%	1.70	0.0%	813.70	2.7%
R17	1.46	0.0%	813.46	8.1%	1.96	0.0%	813.96	2.7%
R18	2.86	0.0%	814.86	8.1%	3.48	0.0%	815.48	2.7%
R19	18.82	0.2%	830.82	8.3%	21.06	0.1%	833.06	2.8%

5.37 At no location of relevant exposure is a short-term concentration of CO predicted to exceed the relevant AQS.

5.38 The data in Table 5.9 show that all short term increases in CO are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.39 As such, significant short-term impacts on CO as a result of maintenance and Testing Scenario 2 are not anticipated. Therefore, short-term CO impacts from maintenance and testing of Scenario 2 can be screened out.

Daily maximum mean PM_{10}

5.40 Table 5.10 below shows the predicted impact of the proposed development, with reference to the 90.41st percentile (i.e., the 36th worst day in the year) daily maximum mean AQO for PM_{10} (50μgm^{-3} not to be exceeded more than 35 days in a year). These results are based on a grid failure event (4 hours).

Table 5.10: Predicted percentile mean concentrations of PM_{10} (for comparison with daily maximum mean AQO)

Receptor Point	90.41st daily maximum Mean PM_{10}			
	PC (μg.m^{-3})	PC % of AQS	PEC (μg.m^{-3})	PEC % of AQS
R1	0.09	0.2%	44.09	88.2%
R2	0.06	0.1%	44.06	88.1%
R3	0.19	0.4%	44.19	88.4%
R4	0.08	0.2%	44.08	88.2%
R5	0.02	0.0%	44.02	88.0%
R6	0.07	0.1%	44.07	88.1%
R7	0.05	0.1%	44.05	88.1%
R8	0.15	0.3%	44.15	88.3%
R9	0.23	0.5%	44.23	88.5%
R10	0.22	0.4%	44.22	88.4%
R11	0.03	0.1%	44.03	88.1%
R12	0.02	0.0%	44.02	88.0%
R13	0.08	0.2%	44.08	88.2%
R14	0.07	0.1%	44.07	88.1%
R15	0.04	0.1%	44.04	88.1%
R16	0.03	0.1%	44.03	88.1%

R17	0.03	0.1%	44.03	88.1%
R18	0.05	0.1%	44.05	88.1%
R19	0.49	1.0%	44.49	89.0%

5.41 At no location of relevant receptor exposure is the daily maximum mean concentration of PM_{10} predicted to exceed the relevant AQS.

5.42 The data in Table 5.10 show that all short term increases in PM_{10} are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.43 As such, significant short-term impacts on PM_{10} as a result of maintenance and Testing Scenario 2 are not anticipated. Therefore, short-term PM_{10} impacts from maintenance and testing of Scenario 2 can be screened out.

Emergency Operation (72-hour grid failure)

5.44 Table 5.11 below shows the predicted impact of the proposed development, with reference to the hourly mean AQO for NO_2.

Table 5.11: Predicted percentile mean concentrations of NO_2

Receptor Point	99.79 Percentile Hourly Mean NO_2				
	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS	PC % of (AQS – 2* background)
R1	36.87	**18%**	108.87	54%	**22.5%**
R2	20.16	**10%**	92.16	46%	12.3%
R3	69.31	**35%**	141.31	71%	**42.3%**
R4	30.09	**15%**	102.09	51%	18.3%
R5	5.32	3%	77.32	39%	3.2%
R6	26.17	**13%**	98.17	49%	16.0%
R7	24.34	**12%**	96.34	48%	14.8%
R8	26.41	**13%**	98.41	49%	16.1%
R9	68.57	**34%**	140.57	70%	**41.8%**
R10	32.14	16%	104.14	52%	19.6%
R11	11.97	6%	83.97	42%	7.3%
R12	12.58	6%	84.58	42%	7.7%
R13	19.97	**10%**	91.97	46%	12.2%
R14	16.27	8%	88.27	44%	9.9%
R15	13.24	7%	85.24	43%	8.1%
R16	8.08	4%	80.08	40%	4.9%
R17	9.55	5%	81.55	41%	5.8%
R18	17.58	9%	89.58	45%	10.7%
R19	82.27	**41%**	154.27	77%	**50.2%**

5.45 The data in Table 5.11 show that the hourly percentile mean PCs of NO_2 is greater than the 10% screening criterion at 11 of the 19 discrete receptors in the vicinity of the site. Furthermore, the second screening criterion is exceeded at 4 of the 19 receptors.

5.46 However, the PEC is less than the 200 µg.m^{-3} AQS at all receptors across the model domain, even at the 99.79th percentile. As a result, a hypergeometric distribution has not been completed as there are no predicted exceedances.

5.47 As such, significant short-term impacts on NO_2 as a result of an emergency grid failure are not anticipated.

5.48 It is also noted that all concentrations of NO_2 are substantially lower than the US EPA's Acute Exposure Guidance Levels (AEGLs)[20]. The AEGL for non-disabling impacts is at 940 µg.m^{-3}, whereas no modelled receptor is expected to experience hourly concentrations in excess of 150 µg.m^{-3}.

SO_2

5.49 Table 5.12 below shows the predicted impact of the facility under an emergency scenario, with reference to the 15-minute mean, 1-hour mean and 24-hour mean AQO for SO_2.

Table 5.12 Predicted percentile mean concentrations of SO_2

Receptor Point	15-minute mean SO_2				1 hour mean SO_2				24 hour mean SO_2			
	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS	PC (µg.m^{-3})	PC % of AQS	PEC (µg.m^{-3})	PEC % of AQS
R1	0.94	0.4%	13.14	4.9%	0.88	0.3%	13.08	6.5%	0.59	0.5%	12.79	10.2%
R2	0.55	0.2%	12.75	4.8%	0.49	0.1%	12.69	6.3%	0.28	0.2%	12.48	10.0%
R3	2.11	0.8%	14.31	5.4%	1.59	0.5%	13.79	6.9%	0.93	0.7%	13.13	10.5%
R4	0.94	0.4%	13.14	4.9%	0.72	0.2%	12.92	6.5%	0.32	0.3%	12.52	10.0%
R5	0.19	0.1%	12.39	4.7%	0.13	0.0%	12.33	6.2%	0.05	0.0%	12.25	9.8%
R6	0.67	0.3%	12.87	4.8%	0.63	0.2%	12.83	6.4%	0.35	0.3%	12.55	10.0%
R7	0.73	0.3%	12.93	4.9%	0.58	0.2%	12.78	6.4%	0.29	0.2%	12.49	10.0%
R8	0.68	0.3%	12.88	4.8%	0.64	0.2%	12.84	6.4%	0.46	0.4%	12.66	10.1%
R9	1.76	0.7%	13.96	5.2%	1.63	0.5%	13.83	6.9%	0.83	0.7%	13.03	10.4%
R10	0.85	0.3%	13.05	4.9%	0.77	0.2%	12.97	6.5%	0.54	0.4%	12.74	10.2%
R11	0.36	0.1%	12.56	4.7%	0.29	0.1%	12.49	6.2%	0.14	0.1%	12.34	9.9%
R12	0.40	0.2%	12.60	4.7%	0.30	0.1%	12.50	6.2%	0.11	0.1%	12.31	9.9%
R13	0.55	0.2%	12.75	4.8%	0.48	0.1%	12.68	6.3%	0.33	0.3%	12.53	10.0%
R14	0.46	0.2%	12.66	4.8%	0.39	0.1%	12.59	6.3%	0.26	0.2%	12.46	10.0%
R15	0.39	0.1%	12.59	4.7%	0.32	0.1%	12.52	6.3%	0.18	0.1%	12.38	9.9%
R16	0.25	0.1%	12.45	4.7%	0.19	0.1%	12.39	6.2%	0.10	0.1%	12.30	9.8%
R17	0.31	0.1%	12.51	4.7%	0.23	0.1%	12.43	6.2%	0.10	0.1%	12.30	9.8%
R18	0.49	0.2%	12.69	4.8%	0.42	0.1%	12.62	6.3%	0.29	0.2%	12.49	10.0%
R19	2.04	0.8%	14.24	5.4%	1.99	0.6%	14.19	7.1%	1.44	1.2%	13.64	10.9%

5.50 At no location of relevant exposure is a short-term mean concentration of SO_2, predicted to exceed the relevant AQS.

[20] US EPA (2012). Acute Exposure Guidance Levels for Selected Airborne Chemicals (Vol. 11).

5.51 The data in Table 5.12 show that all increases in short term increases in SO_2 are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.52 As such, significant short-term impacts on SO_2 as a result of maintenance and Emergency Operation are not anticipated.

CO

5.53 Table 5.13 below shows the predicted impact of the facility under Testing Scenario 2, with reference to the 1-hour mean and 8-hour rolling daily maximum mean AQOs for CO.

Table 5.13: Predicted percentile mean concentrations of CO

Receptor Point	8-hour maximum daily rolling mean				1-hour maximum mean			
	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS	PC ($\mu g.m^{-3}$)	PC % of AQS	PEC ($\mu g.m^{-3}$)	PEC % of AQS
R1	77.10	0.8%	889.10	8.9%	101.29	0.3%	913.29	3.0%
R2	47.39	0.5%	859.39	8.6%	52.52	0.2%	864.52	2.9%
R3	156.71	1.6%	968.71	9.7%	197.19	0.7%	1009.19	3.4%
R4	59.71	0.6%	871.71	8.7%	83.63	0.3%	895.63	3.0%
R5	12.15	0.1%	824.15	8.2%	15.78	0.1%	827.78	2.8%
R6	57.67	0.6%	869.67	8.7%	67.10	0.2%	879.10	2.9%
R7	54.75	0.5%	866.75	8.7%	64.80	0.2%	876.80	2.9%
R8	58.99	0.6%	870.99	8.7%	67.76	0.2%	879.76	2.9%
R9	149.59	1.5%	961.59	9.6%	194.97	0.6%	1006.97	3.4%
R10	70.67	0.7%	882.67	8.8%	83.91	0.3%	895.91	3.0%
R11	24.26	0.2%	836.26	8.4%	33.47	0.1%	845.47	2.8%
R12	25.44	0.3%	837.44	8.4%	35.45	0.1%	847.45	2.8%
R13	45.08	0.5%	857.08	8.6%	51.07	0.2%	863.07	2.9%
R14	37.46	0.4%	849.46	8.5%	42.63	0.1%	854.63	2.8%
R15	28.18	0.3%	840.18	8.4%	34.46	0.1%	846.46	2.8%
R16	17.46	0.2%	829.46	8.3%	20.56	0.1%	832.56	2.8%
R17	21.10	0.2%	833.10	8.3%	24.79	0.1%	836.79	2.8%
R18	40.40	0.4%	852.40	8.5%	47.11	0.2%	859.11	2.9%
R19	188.69	1.9%	1000.69	10.0%	208.35	0.7%	1020.35	3.4%

5.54 At no location of relevant exposure is a short-term concentration of CO predicted to exceed the relevant AQS.

5.55 The data in Table 5.13 show that all short term increases in CO are significantly less than the 10% screening criterion, even when assuming constant operation all year around.

5.56 As such, significant short-term impacts on CO as a result of maintenance and Emergency Operation are not anticipated.

Daily maximum mean PM_{10}

5.57 A 72-hour grid failure event could only occur for a maximum of three days. As such, it is not possible for the daily maximum mean AQO for PM_{10} (50μgm^{-3} not to be exceeded more than 35 days in a year) to be exceeded as a result of a prolonged grid failure of 72 hours.

6. Conclusions

6.1 Phlorum Ltd has been commissioned by HDR to undertake an air quality assessment (AQA) to support the permit application to operate a data centre at Bulls Bridge Industrial Estate, Hayes, UB3 4QQ.

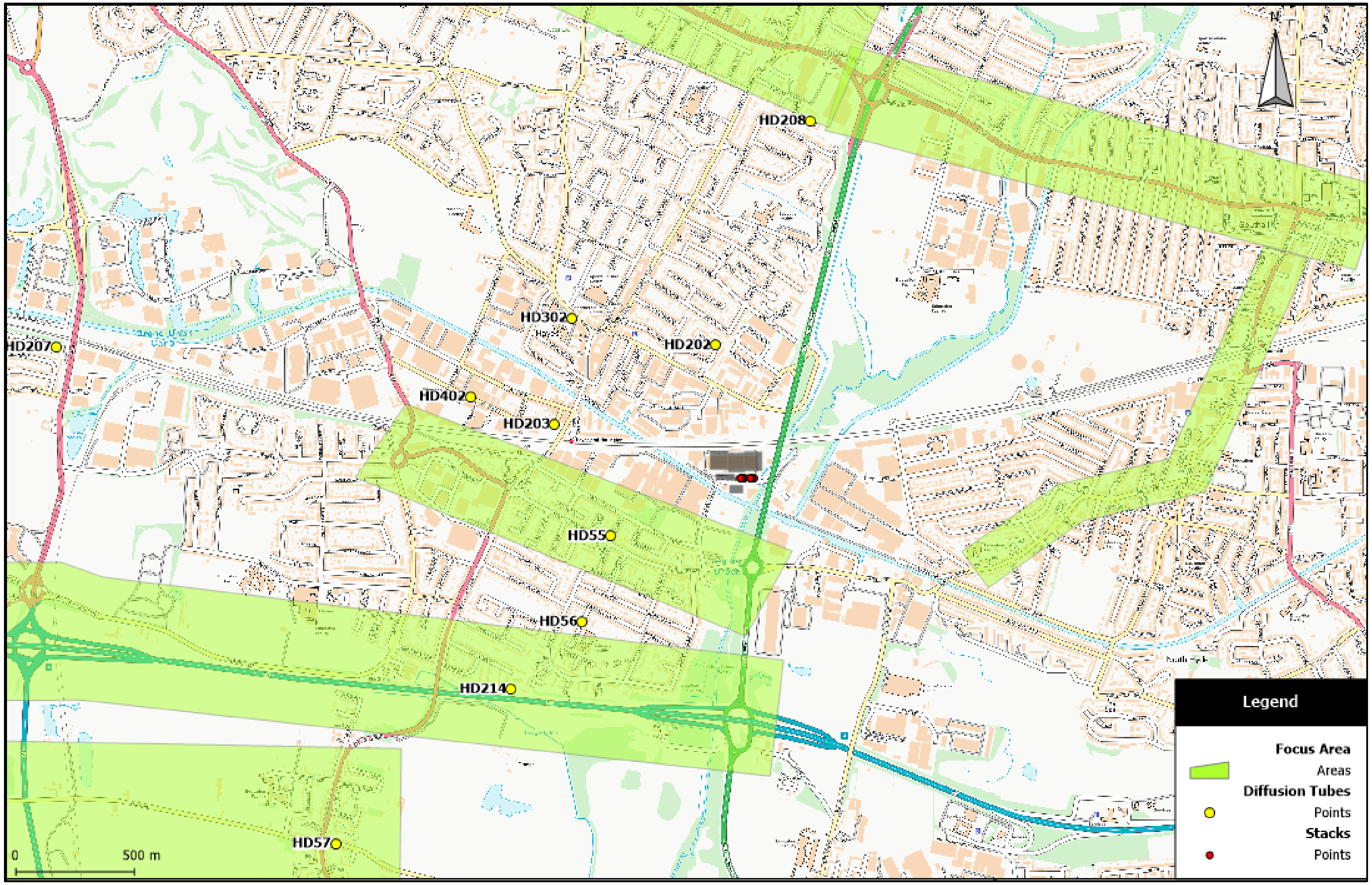
6.2 A dispersion modelling assessment of the 14 SBGs was undertaken, with flues at a height of 23m above ground level and SCR incorporated to achieve a NO_X efficiency of 95 mg/Nm^3. Concentrations of NO_2, PM_{10}, SO_2, CO and benzene were predicted at selected receptors using a detailed dispersion model and compared with the relevant long and short-term AQOs.

6.3 The results in Section 5 of this report show that the relevant screening criteria are not exceeded at any modelled receptor location for particulate matter, SO_2, CO or Benzene. The hourly mean percentile PC of NO_2 is anticipated to exceed both short-term screening criteria at four discrete receptors in the vicinity of the site, during a 72-hour grid failure event. However, the PEC is anticipated to be less than the relevant AQS at all receptors, even at the 99.79th percentile. As such, significant short-term impacts on NO_2 as a result of an emergency grid failure are not anticipated.

6.4 Both long term and short term increases in pollution concentrations as a result of the operation of the proposed SBGs are not expected to have a significant impact on local air quality, in any normal grid failure or testing scenarios.

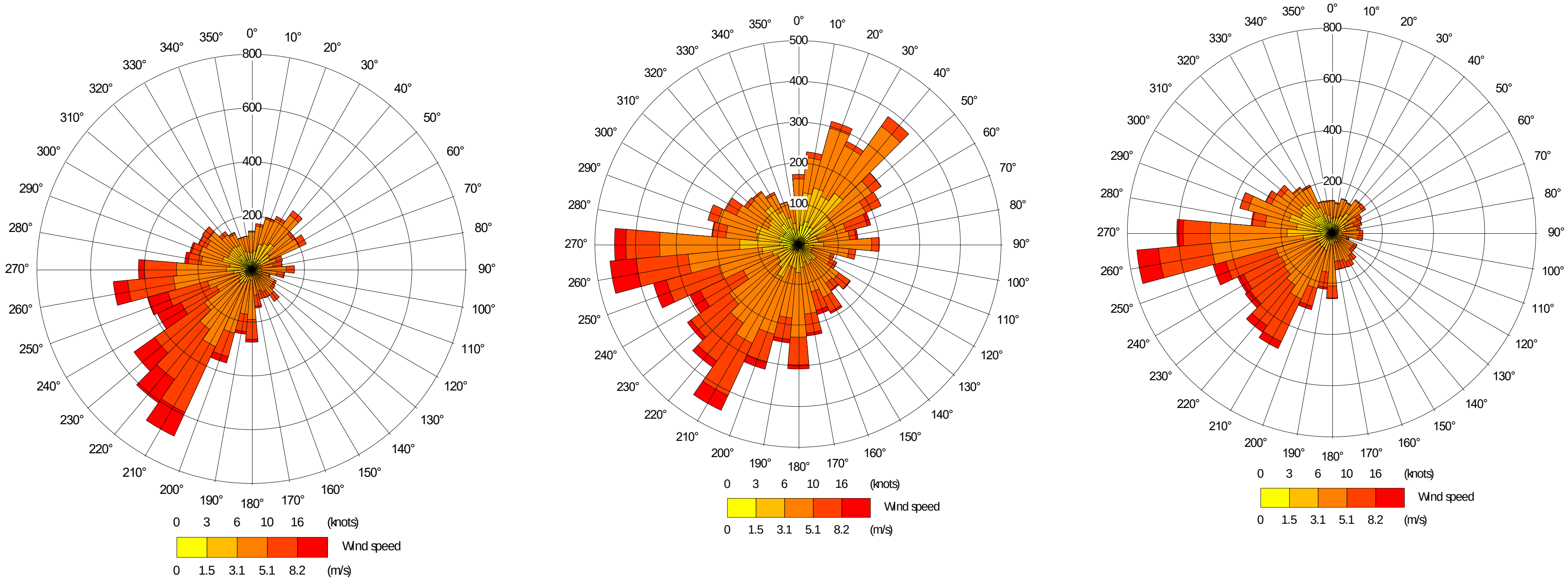
Figures

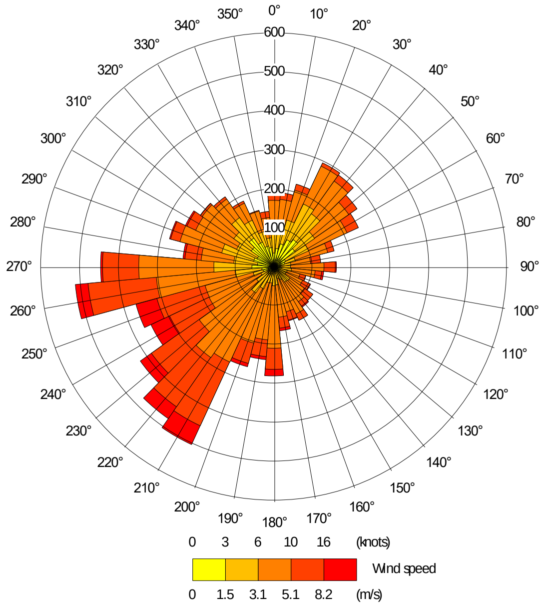
Figure 1: Site Location Plan



Note 1: Contains Ordnance Survey Data ©Crown Copyright and Database Right 2019

Figure 2: Wind Roses for Heathrow Airport 2015 to 2019

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Wind speed
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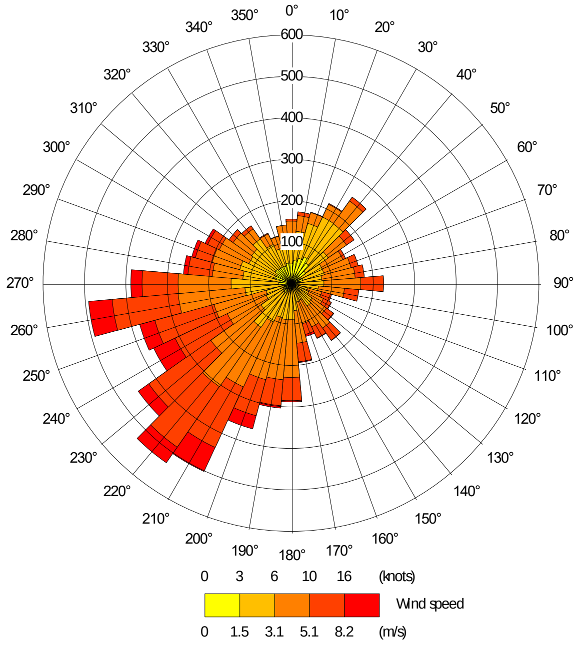
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0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

Figure 3: Impact Assessment Receptors and Stacks

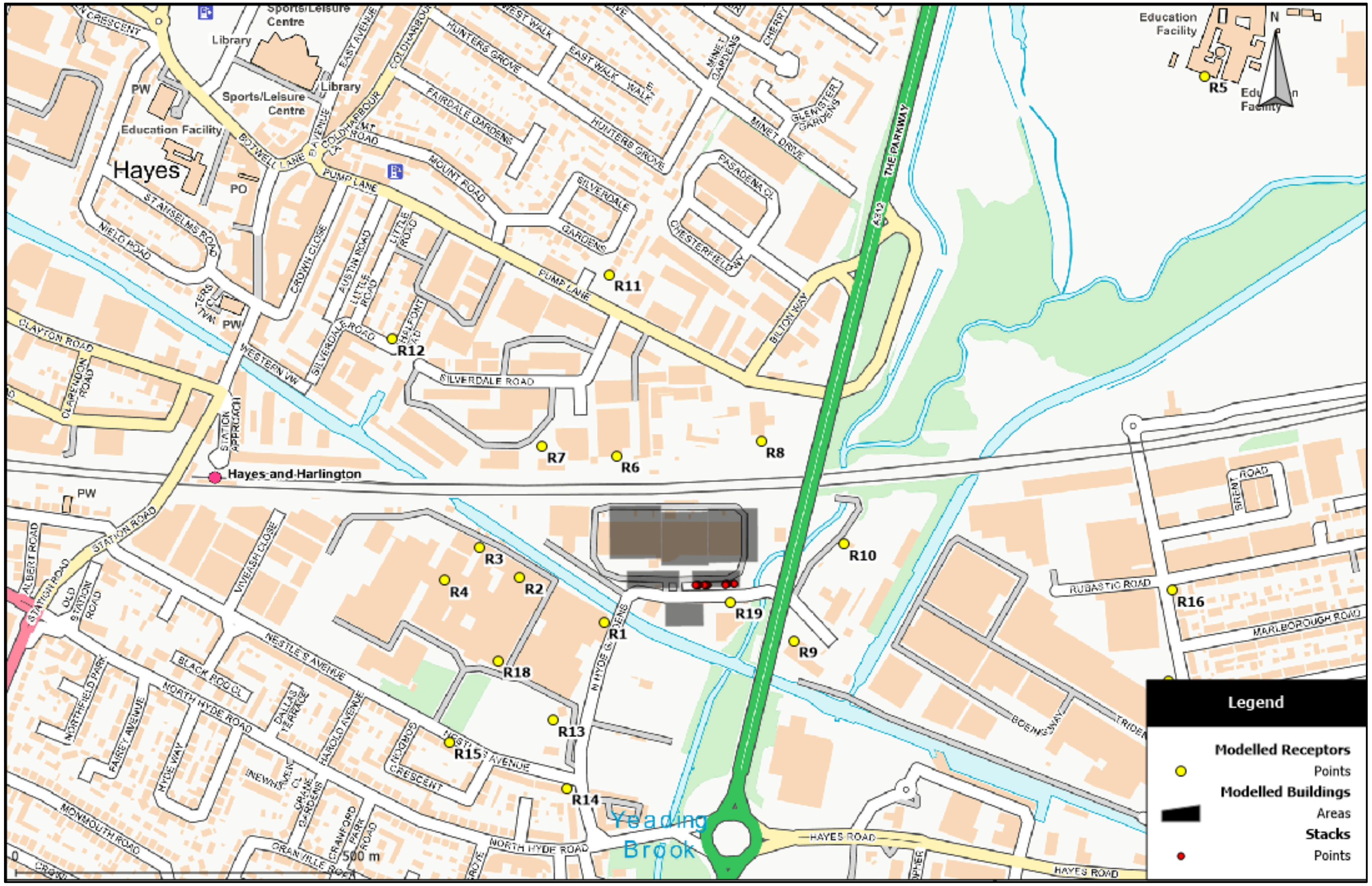

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Figure 4: Annual Mean PC for NO_2 (1.5m) (µg.m^{-3}), Grid Failure

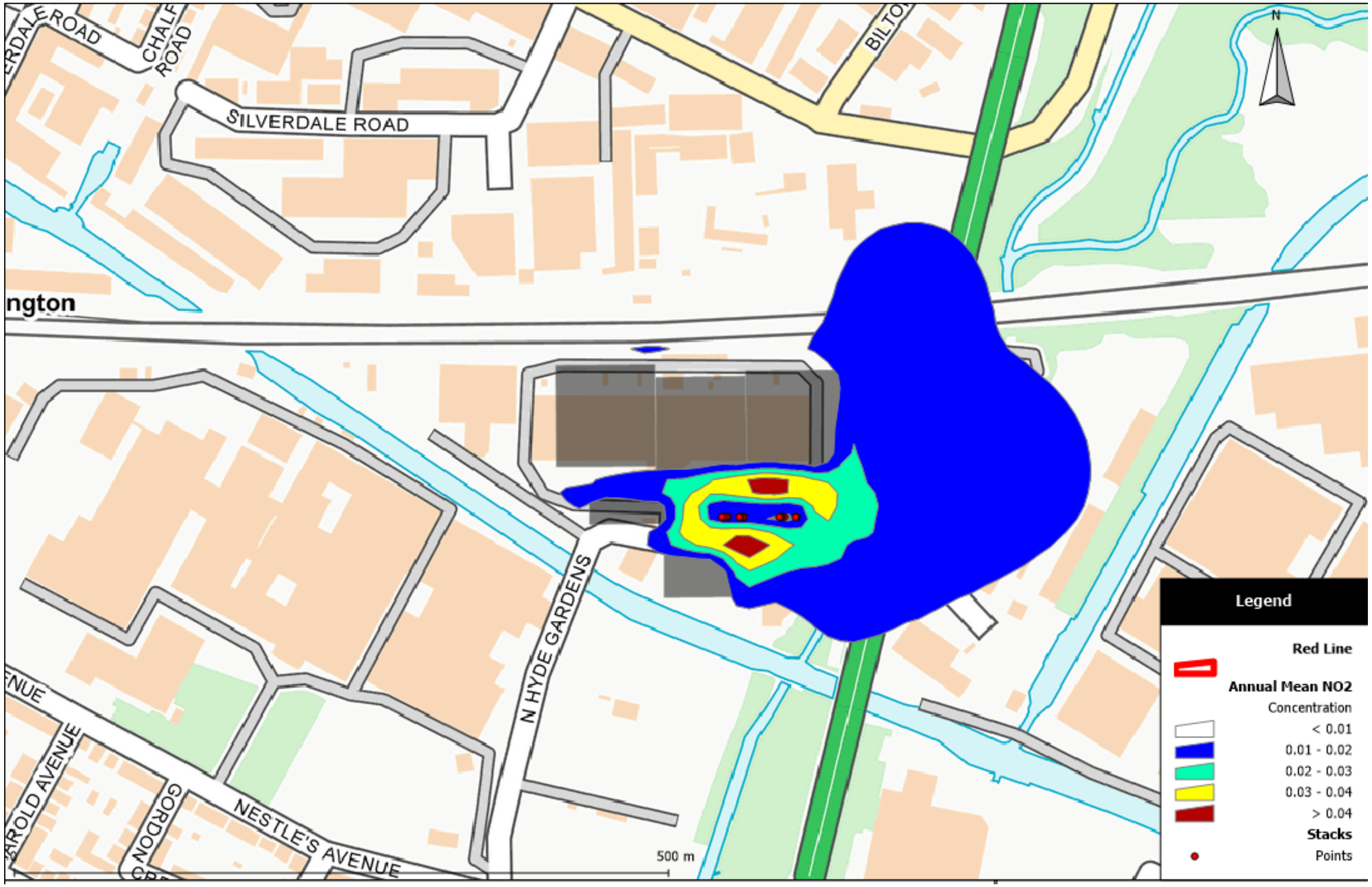

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Figure 5: Annual Mean PC for NO_2 (1.5m) ($\mu g.m^{-3}$),Testing and Maintenance

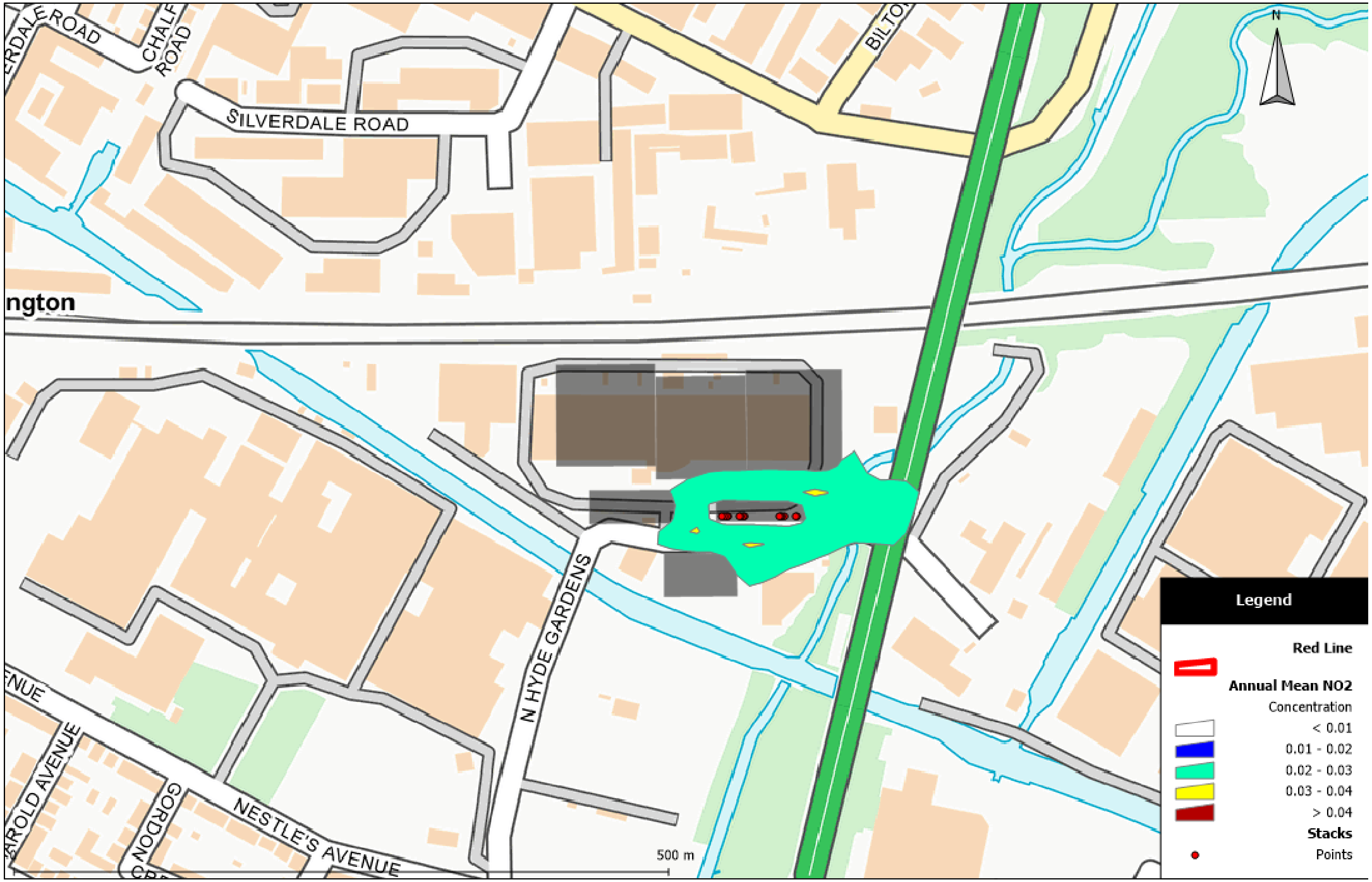

Figure 6: 99.79th percentile hourly PC for NO_2 (1.5m) (µg.m^{-3}),Grid Failure

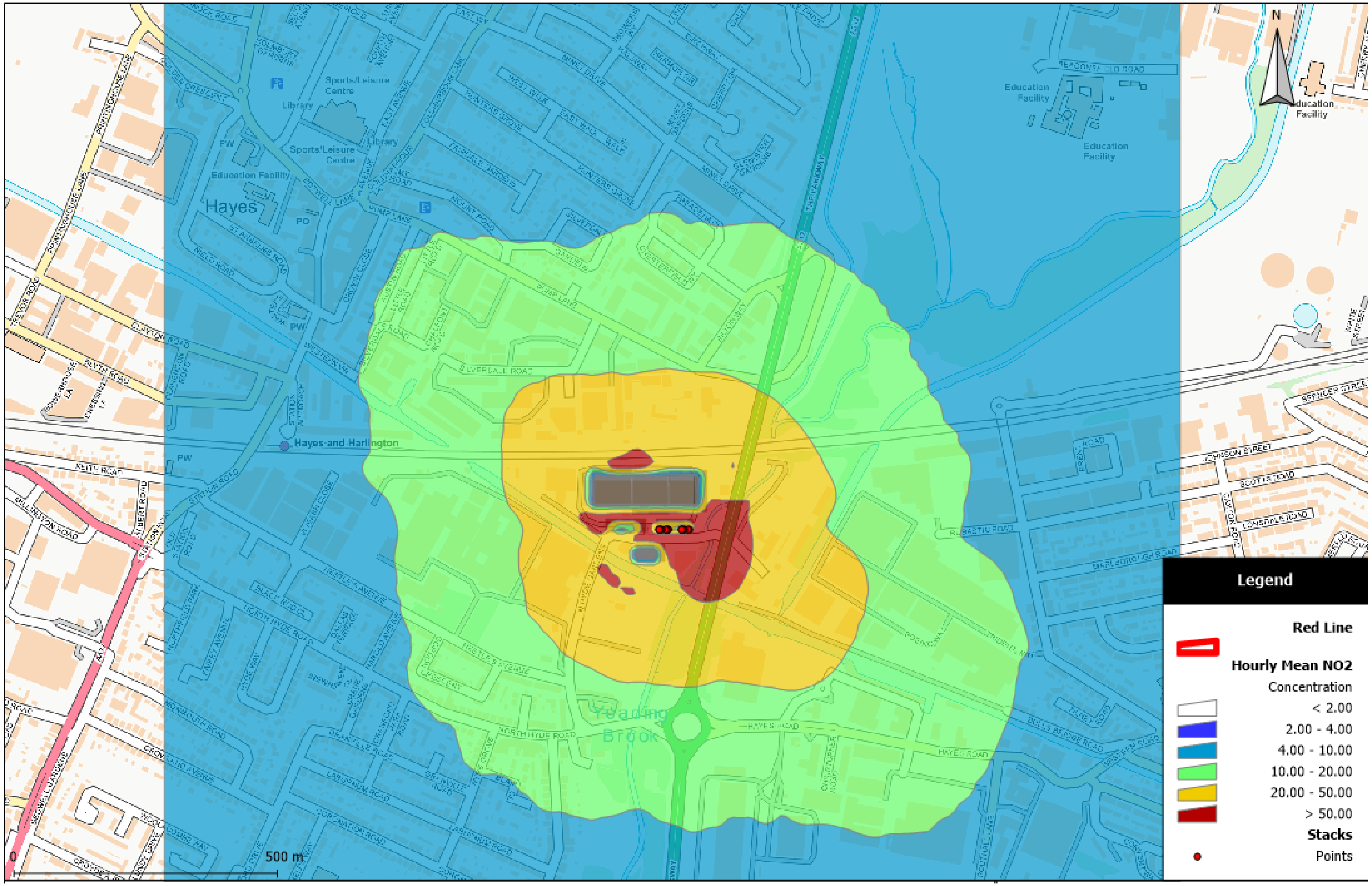

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Figure 7: 99.79th percentile hourly PC for NO_2 (1.5m) ($\mu g.m^{-3}$),Testing Scenario 1 (25% load)

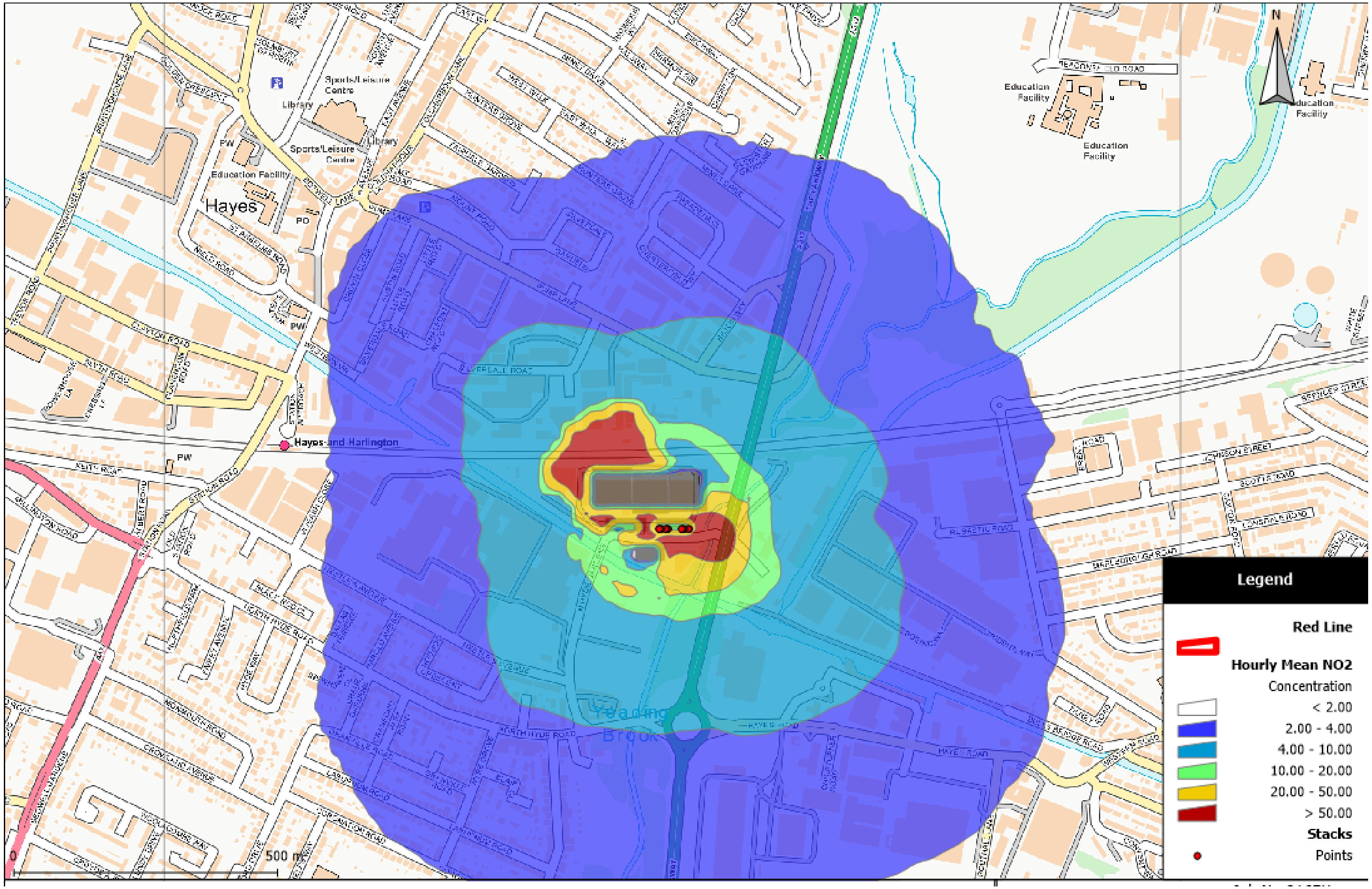

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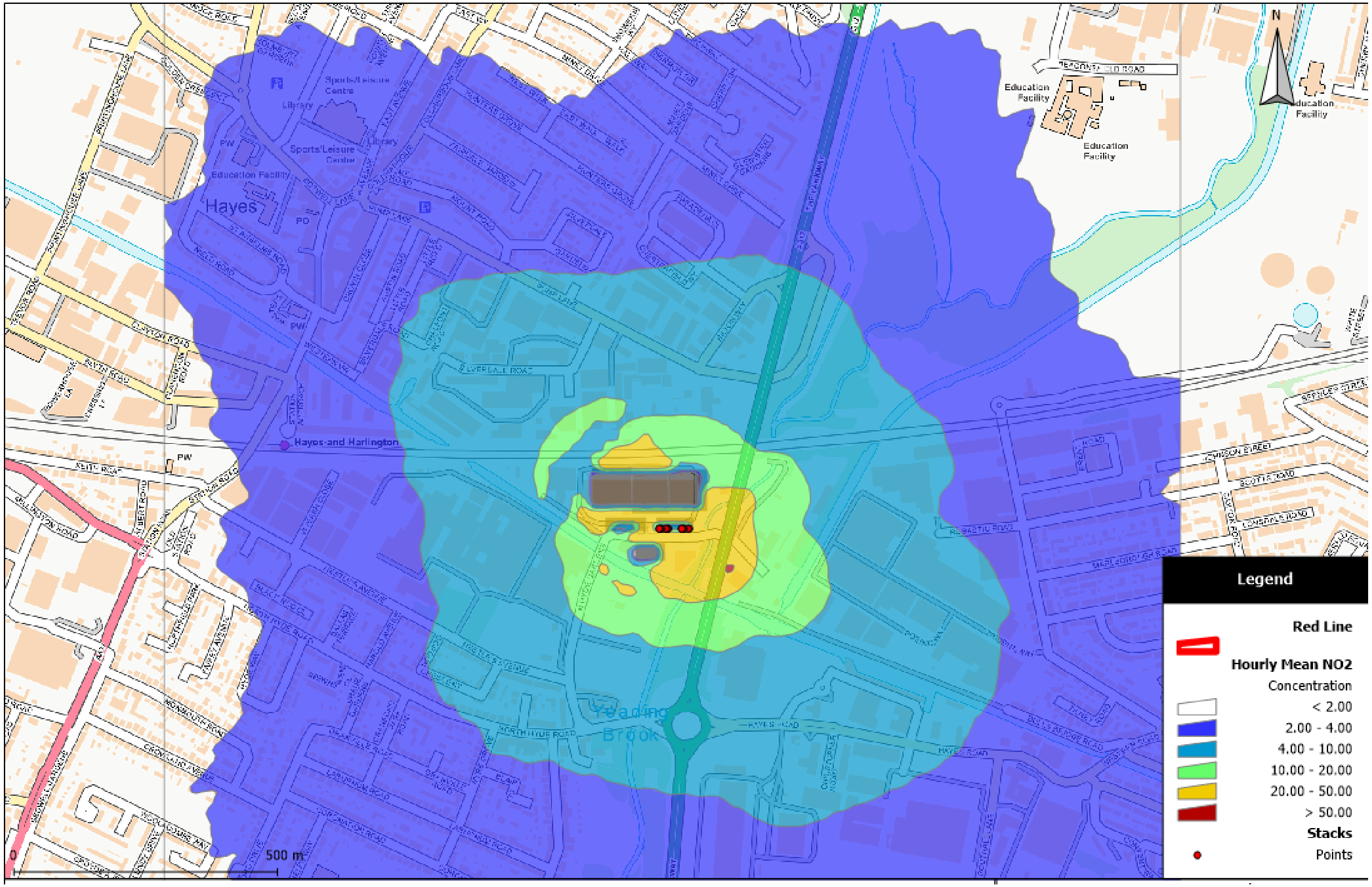
Figure 8: 99.79th percentile hourly PC for NO_2 (1.5m) ($\mu g.m^{-3}$),Testing Scenario 2 (100% load)



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Appendices

Appendix A: EPUK & IAQM Impact Descriptors

IAQM impact Descriptors

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

Explanation

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. .less than 0.5% will be described as Negligible..
3. The Table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

Appendix B: Model Input Data

Table B.1 Modelled Buildings

Building	Centroid		Height (m)	Length(m)	Width(m)	Angle(degrees)
	X	Y				
Energy Centre 1	510401.2	179263.7	21.1	76	24	90
Energy Centre 3	510447.6	179211.4	21.1	56	32	90
Data Centre W	510375.2	179333.8	32.5	77	78	90
Data Centre	510448.3	179324.2	32.5	70	78	90
Data Centre E	510519.1	179329.1	32.5	74	78	90
Energy Centre 2	510494.6	179264.8	21.1	70	24	89

Table B.2 Stack Locations

Stack	X	Y
S1	510521.5	179257
S2	510520.2	179256.9
S3	510511.5	179256.8
S4	510510.2	179256.8
S5	510508.7	179256.8
S6	510507.6	179256.8
S7	510481.5	179256.5
S8	510480.3	179256.5
S9	510478.6	179256.5
S10	510477.5	179256.4
S11	510468.5	179256.3
S12	510467.3	179256.3
S13	510465.7	179256.3
S14	510464.3	179256.3

Appendix C: Emissions Data Sheet (DS4000 20V4000G94LF) – O_2 at 5%

Motordaten

engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G94LF				
Application group	3D				
Emission Stage/Optimisation	NEA Singapore for ORDE				
Test cycle	D2				
fuel sulphur content [ppm]	7				
mg/mN³ values base on residual oxygen value of [%]	5				

Motor Rohemissionen*

*Engine raw emissions**

Cycle point		[-]	n1	n2	n3	n4	n5	n6	n7	n8
Power (P/PN)		[-]	1	0,75	0,50	0,25	0,10			
Power		[kW]	3307	2480	1653	827	331			
Speed (n/nN)		[-]	1	1	1	1	1			
Speed		[rpm]	1500	1499	1499	1500	1499			
Exhaust temperature after turbine		[°C]	482	427	434	403	268			
Exhaust massflow		[kg/h]	19196	15930	12083	7485	5323			
Exhaust back pressure (total)		[mbar]	52	32	14	5	0			
NOx		[g/kWh]	6,6	5,9	4,8	4,4	9,1			
		[mg/mN³]	2362	2172	1639	1375	2411			
CO		[g/kWh]	0,3	0,4	1,0	1,4	2,8			
		[mg/mN³]	111	139	339	445	723			
HC		[g/kWh]	0,05	0,07	0,09	0,16	0,72			
		[mg/mN³]	19	23	29	50	187			
O2		[%]	5,0	5,0	5,0	5,0	5,0			
Particulate measured		[g/kWh]	0,02	0,03	0,10	0,18	0,05			
		[mg/mN³]	7	10	33	55	13			
Particulate calculated		[g/kWh]	-	-	-	-	-			
		[mg/mN³]	-	-	-	-	-			
Dust (only TA-Luft)		[mg/mN³]	-	-	-	-	-			
FSN		[-]	0,2	0,2	0,6	1,0	0,1			
NO/NO2**		[-]	-	-	-	-	-			
CO2		[g/kWh]	645,7	632,1	669,3	721,6	844,5			
		[mg/mN³]	223605	223061	222522	222035	219215			
SO2		[g/kWh]	0,003	0,003	0,003	0,003	0,004			
		[mg/mN³]	1,0	1,0	1,0	1,0	1,0			

* Emission data measurement procedures are consistent with the respective emission evaluation process. Noncertified engines are measured to sales data (TVU/TEN) standard conditions.
These boundary conditions might not be representative for detailed dimensioning of exhaust gas aftertreatment, in this case it is recommended to contact the responsible department for more information.
Measurements are subject to variation. The nominal emission data shown is subject to instrumentation, measurement, facility, and engine-to-engine variations.
All data applies to an engine in new condition. Over extended operating time deterioration may occur which might have an impact on emission.
Exhaust temperature depends on engine ambient conditions.

** No standard test. To be measured on demand.

Aenderungsbeschreibung/Description of Revision	Komm. von/Frequency
Angabe Sauerstoffgehalt im Abgas bei Bezug auf 5% angepasst	

Buchst./Rev. Ltr.	Aenderungs-Nr./Revision Notice No.	Bearbeitungsstatus/Lifecycle
a.1		In Arbeit

MTU Friedrichshafen GmbH

WORD	Datum/ Date	Name
Erstell. Drawn	20.09.2017 09:36:43	zwislerp
Bearb. Change	20.09.2017 13:37:26	zwislerp
Inhalt Content	10.04.2017	Locher
Gepr. Checked	20.09.2017	Knettel

Motortyp / Engine Type: **20V4000G94LF**

Projekt-/Auftrags-Nr. Project/Order No.

Verwendbar f. Typ Applicable to Model

Format/Size: **A3**

Material-Nr./Material No.: **EDS 4000 1162**

Benennung/ Title: **Emissionsdatenblatt**

Emission Data Sheet

Zeichnungs-Nr./Drawing No.: **ZNG00005084**

Beschreibung/Description

Blatt/ Sheet **5** von/of **6**

Appendix D: Methodology for Assessing Ecological Receptors

Results

The proposed development's predicted impact on the ecological receptors in Table 3.6, under normal testing and maintenance, and under an emergency operation, is presented below.

For the assessment of annual mean impacts, the outputs of Testing Scenario 1 and Testing Scenario 2 are combined, to reflect the combined impact of all testing and maintenance on local air quality.

For short term impacts, the results for Testing Scenarios 1 and 2 are presented separately, as the different types of generator testing would not occur within the same hour. The long and short-term impacts associated with an emergency grid failure are also presented separately.

Long Term Changes: Testing Scenario 1 and 2

Table D.1: Annual Mean NO_X

Receptor	Designation	Annual Mean NO_X ($\mu g.m^{-3}$)				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.00	0.0%	26.21	87.4%	No
11	Richmond Park (SAC)	0.00	0.0%	26.74	89.1%	No
12	Priority Orchard	0.01	0.0%	46.45	154.8%	No
13	Priority Woodland	0.12	0.4%	43.21	144.0%	No
14	Priority Woodland	0.05	0.2%	43.14	143.8%	No
15	Priority Woodland	0.02	0.1%	43.11	143.7%	No

Table D.2: Nutrient Nitrogen Deposition

Receptor	Designation	N deposition (kg.N.ha^{-1}.yr-1)					Potentially Significant
		PC	CL	% of CL	PEC	% PEC	
2	South West London Waterbodies (SPA)	0.000	10.00	0.0%	9.10	91%	No
11	Richmond Park (SAC)	0.000	10.00	0.0%	28.28	283%	No
12	Priority Orchard	0.001	10.00	0.0%	30.80	308%	No
13	Priority Woodland	0.024	10.00	0.2%	30.82	308%	No
14	Priority Woodland	0.009	10.00	0.1%	30.81	308%	No
15	Priority Woodland	0.004	10.00	0.0%	30.80	308%	No

Table D.3: Annual Mean SO_2

Receptor	Designation	Annual Mean SO2 ($\mu g.m^{-3}$)				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.000	0.0%	6.10	61.0%	No
11	Richmond Park (SAC)	0.000	0.0%	6.10	61.0%	No
12	Priority Orchard	0.000	0.0%	6.10	61.0%	No

13	Priority Woodland	0.000	0.0%	6.10	61.0%	No
14	Priority Woodland	0.000	0.0%	6.10	61.0%	No
15	Priority Woodland	0.000	0.0%	6.10	61.0%	No

Long Term Changes: Grid Failure

Table D.4: Annual Mean NO_X

Receptor	Designation	Annual Mean NO_X ($\mu g.m^{-3}$)				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.00	0.0%	26.21	87.4%	No
11	Richmond Park (SAC)	0.00	0.0%	26.74	89.1%	No
12	Priority Orchard	0.01	0.0%	46.45	154.8%	No
13	Priority Woodland	0.11	0.4%	43.20	144.0%	No
14	Priority Woodland	0.05	0.2%	43.14	143.8%	No
15	Priority Woodland	0.02	0.1%	43.11	143.7%	No

Table D.5: Annual Mean SO_2

Receptor	Designation	Annual Mean SO_2 ($\mu g.m^{-3}$)				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.000	0.0%	6.10	61.0%	No
11	Richmond Park (SAC)	0.000	0.0%	6.10	61.0%	No
12	Priority Orchard	0.000	0.0%	6.10	61.0%	No
13	Priority Woodland	0.000	0.0%	6.10	61.0%	No
14	Priority Woodland	0.000	0.0%	6.10	61.0%	No
15	Priority Woodland	0.000	0.0%	6.10	61.0%	No

Table D.6 Nutrient Nitrogen Deposition

Receptor	Designation	N deposition ($kg.N.ha^{-1}.yr$-1)					Potentially Significant
		PC	CL	% of CL	PEC	% PEC	
2	South West London Waterbodies (SPA)	0.00	10.00	0.0%	9.10	91.0%	No
11	Richmond Park (SAC)	0.00	10.00	0.0%	28.28	282.8%	No
12	Priority Orchard	0.00	10.00	0.0%	30.80	308.0%	No
13	Priority Woodland	0.03	10.00	0.3%	30.80	308.0%	No
14	Priority Woodland	0.01	10.00	0.1%	30.80	308.0%	No
15	Priority Woodland	0.01	10.00	0.1%	30.80	308.0%	No

Short Term Changes: Testing Scenario 1

Table D.7: 24-hour mean NO_X

Receptor	Designation	24-hour Mean NO_X (µg.m^{-3})				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.18	0.2%	52.60	70.1%	No
11	Richmond Park (SAC)	0.12	0.2%	53.60	71.5%	No
12	Priority Orchard	2.40	3.2%	95.28	127.0%	No
13	Priority Woodland	20.85	27.8%	107.03	142.7%	No
14	Priority Woodland	28.61	38.2%	114.79	153.1%	No
15	Priority Woodland	10.22	13.6%	96.40	128.5%	No

Short Term Changes: Testing Scenario 2

Table D.8: 24-hour mean NO_X

Receptor	Designation	24-hour Mean NO_X (µg.m^{-3})				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.18	0.2%	52.60	70.1%	No
11	Richmond Park (SAC)	0.12	0.2%	53.60	71.5%	No
12	Priority Orchard	2.40	3.2%	95.28	127.0%	No
13	Priority Woodland	20.85	27.8%	107.03	142.7%	No
14	Priority Woodland	28.61	38.2%	114.79	153.1%	No
15	Priority Woodland	10.22	13.6%	96.40	128.5%	No

Short Term Changes: Grid Failure

Table D.9: 24-hour mean NO_X

Receptor	Designation	24-hour Mean NO_X (µg.m^{-3})				Potentially Significant
		NO_X	%AQS	PEC	%AQS	
2	South West London Waterbodies (SPA)	0.30	0.4%	52.72	70.3%	No
11	Richmond Park (SAC)	0.16	0.2%	53.64	71.5%	No
12	Priority Orchard	3.81	5.1%	96.69	128.9%	No
13	Priority Woodland	20.82	27.8%	107.00	142.7%	No
14	Priority Woodland	29.41	39.2%	115.59	154.1%	No
15	Priority Woodland	9.88	13.2%	96.06	128.1%	No

Results Summary

All changes in annual mean NO_X, SO_2, Nutrient nitrogen are less than 1% of the screening criterion at SPAs and SACs, and less than 100% at LWS' and priority woodland. As such, changes in annual mean pollutants as a result of maintenance and testing and a prolonged grid failure are not significant.

All changes in daily-maximum mean NO_X are less than 10% of the relevant critical load at the SPAs and SACs and less than less than 100% at LWS and priority woodland. As such, changes in 24-hour maximum mean NO_X as a result of maintenance and testing and a prolonged grid failure are not significant.

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