LON1 Phase B Environmental Permit Variation Application

Air Emissions Risk Assessment, LON1B, Dagenham

NTT Global Data Centers EMEA Limited

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SLR Project No.: 410.V61547.00001

Client Reference No: 053910

26 July 2024

Revision: V2.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
V0.1	2 November 2023	MF	LB	SA
V1.0	6 December 2023	MF	LB	SA
V2.0	26 July 2024	LB	MF / RG	SOB

Basis of Report

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1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by NTT Global Data Centers EMEA Limited (via RED Engineering Design Limited) to prepare an Environmental Permit (EP) variation application (EP reference EPR/CP3902LV) for the NTT Global Data Centers EMEA Limited owned data centre facility (LON1), which is operated by NTT Global Data Centers EMEA UK Limited (NTT). LON1 is located on Yewtree Avenue, Dagenham, UK, RM10 7FZ.

Electricity for operation of the data centre is provided from connections to the national electricity transmission network; however, given the nature of data centres and their requirement to have an available electricity supply at all times, the data centre also incorporates a number of emergency stand-by generators (SBGs).

The EP currently permits a total of 42 SBGs, each SBG having a thermal rated input of 4.1MWth; the aggregated total combustion capacity being 172.2MWth. The SBGs are to be installed in phases:

- **Current EP activities (based on the initial EP application)**: The initial EP application related to Phase A of the LON1 development (LON1A). Of the 42 permitted SBGs (as stated in the EP), to date 12 have been installed (generator model SDMO KD1800). The installation of the remaining SBGs (up to a maximum of 28 SBGs) will be completed as required, based on customer demands.
- **EP Variation (submitted March 2023)**: An EP variation relating to a change in the number, model and capacity of the remaining 28 SBGs to be installed in LON1A was submitted to the Environment Agency (EA) in March 2023 (SLR project reference 410.V62278.00001). The EP variation application related to NTT's intention to now install 16 larger SBGs to that which was applied for in the initial EP application; NTT intends to install 16 Kohler KD83V16 SBGs, each being 6.947MWth. The 16 SBGs will be installed in two phases, 9 SBGs initially, followed by the remaining 7 SBGs. This variation application has yet to be determined by the EA.
- **Current EP variation application**: This current EP variation application (SLR project reference 410.V61547.00001) relates to Phase B of the LON1 data centre development (LON1B). LON1B will involve the construction of a new data centre building located to the south LON1A, and the installation of 24 new SBGs within this building (with 22 SBGs having a thermal rated input of 7.6MWth and 2 house SBGs 3.8MWth). The SBGs will be fuel by hydrogenated vegetable oil (HVO), with Selective Catalytic Reduction (SCR) abatement installed on the SBGs to reduce emissions of oxides of nitrogen (NO_x) to atmosphere (each SCR abatement system will be powered by the SBG it serves). It should be noted that if HVO is not available then the SBGs will be operated on diesel.

The SBGs will provide power to the data centre in the event of an emergency situation such as a brown- or black-out of the national electricity transmission network where there are fluctuations or loss of the electrical power provided by the network. On occurrence of such an event, there is the potential for a delay between fault detection and initial operation of the SBGs; on-site battery arrays will provide a temporary uninterruptible power supply in order to cover such delays and the potential for a loss/reduction in the power supply to the on-site equipment.

Based on the proposed changes, the aggregated total combustion capacity for the site will now be 335.15MWth as summarised below:

- 12 x KD1800 SBGs – 49.2MWth (already installed in LON1A);
- 16 x KD83V16 SBGs – 111.15MWth (proposed for LON1A (phases 2 and 3));

- 22 x MTU model DS3600 SBGs (IT SBGs) – 167.2MWth (proposed for LON1B); and
- 2 x MTU model DS1650 SBGs (house SBGs) – 7.6MWth.

This report presents the Air Emissions Risk Assessment (AERA) undertaken to support the current EP variation application and is concerned with emissions to air only.

1.1 Scope

The scope of the assessment is limited to the point source combustion emissions to air from the SBGs at the installation. Consistent with previous modelling and EA Schedule 5 requests, the releases of NO_x, particulates (PM_{10} and $PM_{2.5}$) and carbon monoxide (CO) has been assessed.

The objective of the study is to assess the impact of emissions against the relevant Air Quality Standards for the protection of human health and the relevant Critical Levels and Loads for the protection of designated ecological receptors.

2.0 Relevant Guidance and Environmental Benchmarks

2.1 Environmental Permitting Regulations

The installation will be regulated under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) (EPR). The EPR implements European Union Directives including 2010/75/EU (the Industrial Emissions Directive, IED). Guidance produced by the EA in relation to EPR that is of relevance to this assessment is discussed below.

2.1.1 AERA Guidance

The 'Air emissions risk assessment for your environmental permit'[1] guidance (termed the 'AERA guidance' throughout the remainder of the report) produced by the EA is intended to assist operators in assessing risks to air when applying for a permit under the EPR. This is part of the 'Risk assessments for specific activities: environmental permits' collection.

2.1.2 Data Centre FAQ Guidance

The EA have released draft provisional guidance for data centres[2] which sets out their approach to the permitting and regulatory aspects for data centres within the context of the IED and EPR for 1.1A Combustion Activities 'Chapter II' sites aggregated to >50MWth input.

Also of relevance is the EA's 'Guidance on dispersion modelling for oxides of nitrogen assessment from specified generator'[3]. The guidance proposes methods for statistical analysis of impacts from short-term operation (e.g. using hypergeometric probability distribution) and a framework for acceptable probabilities of impact. The methodology is detailed further in Section 3.0 below.

2.2 Air Quality Legislation and Guidance

2.2.1 Air Quality Standards Regulations

The Air Quality Standards Regulations 2010[4] transpose both the European Union (EU) Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) within United Kingdom (UK) legislation. The regulations set Limit Values, Target Values, and Objectives for the protection of human health and the environment.

Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[5] was introduced to mirror revisions to supporting EU legislation. As a result, the fine particulate matter ($PM_{2.5}$) Limit Value was reduced to 20µg/m^3 (to be met by 2020).

2.2.2 US AEGLs

Acute Exposure Guideline Levels (AEGLs) represent short-term exposure limits for toxic airborne chemicals and have been established for nitrogen dioxide (NO_2). AEGL values are developed by the National Advisory Committee for Acute Exposure Guideline Levels for

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[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

[2] Environment Agency, 'Data Centre FAQ Headline Approach', 'Data Centre FAQ DRAFT version 21.0 to Tech UK for Discussion 15/11/22'

[3] https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

[4] The Air Quality Standards Regulations (England) 2010, Statutory Instrument 1001.

[5] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

Hazardous Substances, which is a US federal advisory committee. The AEGL-1 for NO_2 has been considered where appropriate, based on recent assessment feedback from the EA.

2.2.3 Air Quality Strategy

The latest Air Quality Strategy (AQS) for England was published in 2023[6]. The AQS provides the over-arching strategic framework for air quality management in England and contains national air quality standards and objectives established by the UK Government and Devolved Administrations for the protection of public health and the environment.

The AQS objectives apply at locations where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period – herein referred to as 'relevant exposure'. Table 2-2 provides an indication of those locations.

The ambient air quality objectives of relevance to human receptors in this assessment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report) are provided in Table 2-1.

Table 2-1: Relevant Ambient AQALs

Pollutant	AQAL (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean (not to be exceeded on more than 18 occasions per annum)
	956	1-hour mean (US AEGL-1)
PM_{10}	40	Annual mean
	50	24-hour mean (not to be exceeded on more than 35 occasions per annum)
$PM_{2.5}$	20	Annual mean
CO	10,000	8-hour mean across 24-hour period
	30,000	1-hour mean

Table 2-2: Human Health Relevant Exposure

AQAL Averaging Period	AQALs Should Apply At	AQALs Should Not Apply At
Annual mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices or other places of work Hotels Gardens of residences Kerbside sites
24-hour and 8-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites or any other location where public exposure is expected to be short-term
1-hour mean	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

[6] Air Quality Strategy: Framework for Local Authority Delivery, Defra. April 2023.

2.2.4 Local Air Quality Management

Part IV of the Environment Act 1995 requires local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to Review and Assess air quality within their boundaries to determine the likeliness of compliance, regularly and systematically.

Where any of the prescribed AQS objectives are not likely to be achieved, the authority must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to prepare an Air Quality Action Plan (AQAP), which details measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the objective. Local authorities therefore have formal powers to control air quality through a combination of LAQM and through application of wider planning policies.

Defra has published technical guidance for use by local authorities in their LAQM work[7]. This guidance, referred to in this report as LAQM.TG(22), has been used where appropriate in the assessment presented here.

2.3 Protection of Nature Conservation Sites

Sites of nature conservation importance at an international, national, and local level, are provided environmental protection from developments, including from atmospheric emissions. Standards for the protection of ecological receptors are known as Critical Levels (CLe) (for airborne concentrations) and Critical Loads (CLo) (for deposition rates).

The AERA guidance requires that ecological habitats should be assessed against relevant standards if they are located within the following set distances from the Installation:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the Installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the Installation.

2.3.1 Critical Levels (CLe)

CLe's are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The relevant CLe's for the protection of vegetation and ecosystems are presented in Table 2-3.

Table 2-3: Relevant Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	CLe (µg/m^3)	Averaging Period
NOx	30	Annual mean (all ecosystems)
	200 [(A)]	Daily mean (all ecosystems)
Sulphur dioxide (SO_2)	10	Annual mean (where lichens or bryophytes are present)
Ozone (O_3)	6,000	AOT40 (calculated from 1-hour values), annual
Table note: [(A)] 200µg/m^3 is accepted as the daily mean CLe where the baseline ozone concentrations are below the AOT40 CLe and SO_2 is below the lower CLe of 10µg/m^3 (as above).		

[7] Local Air Quality Management Technical Guidance (TG22), Published by Defra in partnership with the Scottish Government, Welsh Government and Department of Agriculture, Environment and Rural Affairs. August 2022.

2.3.2 Critical Loads (CLo)

CLo's are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. CLo's are set for the deposition of various substances to sensitive ecosystems. Deposition of nitrogen can cause eutrophication and acidification; the relevant CLo's are presented in Section 4.3.2.

3.0 Assessment Methodology

The assessment methodology comprises dispersion modelling (see Appendix C for EA modelling checklist), with statistical analysis of the probability of short-term impacts occurring, and deposition calculations for assessment of impacts on ecological receptors.

3.1 Dispersion Modelling

3.1.1 Dispersion Model

For this assessment the US American Meteorological Society and Environmental Protection Agency Regulatory Model (AERMOD v12) dispersion model has been applied; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United State (US) Environmental Protection Agency (EPA).

Model validation studies for AERMOD generally suggest that for the vast majority of cases it is able to predict maximum short-term high percentiles concentrations well within a factor of two; the latest evaluation study for AERMOD[8] shows the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data has been undertaken to validate model performance), between 0.96 and 1.2.

3.1.2 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across an Ordnance Survey map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration to be assessed. A receptor grid was applied extending 2km from the Site as follows:

- 200m x 200m at 20m grid resolution;
- 500m x 500m at 50m grid resolution;
- 1000m x 1000m at 100m grid resolution; and
- 2000m x 2000m at 200m grid resolution.

In addition, the modelling of discrete sensitive receptor locations, as described in Section 4.3, was undertaken to assess the probability of short-term impacts at relevant exposure locations.

3.1.3 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights (Figure 4-3).

[8] US EPA, AERMOD Model Formulation and Evaluation EPA-454/R-18-003 (April 2018).

3.1.4 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Buildings input to the model are represented in Figure 3-1.

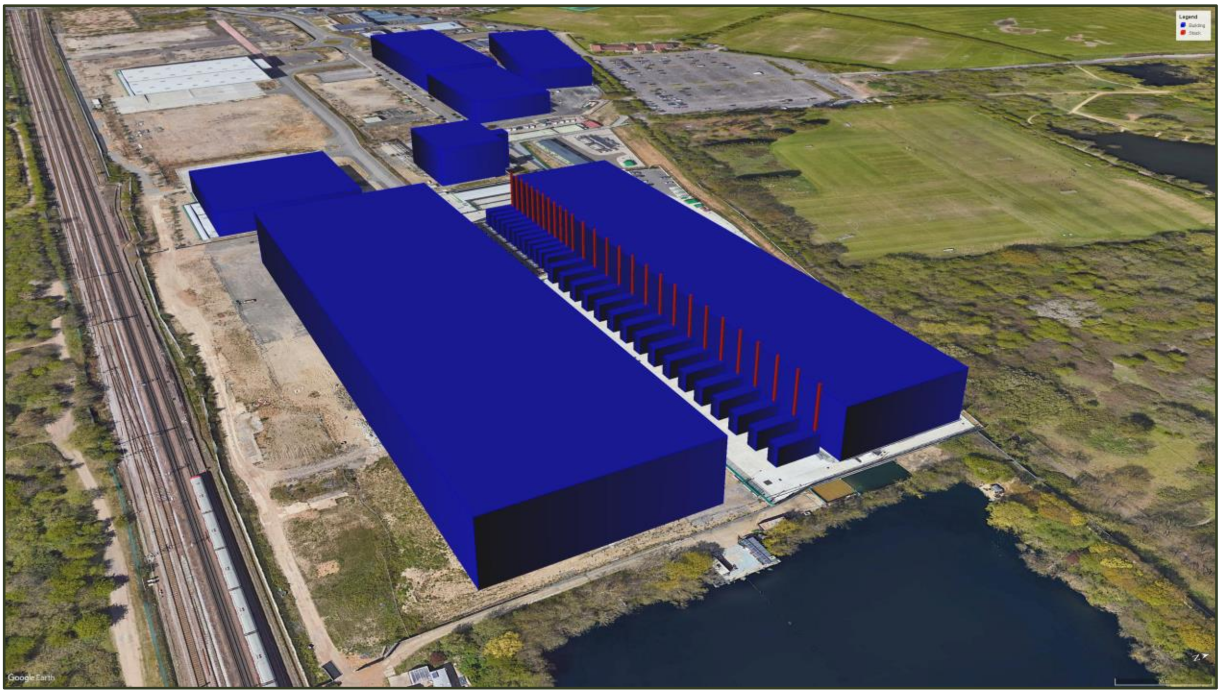

Figure 3-1: Modelled Buildings

3.1.5 Dispersion Coefficients

The 'urban' option for dispersion coefficients was selected in accordance with AERMOD guidance[9].

3.1.6 Meteorological Data and Preparation

The meteorological data provider was consulted for the closest and most representative dataset appropriate to the study area recording all the parameters necessary for dispersion modelling. The observation site selected for use in the assessment was London City Airport, located approximately 8.8km to the southwest of the Site. A windrose is presented in Figure 4-4.

The meteorological data (5 years of hourly sequential data) was obtained in .met format from the data supplier and converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor. Details specific to the Site

[9] US EPA, AERMOD Implementation Workgroup, AERMOD Implementation Guide, August 3, 2015.

location were used to define the surface characteristics; albedo, bowen ratio and surface roughness, applied in the conversion (see Table 3-1).

Table 3-1: Applied Surface Characteristics

Zone (start)	Zone (end)	Albedo	Bowen Ratio	Surface Roughness (m)
0	110	0.17	0.93	0.040
110	240			0.018
240	0			0.070

3.2 Assessment of Impacts on Air Quality

3.2.1 Treatment of Model Output

The assessment of impacts against the AQALs as defined in Section 2.2 was undertaken using model output as described in Table 3-2 below.

Table 3-2: Model Outputs

AQAL being assessed	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
NO_2 1-hour mean. Not to be exceeded more than 18 times a calendar year	99.79%ile of 1-hour means. PC factored for 35% of NO_x present as NO_2. Threshold violation file (threshold set at 200µg/m^3 minus 2x annual mean background, converted to NO_x assuming 35% of NO_x present as NO_2) counts number of hours per annum exceeding threshold.	Probability of exceedance calculated using hypergeometric distribution.
US AEGL-1: NO_2 1-hour mean	PC factored for 35% of NO_x present as NO_2. Threshold violation file (threshold set at 956µg/m^3 minus 2x annual mean background, converted to NO_x assuming 35% of NO_x present as NO_2) counts number of hours per annum exceeding threshold.	Probability of exceedance calculated using hypergeometric distribution.
NO_2, PM_{10} and $PM_{2.5}$ annual mean	Annual mean from 5 met. years (factored for operational hours). PC factored for 70% of NO_x present as NO_2.	PC + annual mean background
CO 8-hour rolling mean	Maximum 8-hour mean	PC + 2 x annual mean background
CO and NO_2 1-hour mean maximum	Maximum 1-hour mean	PC + 2 x annual mean background
PM_{10} 24-hour mean. Not to be exceeded more than 35 times a calendar year	90.41%ile of 24-hour means for PM_{10}	PC + annual mean background
NO_x daily mean CLe	Maximum 24-hour mean (factored for operational hours)	PC + 2 x annual mean background

AQAL being assessed	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
NO_x annual mean CLe	Annual mean from 5 met. years (factored for operational hours)	PC + annual mean background

3.2.2 Statistical Analysis of Short-Term Impacts

The approach to assessment of short-term impacts adopted is consistent with AQMAUs approach defined in the *Guidance on dispersion modelling for oxides of nitrogen assessment from generators*. The approach requires modelling the impact of the generator plant for 8,760 hours of the year in order to ensure that the operating hours coincide with the worst-case dispersal conditions.

In order to determine the probability of an exceedance of the hourly mean AQAL for a short-term infrequent operation, the cumulative hypergeometric distribution has been used (with the 2.5 factor applied for consecutive operating hours) to assess the likelihood of exceedance hours coinciding with the operational hours. The EA guidance provides the following framework to apply to the calculated probability:

- probabilities of 1% or less indicate exceedances are highly unlikely;
- probabilities of less than 5% indicate exceedances are unlikely; and
- probabilities of 5% or more indicate there is potential for the exceedances and may not be considered acceptable on a case-by-case basis.

3.2.3 Assessment of Annual Mean Impact and Significance

In accordance with the EA's AERA guidance, the impact is considered to be insignificant or negligible if the long-term process contribution is <1% of the long-term AQAL. For process contributions that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant AQAL.

3.3 Assessment of Impacts on Vegetation and Ecosystems

3.3.1 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[10]. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered consistent with AQTAG06.

The applied deposition velocities for the relevant chemical species are as shown in Table 3-3.

[10] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

Table 3-3: Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.0030

The predicted deposition rates were converted from µg/m²/s to units of nitrogen deposition and acid equivalent deposition as detailed in Table 3-4.

Table 3-4: Applied Deposition Conversion Factors

	Conversion from NO_2 µg/m²/s to:	Factor
N deposition	N kg/ha/year	95.9
Acid deposition	kg_{eq}/ha/year	6.84

3.3.2 Calculation of PC as a percentage of Acid CLo Function

The calculation of the process contribution of N to the acid CLo function has been carried out according to the guidance on the Air Pollution Information System (APIS)[11], which is as follows:

> "*The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:*
>
> *Where PEC N Deposition < CLminN*
>
> *PC as % CL function = (PC S deposition/CLmaxS)*100*
>
> *Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.*
>
> *Where PEC N Deposition > CLminN*
>
> *PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100*"

3.3.3 Assessment of Impact and Significance

In addition to the AERA guidance, the EA's Operational Instruction 66_12[12] details how the air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)' for international sites, 'no likely damage' for SSSIs and 'no significant pollution' for other sites, as follows:

- PC <1% long-term CLe and/or CLo or that the PEC <70% long-term CLe and/or CLo for international sites and SSSIs;
- PC <10% short-term CLe for NO_x (if applicable) for international sites and SSSIs;
- PC <100% long-term CLe and/or CLo other conservation sites; and

[11] https://www.apis.ac.uk/srcl

[12] EA Working Instruction 66_12 – Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

- PC <100% short-term CLe for NO_x (if applicable) for other conservation sites.

Where impacts cannot be classified as resulting in ‘no likely significant effect’, more detailed assessment may be required depending on the sensitivity of the feature in accordance with EA’s Operational Instruction 67_12[13]. This can require the consideration of the potential for in-combination effects, the actual distribution of sensitive features within the site, and local factors (such as the water table).

The guidance provides the following further criteria:

- if the PEC does not exceed 100% of the appropriate limit it can be assumed there will be no adverse effect;
- if the background is below the limit, but a small PC leads to an exceedance – decision based on local considerations;
- if the background is currently above the limit and the additional PC will cause a small increase – decision based on local considerations;
- if the background is below the limit, but a significant PC leads to an exceedance – cannot conclude no adverse effect; and
- if the background is currently above the limit and the additional PC is large – cannot conclude no adverse effect.

[13] EA Working Instruction 67_12 – Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

4.0 Baseline Environment

4.1 Site Location

The Site is located within London east-UK Business and Technical Park, Yewtree Avenue, Dagenham. The approximate National Grid Reference (NGR) is x550912, y185392. To the north and east the installation is predominantly surrounded by parkland and open green space. To the south is the District Line and London, Tilbury and Southend railway line. To the west there are commercial and light industrial premises.

4.2 Baseline Air Quality

Monitoring data collected prior to the COVID-19 pandemic (i.e. pre-2020) to characterise the baseline environment has been reviewed, as pollutant concentrations monitored during the pandemic are potentially atypical and not representative of the local environment.

4.2.1 LAQM Review and Assessment

The Site is located within the administrative boundary of the London Borough of Barking and Dagenham (LBBD). LBBD, in fulfilment of statutory requirements, has conducted an on-going exercise to review and assess air quality within their administrative area. In 2008, the whole borough was declared an AQMA, known as the 'Barking and Dagenham AQMA', for the annual and 1-hour mean NO_2 AQALs and the 24-hour mean PM_{10} AQAL.

Impacts on the AQMA have been considered within this assessment and modelling was undertaken using a receptor grid (see Section 3.1.2).

4.2.2 Review of Air Quality Monitoring

From review of national and local air quality monitoring networks, the monitoring locations in proximity to the Site are operated by LBBD[14]. Presently, this includes two automatic monitors, and 28 NO_2 diffusion tubes. However, all of the diffusion tubes are 'roadside' locations except DT6, which is 'background' and co-located with the BG1 automatic monitor.

Preference was to consider the two automatic monitoring sites, which are classified as 'suburban background' and therefore comparable to the Site locale. The recent NO_2 and PM_{10} monitoring data (not impacted by the COVID-19 pandemic) is presented in Table 4-1 and Table 4-2, and the monitor locations displayed in Figure 4-1.

Table 4-1: Automatic Monitors: NO_2 Results

ID	Site Type	Annual Mean NO_2 Concentration (µg/m^3)				
		2015	2016	2017	2018	2019
BG1	Suburban Background	20	21	24	24	20
BG2	Suburban Background	29	32	29	26	24
ID	**Site Type**	**Number of Hourly NO_2 Means >200µg/m^3**				
		2015	**2016**	**2017**	**2018**	**2019**
BG1	Suburban Background	0	0	0	0	0
BG2	Suburban Background	0	0	0	0	0

[14] London Borough of Barking and Dagenham, Air Quality Annual Status Report for 2022, May 2023.

Table 4-2: Automatic Monitors: PM_{10} Results

ID	Site Type	Annual Mean PM_{10} Concentration (µg/m^3)				
		2015	2016	2017	2018	2019
BG2	Suburban Background	21	20	20	19	18
ID	**Site Type**	**Number of 24-hour PM_{10} Means >50µg/m^3**				
		2015	**2016**	**2017**	**2018**	**2019**
BG2	Suburban Background	4	4	4	0	6

4.2.3 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution which is routinely used to support LAQM requirements and air quality assessments. The data sets include annual average concentration estimates for NO_x, NO_2, PM_{10} and $PM_{2.5}$ using a reference year of 2018 (the year in which comparisons between modelled and monitored concentrations are made), in addition to data sets for CO (based on a reference year of 2001 – which can be projected forwards using the year adjustment factors).

The 2019 (base year) and 2024 (current year) Defra projected annual mean background concentrations for the above-described pollutants for the grid squares covering the Site and human receptor locations are presented in Table 4-3.

All of the mapped background concentrations presented are well below the respective annual mean AQALs.

Table 4-3: Defra Mapped Background Pollutant Concentrations

Grid Square (X, Y)	Year	Annual Mean Background Concentration (µg/m^3)				
		NO_x	NO_2	PM_{10}	$PM_{2.5}$	CO
550500, 184500	2019	29.8	20.5	17.9	12.1	176.5
	2024	23.9	16.9	16.7	11.2	182.1
550500, 185500	2019	28.1	19.5	17.1	11.6	177.8
	2024	22.8	16.2	15.9	10.8	183.5
550500, 186500	2019	26.0	18.2	16.6	11.3	176.5
	2024	20.9	15.1	15.5	10.5	182.1
551500, 184500	2019	27.2	19.0	17.0	11.5	171.2
	2024	21.9	15.7	15.8	10.7	176.7
551500, 185500	2019	26.8	18.7	16.5	11.2	172.5
	2024	21.9	15.7	15.3	10.4	178.0
551500, 186500	2019	25.9	18.2	16.7	11.4	171.6
	2024	20.8	15.0	15.5	10.5	177.1
552500, 184500	2019	25.4	17.9	16.6	11.3	162.9
	2024	20.7	15.0	15.4	10.5	168.1
552500, 185500	2019	25.4	17.9	16.9	11.7	164.2
	2024	20.7	15.0	15.8	10.8	169.4

Grid Square (X, Y)	Year	Annual Mean Background Concentration (µg/m^3)				
		NO_x	NO_2	PM_{10}	$PM_{2.5}$	CO
552500, 186500	2019	24.3	17.3	16.4	11.3	167.3
	2024	19.8	14.4	15.3	10.4	172.6

4.2.4 Application of Baseline Data

The 2019 annual mean NO_2 (24µg/m^3) and PM_{10} (18µg/m^3) concentrations from LBBD monitoring site BG2 were applied as the background concentrations in this assessment. From comparison of the LBBD monitoring data and Defra mapped background concentrations, this approach is considered conservative as the concentrations recorded at BG2 are higher.

In relation to the other pollutants ($PM_{2.5}$ and CO) and in the absence of local monitoring, the 2019 Defra mapped background concentrations appliable to the grid square of each receptor location were utilised.

4.3 Sensitive Receptors

4.3.1 Human Receptors

A total of fifty-eight discrete sensitive receptors, comprising the closest relevant exposure locations have been selected, as detailed in Table 4-4 and shown in Figure 4-1. All receptors were modelled at a height of 1.5m above ground level.

Table 4-4: Modelled Human Receptors

ID	Description	NGR-X	NGR-Y	Relevant Exposure Period
HR1	Residential Dwelling	550237	184913	All (Long and Short Term)
HR2	Tube Station	550287	185043	Short Term
HR3	Residential Dwelling	550281	185086	All (Long and Short Term)
HR4	Police Station	550267	185130	Short Term
HR5	Pub/Restaurant	550290	185218	Short Term
HR6	Residential Dwelling	550341	185301	All (Long and Short Term)
HR7	Residential Dwelling	550390	185349	All (Long and Short Term)
HR8	School	550453	185291	All (Long and Short Term)
HR9	Residential Dwelling	550408	185371	All (Long and Short Term)
HR10	Playing Fields	550467	185440	Short Term
HR11	Sports Club	550565	185461	Short Term
HR12	Residential Dwelling	550324	185522	All (Long and Short Term)
HR13	School	550273	185692	All (Long and Short Term)
HR14	Residential Dwelling	550286	185810	All (Long and Short Term)
HR15	Playing Fields	550612	185624	Short Term
HR16	Residential Dwelling	550518	186052	All (Long and Short Term)
HR17	Car Park	550726	185477	Short Term
HR18	Playing Fields	550909	185487	Short Term

ID	Description	NGR-X	NGR-Y	Relevant Exposure Period
HR19	Footpath	551008	185225	1-hour AEGL-1 only
HR20	Footpath	551115	185502	1-hour AEGL-1 only
HR21	Footpath	551216	185507	1-hour AEGL-1 only
HR22	Footpath	551026	185659	1-hour AEGL-1 only
HR23	Footpath	551240	185701	1-hour AEGL-1 only
HR24	Cafe within Park	550965	186002	Short Term
HR25	Caravan Site (Permanent)	551066	186007	All (Long and Short Term)
HR26	Car Park	551201	186122	Short Term
HR27	Church	551351	186271	Short Term
HR28	Riding School	551532	186225	Short Term
HR29	Residential Dwelling	550981	186429	All (Long and Short Term)
HR30	College	550849	186807	All (Long and Short Term)
HR31	Residential Dwelling	551375	186510	All (Long and Short Term)
HR32	Residential Dwelling	551572	186599	All (Long and Short Term)
HR33	Play Area	551672	186633	Short Term
HR34	Residential Dwelling	551718	186640	All (Long and Short Term)
HR35	Residential Dwelling	551831	186549	All (Long and Short Term)
HR36	Skatepark	551795	186399	Short Term
HR37	Residential Dwelling	551941	186338	All (Long and Short Term)
HR38	Park Cafe	552578	186391	Short Term
HR39	Balls Court	552073	186105	Short Term
HR40	Healthcare Centre/Dentist	551954	186025	Short Term
HR41	Residential Dwelling	551986	185909	All (Long and Short Term)
HR42	Residential Dwelling	551892	185732	All (Long and Short Term)
HR43	Tube Station	552395	185677	Short Term
HR44	Residential Dwelling	551836	185611	All (Long and Short Term)
HR45	Residential Dwelling	551791	185510	All (Long and Short Term)
HR46	Church	552298	185354	Short Term
HR47	Residential Dwelling	551741	185413	All (Long and Short Term)
HR48	Office/Depot	551620	185341	Short Term
HR49	Lock (Beam River)	551533	185341	1-hour AEGL-1 only
HR50	Playing Fields	551802	185123	Short Term
HR51	Recreation Centre	551691	184872	Short Term
HR52	School	552068	184574	All (Long and Short Term)
HR53	Residential Dwelling	551184	184921	All (Long and Short Term)
HR54	Residential Dwelling	551047	184917	All (Long and Short Term)
HR55	Residential Dwelling	550899	184916	All (Long and Short Term)

ID	Description	NGR-X	NGR-Y	Relevant Exposure Period
HR56	Residential Dwelling	550744	184917	All (Long and Short Term)
HR57	School	550689	184833	All (Long and Short Term)
HR58	Residential Dwelling	550624	184955	All (Long and Short Term)

4.3.2 Ecological Receptors

Designated ecological sites within the set screening distance are presented in Table 4-5 and Figure 4-2. The screening of designated ecological sites has been informed by the Nature and Heritage Conservation Screening Report[15] produced by the EA. In some instances, the LNR and LWS have been assessed collectively where boundaries overlap.

Table 4-5: Modelled Designated Ecological Sites

ID	Site (Designation)	Approx. Distance (m) and Direction from Installation
ER1	Beam Valley (LNR)	140m South
ER2	Beam Valley (Environment Agency) (LNR)	470m Southeast
ER3	Mid Beam Valley in Dagenham and Dagenham East Lake (LWS)	140m South
ER4	Beam Valley South in Dagenham and the Wantz Stream	1,100m Southwest
ER5	Dagenham Village Churchyard (LNR) / St Peter's and St Paul's Churchyard, Dagenham (LWS)	1,100m Southwest
ER6	Ingrebourne Valley (LNR) / Hornchurch Country Park (LWS)	1,960m Southeast
ER7	The Chase and Eastbrookend Country Park (LWS) – incorporates East Brookend Country Park (LNR), The Chase – Havering (LNR), and The Chase – Barking (LNR)	<20m North and east
ER8	Mid Beam Valley in Havering (LWS)	370m Southeast
ER9	Pondfield Park and adjacent railside (LWS)	850m West
ER10	Beam Valley South in Havering (LWS)	1,150m South
ER11	District line in Havering (LWS)	570m East
ER12	Harrow Lodge Park (LWS)	1,180m Northeast
ER13	Wantz Lake and Crowlands Golf Course (LWS)	1,910m Northwest

4.4 Baseline Conditions at Ecological Receptors

The APIS is a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology.

[15] Environment Agency, Nature and Heritage Conservation, Screening Report: Bespoke installations, Reference EPR/CP3902LV/V002, Date report produced 19/08/2022.

APIS, the European Environment Agency website[16], in addition to online literature sources[17] and satellite imagery has been used to provide information on:

- identification of whether the habitats present are sensitive to effects caused by potential emissions;
- current baseline concentrations (Table 4-6);
- CLo and current deposition rates (Table 4-6 and Table 4-7); and
- baseline ozone concentrations.

For locally designated ecological sites, the APIS 'Search by Location' function was utilised to obtain the above information. The NGR of maximum impact on the annual NO_x CLe during testing and maintenance was used as the input.

Table 4-6: NOx, SO_2, Nitrogen Critical Loads and Current Loads

ID	Habitat Critical Load Class	APIS Max NO_x Background (µg/m^3)	APIS Max SO_2 Background (µg/m^3)	Critical Load Range (kg N/ha/yr)	Current Load (kg N/ha/yr)
ER1	Non-mediterranean dry acid and neutral closed grassland	25.5	2.3	6-10	12.5
ER2	Non-mediterranean dry acid and neutral closed grassland	25.2	2.2	6-10	12.4
ER3	Non-mediterranean dry acid and neutral closed grassland	25.5	2.3	6-10	12.5
ER4	Non-mediterranean dry acid and neutral closed grassland	27.1	2.5	6-10	12.5
ER5	Broadleaved deciduous woodland	27.1	2.5	10-15	23.7
ER6	Broadleaved deciduous woodland	24.3	2.3	10-15	23.4
ER7	Non-mediterranean dry acid and neutral closed grassland	25.5	2.3	6-10	12.5
ER8	Non-mediterranean dry acid and neutral closed grassland	25.5	2.3	6-10	12.5
ER9	Non-mediterranean dry acid and neutral closed grassland	26.3	2.3	6-10	12.7
ER10	Non-mediterranean dry acid and neutral closed grassland	27.1	2.5	6-10	12.5
ER11	Non-mediterranean dry acid and neutral closed grassland	25.5	2.3	6-10	12.5
ER12	Broadleaved deciduous woodland	23.1	2.0	10-15	23.7
ER13	Low and medium altitude hay meadows	24.3	1.9	10-20	12.8

[16] Air quality statistics calculated by the EEA (F), accessed: http://aidef.apps.eea.europa.eu.

[17] Denis J Vickers, Consultant Ecologist, Biodiversity Survey of the London Borough of Barking and Dagenham, Produced for the London Borough of Barking and Dagenham, February 2017.

Table 4-7: Acid Critical Load Functions and Current Loads

ID	Habitat Critical Load Class	Critical Load Function (kg_{eq}/ha/yr)			Current Load (kg_{eq}/ha/yr)	
		CLmaxS	CLminN	CLmaxN	N	S
ER1	Acid grassland	0.87	0.44	1.31	0.89	0.18
ER2	Acid grassland	0.88	0.44	1.32	0.89	0.18
ER3	Acid grassland	0.87	0.44	1.31	0.89	0.18
ER4	Acid grassland	0.88	0.44	1.32	0.89	0.18
ER5	Broadleafed/Coniferous unmanaged woodland	1.70	0.36	2.06	1.69	0.23
ER6	Broadleafed/Coniferous unmanaged woodland	1.70	0.36	2.06	1.67	0.23
ER7	Acid grassland	0.87	0.44	1.31	0.89	0.18
ER8	Acid grassland	0.87	0.44	1.31	0.89	0.18
ER9	Acid grassland	0.87	0.44	1.31	0.91	0.18
ER10	Acid grassland	0.88	0.44	1.32	0.89	0.18
ER11	Acid grassland	0.87	0.44	1.31	0.89	0.18
ER12	Broadleafed/Coniferous unmanaged woodland	1.67	0.36	2.03	1.69	0.22
ER13	Calcareous grassland (using base cation)	4.00	0.86	4.86	0.92	0.18

Table 4-8: Baseline Ozone Concentrations

EU Site ID	Site Name	Approx. Distance to Site (km)	AOT40 Annual (µg/m^3).h				
			2015	2016	2017	2018	2019
GB0586A	London Eltham	12.7	2,327	2,096	2,370	9,206	3,688
GB0566A	London Bloomsbury	20.9	505	379	914	4,077	930
GB0645A	Thurrock	12.5	1,318	1,511	1,502	6,218	3,093
CLe (µg/m^3)			***6,000***				

As displayed in Table 4-6, the maximum annual mean SO_2 concentrations at all the modelled ecological designations are well below SO_2 CLe of 10µg/m^3.

Table 4-8 presents a summary of the baseline ozone concentrations (annual AOT40 concentrations) at the three recording stations closest to the Site. For the period 2015-2019, annual AOT40 concentrations have been below the CLe (6,000µg/m^3), except at London Eltham and Thurrock during 2018. However, 2018 appears to be an anomaly when compared to the other years and therefore in general, it is likely that baseline ozone concentrations are below the CLe. Utilising this, it can be inferred that baseline ozone concentrations are likely to be comparable at the Site and therefore also below the CLe.

Given the above, SO_2 and ozone concentrations at the Site are not considered to be high or above the CLe. Therefore, in line with the AERA guidance, it is considered appropriate to apply the 24-hour mean CLe of 200µg/m^3 in the assessment.

Figure 4-1: LBBD Monitoring Locations and Modelled Human Receptors Relative to Site

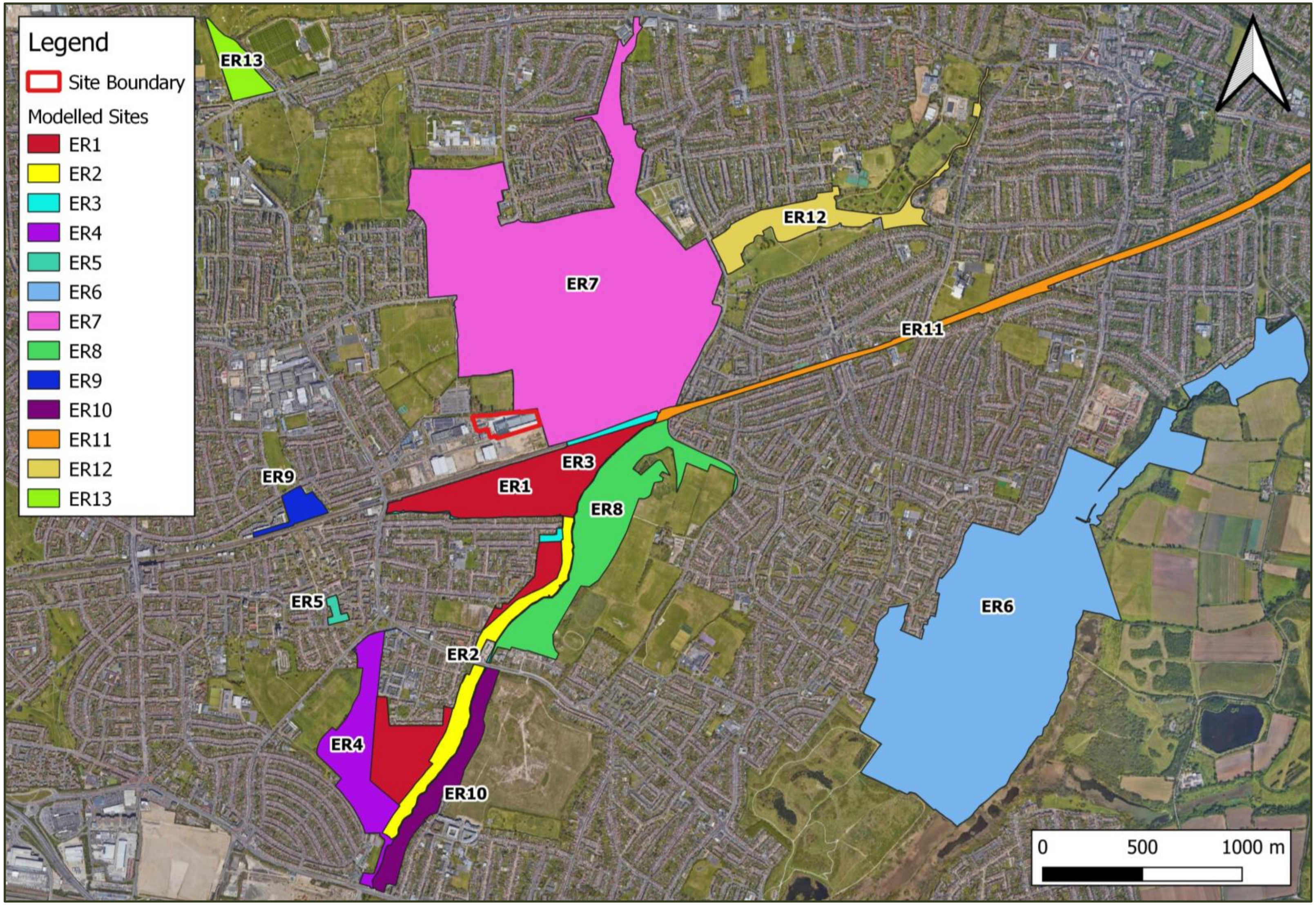

Figure 4-2: Modelled Designated Ecological Sites Relative to Site

4.5 Topography

The Site lies at approximately 10m above ordnance datum (AOD). The topography in the surrounding area rises to approximately 35m AOD in the north within 5km and lowers to 0m AOD in the south within 4.5km at the River Thames. The topography is displayed in Figure 4-3.

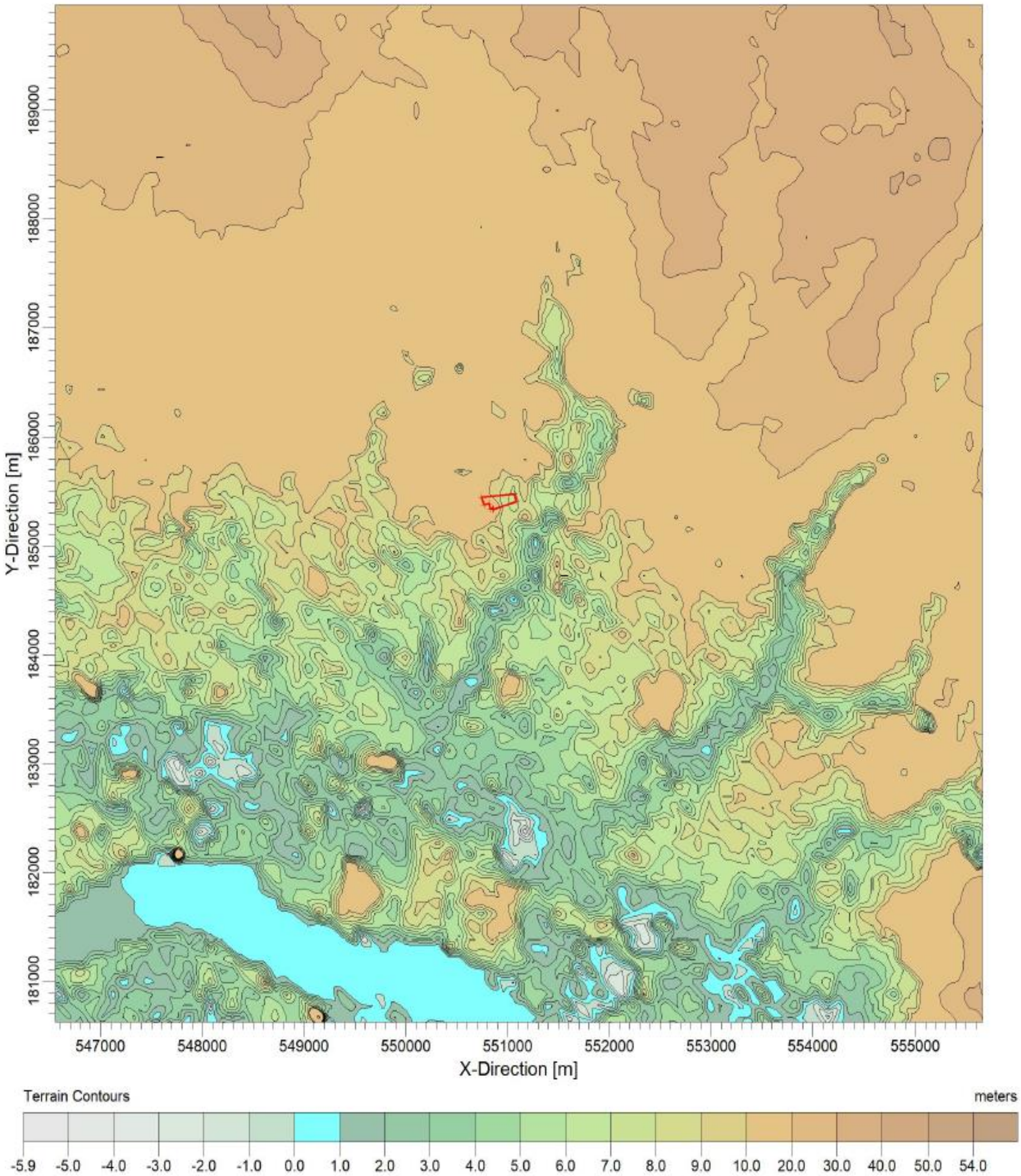

Figure 4-3: Surrounding Topography

4.6 Meteorological Conditions

A windrose for London City Airport observing station for the 5-year period (2015 to 2019), providing the frequency of wind speed and direction, is presented in Figure 4-4. The windrose shows winds from the southwest are most frequent with winds from the north and southeast least frequent.

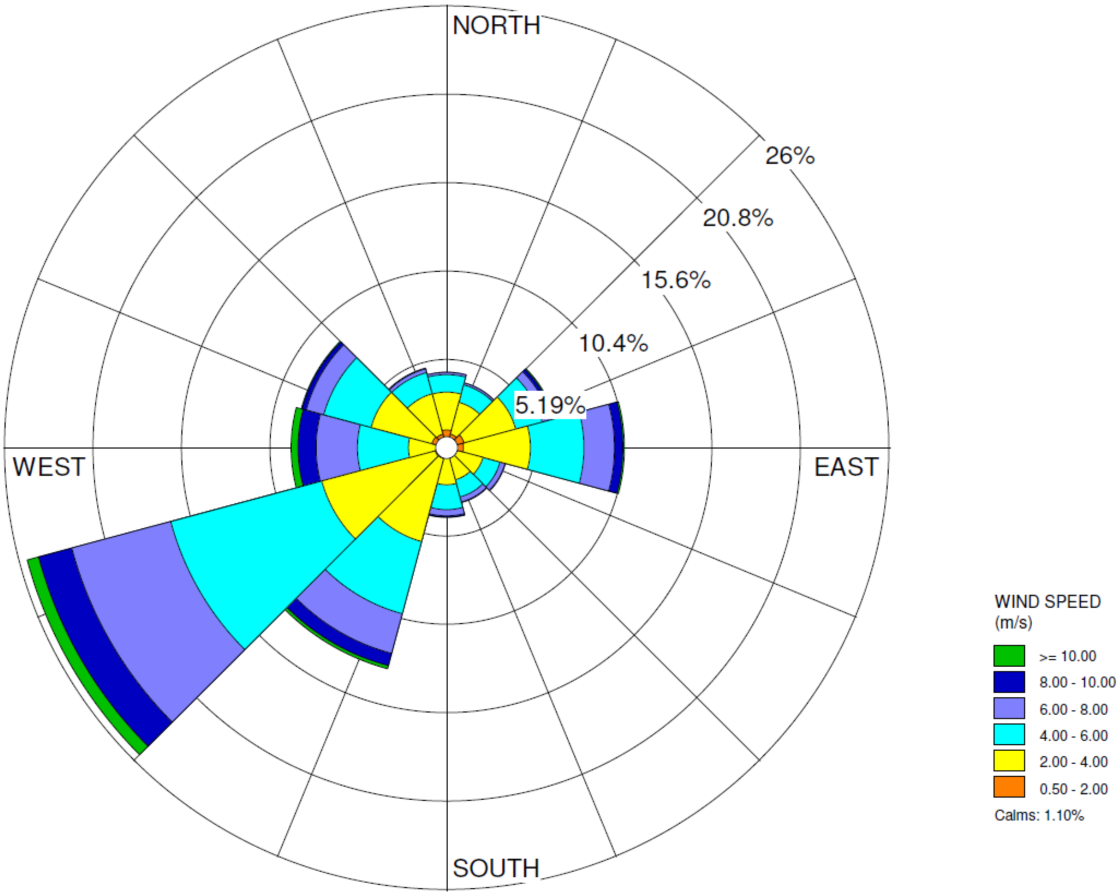

Figure 4-4: Windrose (London City Airport 2015-2019)

5.0 Emissions to Atmosphere

5.1 Emission Points

The emission points to air from LON1B comprise exhausts associated with 24 SBGs with a total thermal input of 174.8MWth.

The SBG circular flue discharges unimpeded and vertically within a rectangular exhaust duct that terminates at roof plant height. The circular flue terminates within the exhaust duct. A precautionary approach to modelling has been adopted and the area of the rectangular exhaust duct has been used to calculate velocity.

5.2 Operating Scenarios

The operating scenarios at the Site include the following:

1. Routine Maintenance Schedule Operations – the predictable, managed testing and maintenance activity (Maintenance Schedule Model), for LON1B this will comprise:

    - Monthly testing (each SBG tested individually typically for 30 minutes, minimum of 60% load);
    - Annual test (each SBG tested individually typically for 4-hours at maximum 100% load);
    - Black building test (all SBGs tested together typically for 1-hour, minimum of 75% load);
    - Annual UPS maintenance (each SBG operated individually, typically for 10-hours per UPS (2 No. UPS = 20 hours), minimum of 75% load);
    - HV maintenance (each SBG tested individually typically for 10-hours, minimum of 75% load); and
    - Diesel powered fire water pumps – tested 30 minutes every week.

    Tests that take place across LON1A that have been included to assess impact from the whole installation include:

    - UPS wrap around, load bank and monthly tests (which are predominantly tested one SBG at a time); and
    - A ‘Black Building’ test once per year, for up to 4-hours, typically on suite by suite basis.

2. Emergency Outage Operations – the unpredictable emergency grid outage any time during the year requiring the maximum plant to operate for the required outage duration (Outage Model). All LON1B SBGs (including redundancy) start up during an outage at a set load (less than 100%). For LON1B this is as follows:

    - Suite 1 generators: 3 no., all start up operating at 66% load;
    - Suite 2 generators: 4 no., all start up operating at 75% load;
    - Suite 3 generators: 4 no., all start up operating at 75% load;
    - Suite 4 generators: 3 no., all start up operating at 66% load;
    - Suite 5 generators: 4 no., all start up operating at 75% load;
    - Suite 6 generators: 4 no., all start up operating at 75% load; and

- House generators: 2 no., all start up operating at 50% load.

In a fail-over situation (FO, i.e. an SBG failure) the remaining SBGs operate at a higher load to compensate for the failed SBG. The standard outage scenario and FO scenario have been compared in terms of mass NOx release rate and the worst-case has been modelled, which is the standard outage scenario described above.

3. Commissioning of the proposed SBGs (22 DS3600 and 2 DS1650), summarised as follows:
   - Each SBG tested individually, referred to as 'CM1':
     - Temporary Loadbank - 12 hours;
     - Busbars - 5 hours;
     - UPS Commissioning - 3 hours;
     - SCR Commissioning Programme - 4.5 hours;
   - Up to 5 SBGs tested together, referred to as 'CM2':
     - IST Testing - 2 x 12-hour tests (24 hours cumulative).

The LON1B scenarios above have been assessed in-combination with existing LON1A operations.

The impacts associated with existing LON1A testing and maintenance (MSM1) and LON1B commissioning (CM1/CM2) occurring concurrently have been considered.

The approach to modelling each operating scenario and the assumptions made are as presented in Table 5-1, with the SBG list displayed in Table 5-2.

Table 5-1: Assessment Scenarios

<table>
<tr><th colspan="2">Operational Scenario</th><th>Model Scenarios and Assumptions</th></tr>
<tr><td rowspan="2">Routine Maintenance Schedule Operations</td><td>LON1A: SBGs tested one at a time, e.g. monthly tests, UPS wrap around, load bank.
LON1A - Phase 1: 22 hrs/year/SBG (264 hours across all SBGs)
LON1A - Phase 2/3: 14 hrs/year/SBG with SCR (224 hours across all SBGs)</td><td rowspan="2">Maintenance Schedule Model (MSM1)
It is assumed LON1A and LON1B SBGs, and fire water pumps could be tested simultaneously.
Modelled as 1 SBG at LON1A (a KD1800, i.e. not with SCR), 1 SBG at LON1B operating, and 1 fire water pump.
For statistical analysis a precautionary assumption of 1450 hours per year combined for all SBGs have been assumed.
Annual mean impacts factored and combined with MSM2.
Maximum daily mean NO_x factored for 6 hours of operation in a day (i.e. 6/24, precautionary assumption based on LON1A Phase 1 UPS wraparound).
On the basis that the level of SCR abatement efficiency is affected by exhaust temperature, SBG emissions with SCR have been factored (4 mins no SCR: 56 mins with SCR).
Maximum 1-hour mean impacts have been presented, and the probability of exceedance assessed based on the combined exceedance hours from LON1A and LON1B for MSM1 and MSM2.</td></tr>
<tr><td>LON1B: SBGs tested one at a time, i.e. monthly and annual tests, UPS and HV maintenance.
40 hrs/year/SBG with SCR (960 hours across all SBGs)
Diesel powered fire water pumps – tested weekly (104 hours per year across both pumps)</td></tr>
</table>

<table>
<tr><th colspan="2">Operational Scenario</th><th>Model Scenarios and Assumptions</th></tr>
<tr><td rowspan="2"></td><td>LON1A: Suite by Suite tests, i.e. Black Building Test up to 5 SBGs operating simultaneously.
LON1A - Phase 1: 1 hr/year/Suite (2 hours across all Suites)
LON1A - Phase 2/3: 4 hrs/year/Suite (16 hours across all Suites)</td><td rowspan="2">Maintenance Schedule Model (MSM2a and MSM2b)
It is assumed LON1A (MSM2a) and LON1B (MSM2b) suites could be tested simultaneously.
- MSM2a: Modelled as 1 Suite at LON1A-Phase 1 (a KD1800 suite, i.e. not with SCR). For statistical analysis against AQAL/AEGLs 2 hours operation per year applied, and for CLe maximum daily mean NO_x factored for 1 hour per day.
- MSM2b: Modelled as all SBGs at LON1B operating. For statistical analysis against AQAL/AEGLs 1 hour operation per year applied, and for CLe maximum daily mean NO_x factored for 1 hour per day.
Annual mean impacts factored based on operating hours above and combined with MSM1.
On the basis that the level of SCR abatement efficiency is affected by exhaust temperature, SBG emissions with SCR have been factored (4 mins no SCR: 56 mins with SCR).
Maximum 1-hour mean impacts have been presented, and the probability of exceedance assessed based on the combined exceedance hours from LON1A and LON1B for MSM1 and MSM2.</td></tr>
<tr><td>LON1B: All SBGs operate together during a Black Building Test (at 75% load) for 1-hour, once per year.</td></tr>
<tr><td colspan="2">Emergency Outage Operations
All SBGs operate (minus redundancy – see Table 5-2).</td><td>Outage Model (OM)
LON1A: SBGs, minus redundancy, operate simultaneously across the Site. Consistent with the LON1A Schedule 5, the following loads have been applied:
• KD1800-E SBGs: even in a situation where an SBG within the suite fails (a fail-over scenario) the generators would not operate above 75% load and therefore the 75% load NOx concentration data from the manufacturer has been applied.
• KD3500-E SBGs: in a fail-over scenario the SBGs may need to operate above 75%, as such the emission data for the next available tier, i.e. 100% load, has been applied as a precautionary approach. SBG emissions with SCR have been factored (4 mins no SCR: 56 mins with SCR). This has been applied to every hour of operation as a precautionary approach.
LON1B: All SBGs operate simultaneously across the Site at 75% load for Suite and 50% for House SBGs.
A 72-hour outage scenario has been considered.
1-hour mean impacts subject to statistical analysis, and annual mean impacts factored for number of operational hours. Maximum daily mean NO_x factored where relevant.</td></tr>
</table>

Operational Scenario		Model Scenarios and Assumptions
LON1B Commissioning Tests	SBG by SBG tests: Temporary Load-bank - 12 hours; Busbars - 5 hours; UPS Commissioning - 3 hours; SCR Commissioning Programme - 4.5 hours.	**Commissioning Model (CM1)** Modelled as a single SBG. For statistical analysis 600 hours per year across all SBGs have been assumed. Annual mean impacts factored and combined with LON1A. Maximum daily mean NO_x factored for 12 hours of operation in a day (i.e.12/24). The SCR systems will not be operable during the CM1 tests, as these too undergo commissioning in the 'SCR Commissioning Programme'.
	IST Testing – Suite by Suite. 2 x 12-hour tests	**Commissioning Model (CM2)** Modelled as a single suite. For statistical analysis 144 hours per year across all suites have been assumed. Maximum daily mean NO_x factored for 12 hours of operation in a day (i.e.12/24).

Table 5-2: Site SBG List

Suite	Level of Redundancy	Model ID	SBG Model	Stack Height (mAGL)	SBG 'on' in Scenario				
					MSM1	MSM2	OM	CM1	CM2
LON1A House	N+1	H-1 A/B	KD1800-E	21.0	-	-	Y	-	-
		H-2 A/B	KD1800-E	21.0	-	-	-	-	-
LON1A Suite 1	N+1	1-1 A/B	KD1800-E	21.0	-	-	Y	-	-
		1-2 A/B	KD1800-E	21.0	-	-	Y	-	-
		1-3 A/B	KD1800-E	21.0	-	-	Y	-	-
		1-4 A/B	KD1800-E	21.0	-	-	Y	-	-
		1-FO A/B	KD1800-E	21.0	-	-	-	-	-
LON1A Suite 6	N+1	6-1 A/B	KD1800-E	21.0	Y	Y	Y	Y	-
		6-2 A/B	KD1800-E	21.0	-	Y	Y	-	-
		6-3 A/B	KD1800-E	21.0	-	Y	Y	-	-
		6-4 A/B	KD1800-E	21.0	-	Y	Y	-	-
		6-FO A/B	KD1800-E	21.0	-	Y	-	-	-
LON1A Suite 2	N+1	2-1 A/B	KD3500-E	21.0	-	-	Y	-	-
		2-2 A/B	KD3500-E	21.0	-	-	Y	-	-
		2-3 A/B	KD3500-E	21.0	-	-	Y	-	-
		2-4 A/B	KD3500-E	21.0	-	-	-	-	-
LON1A Suite 4 & 5	N+2	5-1 A/B	KD3500-E	21.0	-	-	Y	-	-
		5-2 A/B	KD3500-E	21.0	-	-	Y	-	-
		5-3 A/B	KD3500-E	21.0	-	-	Y	-	-
		5-FO A/B	KD3500-E	21.0	-	-	-	-	-
		4-FO A/B	KD3500-E	21.0	-	-	Y	-	-
		4-3 A/B	KD3500-E	21.0	-	-	Y	-	-

Suite	Level of Redundancy	Model ID	SBG Model	Stack Height (mAGL)	SBG 'on' in Scenario				
					MSM1	MSM2	OM	CM1	CM2
		4-2 A/B	KD3500-E	21.0	-	-	Y	-	-
		4-1 A/B	KD3500-E	21.0	-	-	-	-	-
LON1A Suite 3	N+1	3-1 A/B	KD3500-E	21.0	-	-	Y	-	-
		3-2 A/B	KD3500-E	21.0	-	-	Y	-	-
		3-3 A/B	KD3500-E	21.0	-	-	Y	-	-
		3-4 A/B	KD3500-E	21.0	-	-	-	-	-
LON1B Suite 1	N+1	1B_C1_1	DS3600	20.6	-	-	Y	-	-
		1B_C1_2	DS3600	20.6	-	-	Y	-	-
		1B_C1_3	DS3600	20.6	-	-	Y	-	-
LON1B Suite 2	N+1	1B_C4_1	DS3600	20.6	-	-	Y	-	-
		1B_C4_2	DS3600	20.6	-	-	Y	-	-
		1B_C4_3	DS3600	20.6	-	-	Y	-	-
		1B_C4_4	DS3600	20.6	-	-	Y	-	-
LON1B Suite 3	N+1	1B_C2_1	DS3600	20.6	-	-	Y	-	-
		1B_C2_2	DS3600	20.6	-	-	Y	-	-
		1B_C2_3	DS3600	20.6	-	-	Y	-	-
		1B_C2_4	DS3600	20.6	-	-	Y	-	-
LON1B Suite 4	N+1	1B_C5_1	DS3600	20.6	-	-	Y	-	-
		1B_C5_2	DS3600	20.6	-	-	Y	-	-
		1B_C5_3	DS3600	20.6	-	-	Y	-	-
LON1B Suite 5	N+1	1B_C3_1	DS3600	20.6	-	Y	Y	-	Y
		1B_C3_2	DS3600	20.6	-	Y	Y	-	Y
		1B_C3_3	DS3600	20.6	-	Y	Y	-	Y
		1B_C3_4	DS3600	20.6	-	Y	Y	-	Y
LON1B Suite 6	N+1	1B_C6_1	DS3600	20.6	-	-	Y	-	-
		1B_C6_2	DS3600	20.6	-	-	Y	-	-
		1B_C6_3	DS3600	20.6	-	-	Y	Y	-
		1B_C6_4	DS3600	20.6	Y	-	Y	-	-
LON1B House	N+1	1B_H1	DS1650	20.6	-	-	Y	-	-
		1B_H2	DS1650	20.6	-	-	Y	-	-
LON1B Fire Water	n/a	FWP_A	n/a	2.0	Y	-	-	-	-
		FWP_B	n/a	2.0	-	-	-	-	-

Table notes:
A/B represents the double stack of each SBG.
For the MSM scenarios, SBGs in a central location of each phase were modelled for representative impacts.

5.3 Emission Parameters

The emission parameters applied in the modelling and used to determine emission rates are provided in Table 5-3. The LON1B SBG emissions are based upon the manufacturers specification sheet and includes variations due to load relevant to the scenarios modelled. LON1A SBG emissions are presented, but unchanged from the previous EP application and EP variation application Schedule 5 response.

In relation to the SBGs fitted with SCR and potential ammonia slip, the manufacturer indicates that there is no ammonia slip. As such, ammonia emissions have not been assessed. The SCR system being used is described as a “Closed Loop” system with NO_x sensors on the engine out and tailpipe which only doses enough AdBlue (urea that gets converted to ammonia) that can be used by the SCR catalysts. However, as an extra precaution, the SCR reactor has a layer of ASC (Ammonia Slip Catalysts) that will remove any ammonia to prevent it being emitted from the exhaust.

Table 5-3: Emission Characteristics

Parameter	LON1A				LON1B						
	Phase 1		Phase 2 - 3								
SBG Model	KD1800-E		KD3500-E		DS3600			DS1650			Fire pumps
Load (%)	75%		100%		100%	75%	50%	100%	75%	50%	100%
Number of SBGs	12		16		22			2			2
Number of Stacks per SBG	2		2		1			1			1
Stack Internal Diameter (m)	0.33	0.33	0.50	0.50	2.37 (Virtual diameter based on vent)						0.2
Volume Flow (Nm^3/s) per stack	0.51 (A)	0.51 (A)	1.18 (A)	1.18 (A)	2.46 (A)	1.90 (A)	1.32 (A)	3.43 (B)	2.67 (B)	1.84 (B)	0.16 (A)
Emission Temperature (ºC)	504	504	510	510	453	421	421	531	496	464	556
Oxygen Content (% O_2 dry gas)	9.5	9.5	9.5	9.5	10.3	11.5	12.0	8.7	10.0	11.1	11.5
Moisture Content (% H_2O)	8.0	8.0	8.0	8.0	7.1	6.4	6.2	7.1	6.4	6.2	10.7
Actual Flow Rate (Am^3/s) per stack	2.19	2.19	5.13	5.13	10.53	8.69	6.38	5.30	4.37	3.21	0.92
Emission Velocity (m/s) per stack	25.6	25.6	26.1	26.1	2.4	2.0	1.5	1.2	1.0	0.7	29.3
NO_x Concentration (mg/Nm^3) (C)	1969	1969	3174	3174	2306	1865	1624	923	762	660	1348
NO_x Emission (g/s) per stack	1.0	1.0	3.8	3.8	5.7	3.5	2.2	3.2	2.0	1.2	0.22
NO_x Concentration (mg/Nm^3) with SCR	n/a	n/a	667	667	507	507	507	190	190	190	n/a
NO_x Emission (g/s) per stack with SCR	n/a	n/a	0.8	0.8	1.2	1.0	0.7	0.7	0.5	0.4	n/a
NO_x Concentration (mg/Nm^3) (weighted for SCR warm-up) (D)	n/a	n/a	834	834	627	598	581	239	228	221	n/a
NO_x Emission (g/s) per stack (weighted for SCR warm-up)	n/a	n/a	1.0	1.0	1.5	1.1	0.8	0.8	0.6	0.4	n/a
CO Concentration (mg/Nm^3)	163	163	120	120	81	98	365	130	136	112	357

Parameter	LON1A				LON1B						
	Phase 1		Phase 2 - 3								
CO Emission (g/s) per stack	0.083	0.083	0.142	0.142	0.20	0.19	0.48	0.45	0.36	0.21	0.06
PM Concentration (mg/Nm^3)	10	10	7	7	6	8	30	5	8	12	162
PM Emission (g/s) per stack	0.005	0.005	0.008	0.008	0.02	0.01	0.04	0.02	0.02	0.02	0.03

Table notes:

(A) Normalised to 273K, 5% O_2, dry

(B) Normalised to 273K, 15% O_2, dry

(C) NOx concentration applied during commissioning of LON1B SBGs prior to SCR (i.e. CM1 scenario)

(D) NOx concentration applied during assessment of MSM, OM and CM2 scenarios

6.0 Results

The full dispersion modelling results tables are provided in Appendix A and relevant isopleth plots in Appendix B. This section provides a summary of the results.

6.1 Maintenance Schedule Model

6.1.1 Impacts on Annual Mean NO_2

The predicted annual mean NO_2 impacts, combined for MSM1 and MSM2, at receptor locations relevant for 'annual mean' exposure are presented in Table A-1 of Appendix A. A contour plot is presented in Figure B-1 of Appendix B.

The PC is low, not exceeding 1.5% of the AQAL at any receptor. The PEC does not exceed the AQAL at any of the modelled receptor locations.

6.1.2 Impacts on 1-hour Mean NO_2

6.1.2.1 AQAL

The risks of exceedances of the 1-hour mean NO_2 AQAL at relevant receptor exposure locations are presented in Table A-2 of Appendix A. The maximum 1-hour impact is presented in Figure B-2 of Appendix B.

The table presents the number of hours that the PEC potentially exceeds 200µg/m^3 (based on 8,760 hours operation), and the probability of there being more than the allowance (of 18 exceedances) given the actual number of planned operational hours per suite and per SBG during routine testing and maintenance.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all relevant receptors.

6.1.2.2 US AEGL-1

The risks of exceedances of the 1-hour mean NO_2 US AEGL-1 at relevant receptor exposure locations are presented in Table A-3 of Appendix A.

The table presents the number of hours that the PEC potentially exceeds 956µg/m^3 (based on 8,760 hours operation), and the probability of there being any exceedances given the number of planned operational hours per suite and per SBG during routine testing and maintenance.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all relevant receptors.

6.1.3 Impacts on Ecological Receptors

The impacts on CLe's and CLo's are presented in Table A-4 to Table A-6 of Appendix A. The findings are that:

- the PC does not exceed 100% of the annual or daily CLe at any of the locally designated sites and therefore it can be concluded that there is 'no significant pollution'; and
- the PC does not exceed 100% of the CLo's at any of the locally designated sites and therefore it can be concluded there is 'no significant pollution'.

6.2 Emergency Outage Model

6.2.1 Impacts on Annual Mean NO_2

The predicted annual mean NO_2 impacts, for the outage model (OM) based on 72 hours operation, at receptor locations relevant for 'annual mean' exposure are presented in Table A-7 of Appendix A.

The PC is low, only exceeding 1% of the AQAL at one receptor location. The PEC does not exceed the AQAL at any of the modelled receptor locations.

6.2.2 Impacts on 1-hour Mean NO_2

6.2.2.1 AQAL

The risks of exceedances of the 1-hour mean NO_2 AQAL at relevant receptor exposure locations are presented in Table A-8 of Appendix A.

The table presents the number of hours that the PEC potentially exceeds 200µg/m^3 (based on 8,760 hours operation), and the probability of there being more than the allowance (of 18 exceedances) given 72 emergency operational hours.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all relevant receptors.

6.2.2.2 US AEGL-1

The risks of exceedances of the 1-hour mean NO_2 US AEGL-1 at relevant receptor exposure locations are presented in Table A-9 of Appendix A.

The table presents the number of hours that the PEC potentially exceeds 956µg/m^3 (based on 8,760 hours operation), and the probability of there being any exceedances given 72 emergency operational hours.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all receptors except R19 where it exceeds 5%. The probability of an exceedance is presented for a 72-hour and 1-hour outage with the probability falling to less than 1% for a 1-hour outage. These receptor locations represent footpaths and the likelihood of a person being present for an hour during an outage is considered unlikely (see Figure B-3 and Figure B-4).

6.2.3 Impacts on Ecological Receptors

The impacts on CLe's and CLo's are presented in Table A-10 to Table A-12 of Appendix A.

The results are based on the unlikely scenario of a 72-hour long outage occurring and coinciding with the worst-case conditions for dispersal of emissions. The findings are that:

- the PC does not exceed 100% of the annual mean CLe at any of the locally designated sites;
- the PC exceeds 100% of the daily mean CLe at most of the locally designated sites, however not ER6 and ER13; and
- the PC does not exceed 100% of the CLo's at any of the locally designated sites and therefore it can be concluded there is 'no significant pollution' due to deposition.

6.3 Commissioning

6.3.1 Impacts on Annual Mean NO_2

The predicted annual mean NO_2 impacts, for the commissioning year combined with impacts from normal maintenance schedule, at receptor locations relevant for 'annual mean' exposure are presented in Table A-13 of Appendix A.

The PC is low, <2.5% of the AQAL, and the PEC does not exceed the AQAL at any of the modelled receptor locations.

6.3.2 Impacts on 1-hour Mean NO_2

6.3.2.1 AQAL

The 1-hour mean NO_2 AQAL at relevant receptor exposure locations are presented in Table A-14 of Appendix A.

The table presents the number of hours that the PEC potentially exceeds 200µg/m^3 (based on 8,760 hours operation), and the probability of there being more than the allowance (of 18 exceedances) based on the commissioning tests.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all relevant receptors.

6.3.2.2 US AEGL-1

The risks of exceedances of the 1-hour mean NO_2 US AEGL-1 at relevant receptor exposure locations are presented in Table A-15 of Appendix A.

The table presents the number of hours that the PEC potentially exceeds 956µg/m^3 (based on 8,760 hours operation), and the probability of there being any exceedances based on the commissioning tests.

The findings are that the risk of exceedance is less than 1% and therefore 'highly unlikely' at all relevant receptors.

6.3.3 Impacts on Ecological Receptors

The impacts on CLe's and CLo's are presented in Table A-16 to Table A-18, in Appendix A.

The results are based on the unlikely scenario of the commissioning tests coinciding with the worst-case conditions for dispersal of emissions. The findings are that:

- the PC does not exceed 100% of the annual or daily mean CLe at any of the locally designated sites and therefore it can be concluded that there is 'no significant pollution'; and
- the PC does not exceed 100% of the CLo's at any of the locally designated sites, and therefore it can be concluded that there is 'no significant pollution'.

6.4 Impacts on Carbon Monoxide and Particulate Matter

The predicted carbon monoxide and particulate matter (PM_{10} and $PM_{2.5}$) impacts at sensitive receptors are presented in Appendix A (Table A-19 to Table A-22). All impacts are insignificant or low for all scenarios and there are no predicted exceedances of the AQALs.

7.0 Conclusions

The assessment has considered potential impacts on air quality from the installation as a result of routine testing and maintenance operations, non-routine emergency outage operation, and commissioning.

The findings of the assessment are summarised below for each scenario.

Routine Testing and Maintenance Operations:

- the annual mean NO_2 PC is low, at <1.5% of the AQAL at all of the selected human receptor locations and the AQAL is not predicted to be exceeded;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 AQAL predicts exceedances to be 'highly unlikely' at all of the selected human receptors;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 US AEGL-1 predicts exceedances to be 'highly unlikely'; and
- the PC does not exceed 100% of the annual mean CLe or CLo and daily mean CLe at any of the locally designated sites therefore it can be concluded that there is 'no significant pollution'.

Non-routine Emergency Outage Operation (72-hour outage considered):

- based on a 72-hour outage, the annual mean NO_2 PC is low, only exceeding 1% of the AQAL at one selected human receptor location and the AQAL is not predicted to be exceeded;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 AQAL predicts exceedances to be 'highly unlikely' at all of the selected human receptors;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 US AEGL-1 predicts exceedances to be 'highly unlikely' at all the selected human receptors, except receptor R19 where it exceeds 5%, and therefore there is a risk of exceedance. Receptor R19 is a footpath and the likelihood of a person being present for an hour during an outage is considered low. The probability of an exceedance is also presented for a more realistic 1-hour outage with the probability of exceedance falling to less than 1%;
- the PC does not exceed 100% of the annual mean CLe or CLo at any of the locally designated sites; and
- the PC exceeds 100% of the maximum daily mean CLe at most of the locally designated sites, however not ER6 and ER13.

Commissioning:

- the annual mean NO_2 PC is low, not exceeding 2.5% of the AQAL at all of the selected human receptors locations and the AQAL is not predicted to be exceeded;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 AQAL predicts exceedances to be 'highly unlikely' at all of the selected human receptors;
- statistical analysis of the probability of exceedances of the 1-hour mean NO_2 AEGL-1 predicts exceedances to be 'highly unlikely' at all of the selected human receptors; and
- the PC does not exceed 100% of the annual mean CLe or CLo and daily mean CLe at any of the locally designated sites therefore it can be concluded that there is 'no significant pollution'.

Appendix A Tabulated Model Results

LON1 Phase B Environmental Permit Variation Application

Air Emissions Risk Assessment, LON1B, Dagenham

NTT Global Data Centers EMEA Limited

SLR Project No.: 410.V61547.00001

26 July 2024

A.1 Maintenance Schedule Model Results

A.1.1 Impacts on Annual Mean NO_2

Table A-1: MSM – Impacts on Annual Mean NO_2

ID	Max. PC (µg/m^3)	PC % of AQAL	Max. PEC (µg/m^3)	PEC % of AQAL
HR1	0.24	0.6%	n/a	n/a
HR3	0.30	0.7%	n/a	n/a
HR6	0.40	1.0%	24.4	61.0%
HR7	0.43	1.1%	24.4	61.1%
HR8	0.50	1.2%	24.5	61.2%
HR9	0.44	1.1%	24.4	61.1%
HR12	0.25	0.6%	n/a	n/a
HR13	0.13	0.3%	n/a	n/a
HR14	0.10	0.3%	n/a	n/a
HR16	0.11	0.3%	n/a	n/a
HR25	0.18	0.5%	n/a	n/a
HR29	0.09	0.2%	n/a	n/a
HR30	0.06	0.1%	n/a	n/a
HR31	0.12	0.3%	n/a	n/a
HR32	0.15	0.4%	n/a	n/a
HR34	0.16	0.4%	n/a	n/a
HR35	0.21	0.5%	n/a	n/a
HR37	0.28	0.7%	n/a	n/a
HR41	0.38	1.0%	24.4	61.0%
HR42	0.38	1.0%	24.4	61.0%
HR44	0.36	0.9%	n/a	n/a
HR45	0.30	0.7%	n/a	n/a
HR47	0.24	0.6%	n/a	n/a
HR52	0.14	0.3%	n/a	n/a
HR53	0.32	0.8%	n/a	n/a
HR54	0.38	1.0%	24.4	61.0%
HR55	0.37	0.9%	n/a	n/a
HR56	0.31	0.8%	n/a	n/a
HR57	0.25	0.6%	n/a	n/a
HR58	0.27	0.7%	n/a	n/a
Table note: n/a = PEC not assessed where PC is insignificant				

A.1.2 Impacts on 1-hour Mean NO_2 AQAL

Table A-2: MSM – Risk of Exceedance of 1-hour Mean NO_2 AQAL

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	MSM1 No. of potential exceedances	MSM1 Probability of exceedance[a]	MSM2a No. of potential exceedances	MSM2a Probability of exceedance[b]	MSM2b No. of potential exceedances	MSM2b Probability of exceedance[b]	Summed Probability of exceedance
HR1	116	0	0.0%	0	0.0%	0	0.0%	0.0%
HR2	128	0	0.0%	0	0.0%	0	0.0%	0.0%
HR3	133	0	0.0%	0	0.0%	0	0.0%	0.0%
HR4	136	0	0.0%	0	0.0%	0	0.0%	0.0%
HR5	137	0	0.0%	0	0.0%	0	0.0%	0.0%
HR6	141	0	0.0%	0	0.0%	0	0.0%	0.0%
HR7	143	0	0.0%	0	0.0%	0	0.0%	0.0%
HR8	155	0	0.0%	0	0.0%	3	0.0%	0.0%
HR9	141	0	0.0%	0	0.0%	0	0.0%	0.0%
HR10	131	0	0.0%	0	0.0%	0	0.0%	0.0%
HR11	135	0	0.0%	0	0.0%	0	0.0%	0.0%
HR12	121	0	0.0%	0	0.0%	0	0.0%	0.0%
HR13	99	0	0.0%	0	0.0%	0	0.0%	0.0%
HR14	95	0	0.0%	0	0.0%	0	0.0%	0.0%
HR15	110	0	0.0%	0	0.0%	0	0.0%	0.0%
HR16	95	0	0.0%	0	0.0%	0	0.0%	0.0%
HR17	127	0	0.0%	0	0.0%	0	0.0%	0.0%
HR18	211	0	0.0%	0	0.0%	62	0.0%	0.0%
HR24	98	0	0.0%	0	0.0%	0	0.0%	0.0%
HR25	99	0	0.0%	0	0.0%	0	0.0%	0.0%
HR26	91	0	0.0%	0	0.0%	0	0.0%	0.0%
HR27	85	0	0.0%	0	0.0%	0	0.0%	0.0%
HR28	87	0	0.0%	0	0.0%	0	0.0%	0.0%
HR29	77	0	0.0%	0	0.0%	0	0.0%	0.0%
HR30	59	0	0.0%	0	0.0%	0	0.0%	0.0%
HR31	72	0	0.0%	0	0.0%	0	0.0%	0.0%
HR32	67	0	0.0%	0	0.0%	0	0.0%	0.0%
HR33	66	0	0.0%	0	0.0%	0	0.0%	0.0%
HR34	64	0	0.0%	0	0.0%	0	0.0%	0.0%
HR35	67	0	0.0%	0	0.0%	0	0.0%	0.0%

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC ($\mu g/m^3$)	MSM1 No. of potential exceedances	MSM1 Probability of exceedance[(a)]	MSM2a No. of potential exceedances	MSM2a Probability of exceedance[(b)]	MSM2b No. of potential exceedances	MSM2b Probability of exceedance[(b)]	Summed Probability of exceedance
HR36	74	0	0.0%	0	0.0%	0	0.0%	0.0%
HR37	73	0	0.0%	0	0.0%	0	0.0%	0.0%
HR38	51	0	0.0%	0	0.0%	0	0.0%	0.0%
HR39	79	0	0.0%	0	0.0%	0	0.0%	0.0%
HR40	85	0	0.0%	0	0.0%	0	0.0%	0.0%
HR41	84	0	0.0%	0	0.0%	0	0.0%	0.0%
HR42	95	0	0.0%	0	0.0%	0	0.0%	0.0%
HR43	58	0	0.0%	0	0.0%	0	0.0%	0.0%
HR44	107	0	0.0%	0	0.0%	0	0.0%	0.0%
HR45	122	0	0.0%	0	0.0%	0	0.0%	0.0%
HR46	74	0	0.0%	0	0.0%	0	0.0%	0.0%
HR47	128	0	0.0%	0	0.0%	0	0.0%	0.0%
HR48	136	0	0.0%	0	0.0%	0	0.0%	0.0%
HR50	118	0	0.0%	0	0.0%	0	0.0%	0.0%
HR51	123	0	0.0%	0	0.0%	0	0.0%	0.0%
HR52	72	0	0.0%	0	0.0%	0	0.0%	0.0%
HR53	145	0	0.0%	0	0.0%	0	0.0%	0.0%
HR54	155	0	0.0%	2	0.0%	0	0.0%	0.0%
HR55	159	0	0.0%	11	0.0%	0	0.0%	0.0%
HR56	130	0	0.0%	0	0.0%	0	0.0%	0.0%
HR57	123	0	0.0%	0	0.0%	0	0.0%	0.0%
HR58	137	0	0.0%	0	0.0%	0	0.0%	0.0%

A.1.3 Impacts on 1-hour Mean NO_2 AEGL-1

Table A-3: MSM – Risk of Exceedance of 1-hour Mean NO_2 AEGL1

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC ($\mu g/m^3$)	MSM1 No. of potential exceedances	MSM1 Probability of exceedance[(a)]	MSM2a No. of potential exceedances	MSM2a Probability of exceedance[(b)]	MSM2b No. of potential exceedances	MSM2b Probability of exceedance[(b)]	Summed Probability of exceedance
HR19	442	0	0.0%	0	0.0%	0	0.0%	0.5%
HR20	220	0	0.0%	0	0.0%	0	0.0%	0.0%
HR21	206	0	0.0%	0	0.0%	0	0.0%	0.0%
HR22	102	0	0.0%	0	0.0%	0	0.0%	0.0%
HR23	148	0	0.0%	0	0.0%	0	0.0%	0.0%
HR49	140	0	0.0%	0	0.0%	0	0.0%	0.0%

A.1.4 Impacts on Ecological Receptors

Table A-4: MSM – Impacts on NOx Critical Levels

ID	Max. Annual Mean NO_x PC [(a)] ($\mu g/m^3$)	PC as % of CLe	Max. Potential Daily Mean NO_x PC [(b)] ($\mu g/m^3$)	PC as % of CLe
ER1	3.69	12.3%	47.6	23.8%
ER2	0.47	1.6%	9.2	4.6%
ER3	3.72	12.4%	47.6	23.8%
ER4	0.15	0.5%	4.2	2.1%
ER5	0.14	0.5%	3.3	1.6%
ER6	0.15	0.5%	2.5	1.2%
ER7	7.18	23.9%	42.9	21.5%
ER8	0.89	3.0%	12.0	6.0%
ER9	0.26	0.9%	3.8	1.9%
ER10	0.14	0.5%	3.2	1.6%
ER11	0.45	1.5%	4.7	2.3%
ER12	0.52	1.7%	3.9	1.9%
ER13	0.04	0.1%	1.5	0.8%

Table notes:
(a) MSM1 and MSM2 hours factored and combined.
(b) The maximum potential daily NO_x PC across MSM1 / MSM2 has been presented.

Table A-5: MSM – Impacts on Nitrogen Critical Loads

ID	Applied CLo (kg N/ha/yr)	Max. PC (kg N/ha/yr)	PC as % of CLo
ER1	6	0.372	6.2%
ER2	6	0.047	0.8%
ER3	6	0.374	6.2%
ER4	6	0.015	0.2%
ER5	10	0.028	0.3%
ER6	10	0.031	0.3%
ER7	6	0.723	12.1%
ER8	6	0.090	1.5%
ER9	6	0.026	0.4%
ER10	6	0.014	0.2%
ER11	6	0.045	0.8%
ER12	10	0.105	1.1%
ER13	10	0.004	<0.1%

Table A-6: MSM – Impacts on Acid Critical Loads

ID	Applied CLo (kg_{eq}/ha/yr)	Max. PC (kg_{eq}/ha/yr)	PC as % of CLo
ER1	1.31	0.027	2.0%
ER2	1.32	0.003	0.3%
ER3	1.31	0.027	2.0%
ER4	1.32	0.001	0.1%
ER5	2.06	0.002	0.1%
ER6	2.06	0.002	0.1%
ER7	1.31	0.052	3.9%
ER8	1.31	0.006	0.5%
ER9	1.31	0.002	0.1%
ER10	1.32	0.001	0.1%
ER11	1.31	0.003	0.2%
ER12	2.03	0.008	0.4%
ER13	4.86	<0.001	<0.1%

A.2 Outage Model Results

A.2.1 Impacts on Annual Mean NO_2

Table A-7: OM – Impacts on Annual Mean NO_2 (72-hour outage)

ID	Max. PC (µg/m³)	PC % of AQAL	Max. PEC (µg/m³)	PEC % of AQAL
HR1	0.2	0.5%	n/a	n/a
HR3	0.2	0.6%	n/a	n/a
HR6	0.3	0.8%	n/a	n/a
HR7	0.3	0.9%	n/a	n/a
HR8	0.4	1.0%	24.4	61.0%
HR9	0.3	0.9%	n/a	n/a
HR12	0.2	0.5%	n/a	n/a
HR13	0.1	0.3%	n/a	n/a
HR14	0.1	0.2%	n/a	n/a
HR16	0.1	0.2%	n/a	n/a
HR25	0.1	0.4%	n/a	n/a
HR29	0.1	0.2%	n/a	n/a
HR30	0.0	0.1%	n/a	n/a
HR31	0.1	0.2%	n/a	n/a
HR32	0.1	0.3%	n/a	n/a
HR34	0.1	0.3%	n/a	n/a
HR35	0.2	0.4%	n/a	n/a
HR37	0.2	0.5%	n/a	n/a
HR41	0.3	0.8%	n/a	n/a
HR42	0.3	0.8%	n/a	n/a
HR44	0.3	0.7%	n/a	n/a
HR45	0.2	0.6%	n/a	n/a
HR47	0.2	0.5%	n/a	n/a
HR52	0.1	0.3%	n/a	n/a
HR53	0.2	0.6%	n/a	n/a
HR54	0.3	0.7%	n/a	n/a
HR55	0.3	0.6%	n/a	n/a
HR56	0.2	0.6%	n/a	n/a
HR57	0.2	0.5%	n/a	n/a
HR58	0.2	0.5%	n/a	n/a
Table note: n/a = PEC not assessed where PC is insignificant				

A.2.2 Impacts on 1-hour Mean NO_2 AQAL

Table A-8: OM – Risk of Exceedance of 1-hour Mean NO_2 AQAL (72-hour outage)

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC ($\mu g/m^3$)	Maximum Potential 1 hour mean (99.79%ile) NO_2 PC ($\mu g/m^3$)	No. of potential exceedances – 72-hour outage	Probability of exceedance
HR1	311	292	227	0.0%
HR2	359	326	231	0.0%
HR3	352	312	204	0.0%
HR4	348	305	197	0.0%
HR5	399	359	252	0.0%
HR6	433	370	385	0.0%
HR7	433	385	440	0.0%
HR8	487	436	489	0.0%
HR9	429	385	468	0.0%
HR10	410	374	457	0.0%
HR11	415	377	502	0.0%
HR12	369	325	220	0.0%
HR13	302	267	100	0.0%
HR14	285	239	69	0.0%
HR15	348	307	200	0.0%
HR16	311	245	75	0.0%
HR17	347	323	489	0.0%
HR18	414	362	567	0.0%
HR24	282	260	142	0.0%
HR25	286	242	148	0.0%
HR26	273	232	141	0.0%
HR27	234	221	133	0.0%
HR28	247	236	245	0.0%
HR29	222	194	65	0.0%
HR30	183	156	22	0.0%
HR31	202	174	39	0.0%
HR32	196	187	81	0.0%
HR33	190	178	76	0.0%
HR34	188	177	67	0.0%
HR35	199	190	107	0.0%
HR36	215	205	143	0.0%
HR37	222	208	148	0.0%

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	Maximum Potential 1 hour mean (99.79%ile) NO_2 PC (µg/m^3)	No. of potential exceedances – 72-hour outage	Probability of exceedance
HR38	181	157	26	0.0%
HR39	228	209	147	0.0%
HR40	248	222	200	0.0%
HR41	247	228	128	0.0%
HR42	271	208	96	0.0%
HR43	186	129	12	0.0%
HR44	317	220	155	0.0%
HR45	362	215	115	0.0%
HR46	231	168	21	0.0%
HR47	391	254	97	0.0%
HR48	440	331	210	0.0%
HR50	380	319	206	0.0%
HR51	387	329	282	0.0%
HR52	253	214	74	0.0%
HR53	414	358	339	0.0%
HR54	434	375	427	0.0%
HR55	449	379	351	0.0%
HR56	457	343	306	0.0%
HR57	434	326	247	0.0%
HR58	375	334	270	0.0%

A.2.3 Impacts on 1-hour Mean NO_2 AEGL-1

Table A-9: OM – Risk of Exceedance of 1-hour Mean NO_2 AEGL1

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	No. of potential exceedances	Probability of exceedance (72-hour outage)	Probability of exceedance (1 hour outage)
HR19	1001	22	41.6%	0.6%
HR20	613	0	0.0%	0.0%
HR21	626	0	0.0%	0.0%
HR22	324	0	0.0%	0.0%
HR23	417	0	0.0%	0.0%
HR49	462	0	0.0%	0.0%

A.2.4 Impacts on Ecological Receptors

Table A-10: OM – Impacts on NOx Critical Levels

ID	Max. Annual Mean NO_x PC (µg/m^3)	PC as % of CLe	Max. Potential Daily Mean NO_x PC (µg/m^3) – Outage 24-hour or longer	PC as % of CLe
ER1	3.20	10.7%	2617	1308%
ER2	0.36	1.2%	633	317%
ER3	3.26	10.9%	2710	1355%
ER4	0.11	0.4%	279	140%
ER5	0.10	0.3%	213	106%
ER6	0.12	0.4%	148	74%
ER7	5.33	17.8%	2598	1299%
ER8	0.72	2.4%	723	362%
ER9	0.19	0.6%	225	113%
ER10	0.10	0.3%	208	104%
ER11	0.37	1.2%	316	158%
ER12	0.41	1.4%	233	116%
ER13	0.03	0.1%	91	45%

Table A-11: OM – Impacts on Nitrogen Critical Loads

ID	Applied CLo (kg N/ha/yr)	Max. PC (kg N/ha/yr)	PC as % of CLo
ER1	6	0.322	5.4%
ER2	6	0.037	0.6%
ER3	6	0.328	5.5%
ER4	6	0.011	0.2%
ER5	10	0.021	0.2%
ER6	10	0.025	0.2%
ER7	6	0.536	8.9%
ER8	6	0.072	1.2%
ER9	6	0.019	0.3%
ER10	6	0.010	0.2%
ER11	6	0.038	0.6%
ER12	10	0.083	0.8%
ER13	10	0.003	<0.1%

Table A-12: OM – Impacts on Acid Critical Loads

ID	Applied CLo (kg_{eq}/ha/yr)	Max. PC (kg_{eq}/ha/yr)	PC as % of CLo
ER1	1.308	0.023	1.8%
ER2	1.318	0.003	0.2%
ER3	1.308	0.023	1.8%
ER4	1.318	0.001	0.1%
ER5	2.058	0.001	0.1%
ER6	2.059	0.002	0.1%
ER7	1.308	0.038	2.9%
ER8	1.308	0.005	0.4%
ER9	1.308	0.001	0.1%
ER10	1.318	0.001	0.1%
ER11	1.308	0.003	0.2%
ER12	2.025	0.006	0.3%
ER13	4.856	<0.001	<0.1%

A.3 Commissioning Model Results

A.3.1 Impacts on Annual Mean NO_2

Table A-13: CM – Impacts on Annual Mean NO_2

ID	Max. PC (µg/m^3)	PC % of AQAL	Max. PEC (µg/m^3)	PEC % of AQAL
HR1	0.44	1.1%	24.4	61.1%
HR3	0.52	1.3%	24.5	61.3%
HR6	0.70	1.8%	24.7	61.8%
HR7	0.76	1.9%	24.8	61.9%
HR8	0.87	2.2%	24.9	62.2%
HR9	0.77	1.9%	24.8	61.9%
HR12	0.46	1.1%	24.5	61.1%
HR13	0.24	0.6%	n/a	n/a
HR14	0.18	0.5%	n/a	n/a
HR16	0.18	0.5%	n/a	n/a
HR25	0.32	0.8%	n/a	n/a
HR29	0.15	0.4%	n/a	n/a
HR30	0.10	0.3%	n/a	n/a
HR31	0.20	0.5%	n/a	n/a
HR32	0.26	0.6%	n/a	n/a
HR34	0.28	0.7%	n/a	n/a
HR35	0.36	0.9%	n/a	n/a

ID	Max. PC (µg/m^3)	PC % of AQAL	Max. PEC (µg/m^3)	PEC % of AQAL
HR37	0.49	1.2%	24.5	61.2%
HR41	0.70	1.8%	24.7	61.8%
HR42	0.71	1.8%	24.7	61.8%
HR44	0.67	1.7%	24.7	61.7%
HR45	0.55	1.4%	24.6	61.4%
HR47	0.44	1.1%	24.4	61.1%
HR52	0.23	0.6%	n/a	n/a
HR53	0.55	1.4%	24.5	61.4%
HR54	0.65	1.6%	24.6	61.6%
HR55	0.62	1.6%	24.6	61.6%
HR56	0.54	1.3%	24.5	61.3%
HR57	0.44	1.1%	24.4	61.1%
HR58	0.46	1.2%	24.5	61.2%
Table note: n/a = PEC not assessed where PC is insignificant				

A.3.2 Impacts on 1-hour Mean NO_2 AQAL

Table A-14: CM – Risk of Exceedance of 1-hour Mean NO_2 AQAL

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	CM1 No. of potential exceedances	CM1 Probability of exceedance	CM2 No. of potential exceedances	CM2 Probability of exceedance	Summed Probability of exceedance
HR1	33	0	0.0%	0	0.0%	0.0%
HR2	38	0	0.0%	0	0.0%	0.0%
HR3	37	0	0.0%	0	0.0%	0.0%
HR4	38	0	0.0%	0	0.0%	0.0%
HR5	44	0	0.0%	0	0.0%	0.0%
HR6	48	0	0.0%	0	0.0%	0.0%
HR7	49	0	0.0%	0	0.0%	0.0%
HR8	54	0	0.0%	0	0.0%	0.0%
HR9	50	0	0.0%	0	0.0%	0.0%
HR10	49	0	0.0%	0	0.0%	0.0%
HR11	50	0	0.0%	0	0.0%	0.0%
HR12	44	0	0.0%	0	0.0%	0.0%
HR13	35	0	0.0%	0	0.0%	0.0%
HR14	32	0	0.0%	0	0.0%	0.0%

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	CM1 No. of potential exceedances	CM1 Probability of exceedance	CM2 No. of potential exceedances	CM2 Probability of exceedance	Summed Probability of exceedance
HR15	38	0	0.0%	0	0.0%	0.0%
HR16	27	0	0.0%	0	0.0%	0.0%
HR17	44	0	0.0%	0	0.0%	0.0%
HR18	106	0	0.0%	0	0.0%	0.0%
HR24	34	0	0.0%	0	0.0%	0.0%
HR25	30	0	0.0%	0	0.0%	0.0%
HR26	26	0	0.0%	0	0.0%	0.0%
HR27	22	0	0.0%	0	0.0%	0.0%
HR28	21	0	0.0%	0	0.0%	0.0%
HR29	21	0	0.0%	0	0.0%	0.0%
HR30	16	0	0.0%	0	0.0%	0.0%
HR31	18	0	0.0%	0	0.0%	0.0%
HR32	16	0	0.0%	0	0.0%	0.0%
HR33	15	0	0.0%	0	0.0%	0.0%
HR34	15	0	0.0%	0	0.0%	0.0%
HR35	16	0	0.0%	0	0.0%	0.0%
HR36	17	0	0.0%	0	0.0%	0.0%
HR37	17	0	0.0%	0	0.0%	0.0%
HR38	16	0	0.0%	0	0.0%	0.0%
HR39	20	0	0.0%	0	0.0%	0.0%
HR40	21	0	0.0%	0	0.0%	0.0%
HR41	20	0	0.0%	0	0.0%	0.0%
HR42	21	0	0.0%	0	0.0%	0.0%
HR43	18	0	0.0%	0	0.0%	0.0%
HR44	25	0	0.0%	0	0.0%	0.0%
HR45	31	0	0.0%	0	0.0%	0.0%
HR46	22	0	0.0%	0	0.0%	0.0%
HR47	37	0	0.0%	0	0.0%	0.0%
HR48	40	0	0.0%	0	0.0%	0.0%
HR50	35	0	0.0%	0	0.0%	0.0%
HR51	30	0	0.0%	0	0.0%	0.0%
HR52	21	0	0.0%	0	0.0%	0.0%

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	CM1 No. of potential exceedances	CM1 Probability of exceedance	CM2 No. of potential exceedances	CM2 Probability of exceedance	Summed Probability of exceedance
HR53	38	0	0.0%	0	0.0%	0.0%
HR54	41	0	0.0%	0	0.0%	0.0%
HR55	39	0	0.0%	0	0.0%	0.0%
HR56	39	0	0.0%	0	0.0%	0.0%
HR57	37	0	0.0%	0	0.0%	0.0%
HR58	38	0	0.0%	0	0.0%	0.0%

A.3.3 Impacts on 1-hour Mean NO_2 AEGL-1

Table A-15: CM – Risk of Exceedance of 1-hour Mean NO_2 AEGL1

Rec.	Maximum Potential 1 hour mean (100%ile) NO_2 PC (µg/m^3)	CM1 No. of potential exceedances	CM1 Probability of exceedance	CM2 No. of potential exceedances	CM2 Probability of exceedance	Summed Probability of exceedance
HR19	145	0	0.0%	0	0.0%	0.0%
HR20	46	0	0.0%	0	0.0%	0.0%
HR21	43	0	0.0%	0	0.0%	0.0%
HR22	38	0	0.0%	0	0.0%	0.0%
HR23	34	0	0.0%	0	0.0%	0.0%
HR49	41	0	0.0%	0	0.0%	0.0%

A.3.4 Impacts on Ecological Receptors

Table A-16: CM – Impacts on NOx Critical Levels

ID	Max. Annual Mean NO_x PC [(a)] (µg/m^3)	PC as % of CLe	Max. Potential Daily Mean NO_x PC [(b)] (µg/m^3)	PC as % of CLe
ER1	5.77	19.2%	186.4	93.2%
ER2	0.80	2.7%	30.2	15.1%
ER3	5.74	19.1%	192.2	96.1%
ER4	0.26	0.9%	13.6	6.8%
ER5	0.24	0.8%	9.7	4.9%
ER6	0.27	0.9%	7.2	3.6%

ID	Max. Annual Mean NO_x PC [(a)] (µg/m^3)	PC as % of CLe	Max. Potential Daily Mean NO_x PC [(b)] (µg/m^3)	PC as % of CLe
ER7	10.20	34.0%	86.6	43.3%
ER8	1.51	5.0%	30.9	15.5%
ER9	0.45	1.5%	12.2	6.1%
ER10	0.24	0.8%	9.7	4.8%
ER11	0.84	2.8%	16.2	8.1%
ER12	0.91	3.0%	10.7	5.3%
ER13	0.07	0.2%	4.0	2.0%

Table notes:
[(a)] CM1 and CM2 hours factored and combined with LON1A and LON1B MSM hours.
[(b)] The maximum potential daily NO_x PC across CM1 / CM2 has been presented.

Table A-17: CM – Impacts on Nitrogen Critical Loads

ID	Applied CLo (kg N/ha/yr)	Max. PC (kg N/ha/yr)	PC as % of CLo
ER1	6	0.581	9.7%
ER2	6	0.080	1.3%
ER3	6	0.578	9.6%
ER4	6	0.026	0.4%
ER5	10	0.048	0.5%
ER6	10	0.055	0.6%
ER7	6	1.027	17.1%
ER8	6	0.153	2.5%
ER9	6	0.045	0.8%
ER10	6	0.024	0.4%
ER11	6	0.085	1.4%
ER12	10	0.183	1.8%
ER13	10	0.007	0.1%

Table A-18: CM – Impacts on Acid Critical Loads

ID	Applied CLo (kg_{eq}/ha/yr)	Max. PC (kg_{eq}/ha/yr)	PC as % of CLo
ER1	1.31	0.041	3.2%
ER2	1.32	0.006	0.4%
ER3	1.31	0.041	3.2%
ER4	1.32	0.002	0.1%
ER5	2.06	0.003	0.2%
ER6	2.06	0.004	0.2%
ER7	1.31	0.073	5.6%

ID	Applied CLo (kg_{eq}/ha/yr)	Max. PC (kg_{eq}/ha/yr)	PC as % of CLo
ER8	1.31	0.011	0.8%
ER9	1.31	0.003	0.2%
ER10	1.32	0.002	0.1%
ER11	1.31	0.006	0.5%
ER12	2.03	0.013	0.6%
ER13	4.86	0.001	<0.1%

A.4 Other Pollutants

Table A-19: CO Impacts

ID	Maintenance Schedule Model				Outage Model			
	1-hour Max. PC (µg/m^3)	1-hour Max. PC as % of AQAL	8-hour Max. PC (µg/m^3)	8-hour Max. PC as % of AQAL	1-hour Max. PC (µg/m^3)	1-hour Max. PC as % of AQAL	8-hour Max. PC (µg/m^3)	8-hour Max. PC as % of AQAL
HR1	61.1	0.2%	40.0	0.4%	123.4	0.4%	79.4	0.8%
HR2	67.0	0.2%	37.4	0.4%	140.7	0.5%	78.3	0.8%
HR3	70.0	0.2%	37.5	0.4%	133.3	0.4%	69.7	0.7%
HR4	71.4	0.2%	38.9	0.4%	136.3	0.5%	65.1	0.7%
HR5	72.1	0.2%	45.6	0.5%	153.3	0.5%	90.6	0.9%
HR6	74.5	0.2%	43.5	0.4%	164.2	0.5%	96.5	1.0%
HR7	75.3	0.3%	45.6	0.5%	163.0	0.5%	99.6	1.0%
HR8	81.1	0.3%	52.7	0.5%	181.8	0.6%	120.7	1.2%
HR9	74.4	0.2%	47.2	0.5%	161.9	0.5%	101.1	1.0%
HR10	68.2	0.2%	44.2	0.4%	152.6	0.5%	107.6	1.1%
HR11	67.5	0.2%	46.3	0.5%	154.4	0.5%	103.8	1.0%
HR12	62.3	0.2%	35.9	0.4%	138.5	0.5%	76.7	0.8%
HR13	51.9	0.2%	31.1	0.3%	113.1	0.4%	68.9	0.7%
HR14	47.7	0.2%	30.8	0.3%	105.7	0.4%	62.6	0.6%
HR15	54.1	0.2%	44.1	0.4%	125.6	0.4%	96.6	1.0%
HR16	45.6	0.2%	29.0	0.3%	111.3	0.4%	64.8	0.6%
HR17	60.5	0.2%	47.5	0.5%	135.4	0.5%	109.0	1.1%
HR18	102.7	0.3%	76.5	0.8%	174.8	0.6%	136.1	1.4%
HR19	149.1	0.5%	123.8	1.2%	367.6	1.2%	282.5	2.8%
HR20	84.0	0.3%	68.7	0.7%	201.3	0.7%	169.8	1.7%
HR21	90.3	0.3%	73.1	0.7%	205.1	0.7%	163.7	1.6%
HR22	57.7	0.2%	45.4	0.5%	119.1	0.4%	92.0	0.9%
HR23	65.6	0.2%	50.7	0.5%	146.0	0.5%	108.5	1.1%

ID	Maintenance Schedule Model				Outage Model			
HR24	49.8	0.2%	33.7	0.3%	108.0	0.4%	76.1	0.8%
HR25	51.9	0.2%	35.8	0.4%	109.4	0.4%	76.0	0.8%
HR26	50.1	0.2%	31.6	0.3%	105.9	0.4%	67.1	0.7%
HR27	44.4	0.1%	26.6	0.3%	93.4	0.3%	54.8	0.5%
HR28	46.1	0.2%	29.3	0.3%	95.2	0.3%	65.5	0.7%
HR29	39.5	0.1%	22.5	0.2%	87.6	0.3%	48.0	0.5%
HR30	30.2	0.1%	16.4	0.2%	70.5	0.2%	35.6	0.4%
HR31	38.3	0.1%	20.9	0.2%	79.6	0.3%	45.1	0.5%
HR32	36.4	0.1%	18.7	0.2%	76.1	0.3%	41.1	0.4%
HR33	35.3	0.1%	19.1	0.2%	73.4	0.2%	44.3	0.4%
HR34	35.0	0.1%	20.3	0.2%	72.4	0.2%	45.1	0.5%
HR35	36.4	0.1%	21.8	0.2%	76.0	0.3%	47.1	0.5%
HR36	40.5	0.1%	22.7	0.2%	83.4	0.3%	49.2	0.5%
HR37	40.1	0.1%	20.6	0.2%	83.0	0.3%	46.4	0.5%
HR38	29.1	0.1%	17.8	0.2%	66.7	0.2%	39.5	0.4%
HR39	43.6	0.1%	27.7	0.3%	85.9	0.3%	56.3	0.6%
HR40	47.2	0.2%	30.2	0.3%	93.7	0.3%	60.7	0.6%
HR41	46.4	0.2%	29.6	0.3%	92.1	0.3%	57.4	0.6%
HR42	54.1	0.2%	28.9	0.3%	99.6	0.3%	54.1	0.5%
HR43	33.1	0.1%	16.7	0.2%	69.0	0.2%	33.6	0.3%
HR44	60.4	0.2%	31.3	0.3%	117.0	0.4%	59.6	0.6%
HR45	68.8	0.2%	31.2	0.3%	132.9	0.4%	57.6	0.6%
HR46	41.7	0.1%	15.6	0.2%	86.2	0.3%	31.8	0.3%
HR47	72.1	0.2%	28.1	0.3%	145.0	0.5%	57.3	0.6%
HR48	77.1	0.3%	35.0	0.4%	157.4	0.5%	66.1	0.7%
HR49	80.3	0.3%	40.0	0.4%	164.4	0.5%	75.1	0.8%
HR50	59.9	0.2%	38.2	0.4%	132.4	0.4%	80.2	0.8%
HR51	55.6	0.2%	39.0	0.4%	139.9	0.5%	84.6	0.8%
HR52	37.3	0.1%	22.5	0.2%	91.4	0.3%	47.3	0.5%
HR53	58.3	0.2%	47.1	0.5%	148.1	0.5%	108.1	1.1%
HR54	58.9	0.2%	49.4	0.5%	153.8	0.5%	125.7	1.3%
HR55	60.0	0.2%	42.0	0.4%	162.7	0.5%	98.6	1.0%
HR56	64.8	0.2%	48.7	0.5%	173.4	0.6%	103.8	1.0%
HR57	62.4	0.2%	46.0	0.5%	162.2	0.5%	96.3	1.0%
HR58	71.2	0.2%	49.7	0.5%	152.7	0.5%	106.1	1.1%

Table A-20: PM_{10} 24-hour Impacts

ID	Maintenance Schedule Model				Outage Model			
	24-hour Max. PC (µg/m³)	24-hour Max. PC as % of AQAL	24-hour Max. PEC (µg/m³)	24-hour Max. PEC as % of AQAL	24-hour Max. PC (µg/m³)	24-hour Max. PC as % of AQAL	24-hour Max. PEC (µg/m³)	24-hour Max. PEC as % of AQAL
HR1	0.04	0.1%	18.0	36%	0.66	1.3%	18.7	37%
HR2	0.04	0.1%	18.0	36%	0.75	1.5%	18.8	38%
HR3	0.04	0.1%	18.0	36%	0.83	1.7%	18.8	38%
HR4	0.04	0.1%	18.0	36%	0.91	1.8%	18.9	38%
HR5	0.05	0.1%	18.0	36%	1.10	2.2%	19.1	38%
HR6	0.06	0.1%	18.1	36%	1.46	2.9%	19.5	39%
HR7	0.06	0.1%	18.1	36%	1.62	3.2%	19.6	39%
HR8	0.07	0.1%	18.1	36%	1.80	3.6%	19.8	40%
HR9	0.06	0.1%	18.1	36%	1.74	3.5%	19.7	39%
HR10	0.06	0.1%	18.1	36%	1.69	3.4%	19.7	39%
HR11	0.07	0.1%	18.1	36%	1.76	3.5%	19.8	40%
HR12	0.04	0.1%	18.0	36%	1.03	2.1%	19.0	38%
HR13	0.02	<0.1%	18.0	36%	0.48	1.0%	18.5	37%
HR14	0.01	<0.1%	18.0	36%	0.34	0.7%	18.3	37%
HR15	0.03	0.1%	18.0	36%	0.68	1.4%	18.7	37%
HR16	0.01	<0.1%	18.0	36%	0.33	0.7%	18.3	37%
HR17	0.08	0.2%	18.1	36%	1.71	3.4%	19.7	39%
HR18	0.11	0.2%	18.1	36%	2.25	4.5%	20.3	41%
HR19	0.24	0.5%	18.2	36%	8.05	16.1%	26.0	52%
HR20	0.22	0.4%	18.2	36%	6.38	12.8%	24.4	49%
HR21	0.20	0.4%	18.2	36%	5.57	11.1%	23.6	47%
HR22	0.06	0.1%	18.1	36%	1.85	3.7%	19.8	40%
HR23	0.10	0.2%	18.1	36%	2.93	5.9%	20.9	42%
HR24	0.02	<0.1%	18.0	36%	0.61	1.2%	18.6	37%
HR25	0.02	<0.1%	18.0	36%	0.63	1.3%	18.6	37%
HR26	0.02	<0.1%	18.0	36%	0.69	1.4%	18.7	37%
HR27	0.02	<0.1%	18.0	36%	0.72	1.4%	18.7	37%
HR28	0.04	0.1%	18.0	36%	1.02	2.0%	19.0	38%
HR29	0.01	<0.1%	18.0	36%	0.29	0.6%	18.3	37%
HR30	0.01	<0.1%	18.0	36%	0.21	0.4%	18.2	36%
HR31	0.02	<0.1%	18.0	36%	0.45	0.9%	18.5	37%
HR32	0.02	<0.1%	18.0	36%	0.56	1.1%	18.6	37%

ID	Maintenance Schedule Model				Outage Model			
HR33	0.02	<0.1%	18.0	36%	0.57	1.1%	18.6	37%
HR34	0.02	<0.1%	18.0	36%	0.58	1.2%	18.6	37%
HR35	0.03	0.1%	18.0	36%	0.66	1.3%	18.7	37%
HR36	0.03	0.1%	18.0	36%	0.77	1.5%	18.8	38%
HR37	0.03	0.1%	18.0	36%	0.85	1.7%	18.9	38%
HR38	0.02	<0.1%	18.0	36%	0.65	1.3%	18.7	37%
HR39	0.04	0.1%	18.0	36%	1.04	2.1%	19.0	38%
HR40	0.04	0.1%	18.0	36%	1.16	2.3%	19.2	38%
HR41	0.04	0.1%	18.0	36%	1.13	2.3%	19.1	38%
HR42	0.04	0.1%	18.0	36%	1.23	2.5%	19.2	38%
HR43	0.01	<0.1%	18.0	36%	0.53	1.1%	18.5	37%
HR44	0.04	0.1%	18.0	36%	1.22	2.4%	19.2	38%
HR45	0.03	0.1%	18.0	36%	1.04	2.1%	19.0	38%
HR46	0.01	<0.1%	18.0	36%	0.37	0.7%	18.4	37%
HR47	0.03	0.1%	18.0	36%	0.85	1.7%	18.8	38%
HR48	0.04	0.1%	18.0	36%	1.02	2.0%	19.0	38%
HR49	0.04	0.1%	18.0	36%	1.21	2.4%	19.2	38%
HR50	0.04	0.1%	18.0	36%	0.88	1.8%	18.9	38%
HR51	0.04	0.1%	18.0	36%	1.05	2.1%	19.1	38%
HR52	0.02	<0.1%	18.0	36%	0.54	1.1%	18.5	37%
HR53	0.07	0.1%	18.1	36%	1.21	2.4%	19.2	38%
HR54	0.08	0.2%	18.1	36%	1.34	2.7%	19.3	39%
HR55	0.06	0.1%	18.1	36%	1.07	2.1%	19.1	38%
HR56	0.05	0.1%	18.0	36%	0.85	1.7%	18.9	38%
HR57	0.04	0.1%	18.0	36%	0.68	1.4%	18.7	37%
HR58	0.05	0.1%	18.0	36%	0.88	1.8%	18.9	38%

Table A-21: MSM – PM_{10} and $PM_{2.5}$ Annual Impacts

ID	Annual PM_{10} PC (µg/m^3)	PC as % of AQAL	Annual PM_{10} PEC (µg/m^3)	PEC as % of AQAL	Annual $PM_{2.5}$ PC (µg/m^3)	PC as % of AQAL	Annual $PM_{2.5}$ PEC (µg/m^3)	PEC as % of AQAL
HR1	0.10	0.3%	18.1	45.3%	0.10	0.5%	12.2	60.8%
HR3	0.13	0.3%	18.1	45.3%	0.13	0.7%	11.8	58.8%
HR6	0.20	0.5%	18.2	45.5%	0.20	1.0%	11.8	59.2%
HR7	0.23	0.6%	18.2	45.6%	0.23	1.1%	11.9	59.3%
HR8	0.25	0.6%	18.2	45.6%	0.25	1.2%	11.9	59.4%
HR9	0.23	0.6%	18.2	45.6%	0.23	1.2%	11.9	59.3%

ID	Annual PM_{10} PC (µg/m³)	PC as % of AQAL	Annual PM_{10} PEC (µg/m³)	PEC as % of AQAL	Annual $PM_{2.5}$ PC (µg/m³)	PC as % of AQAL	Annual $PM_{2.5}$ PEC (µg/m³)	PEC as % of AQAL
HR12	0.14	0.3%	18.1	45.3%	0.14	0.7%	11.8	58.9%
HR13	0.07	0.2%	18.1	45.2%	0.07	0.4%	11.7	58.5%
HR14	0.05	0.1%	18.1	45.1%	0.05	0.3%	11.7	58.4%
HR16	0.05	0.1%	18.1	45.1%	0.05	0.3%	11.4	57.0%
HR25	0.10	0.3%	18.1	45.3%	0.10	0.5%	11.5	57.4%
HR29	0.05	0.1%	18.0	45.1%	0.05	0.2%	11.4	56.9%
HR30	0.03	0.1%	18.0	45.1%	0.03	0.2%	11.4	56.8%
HR31	0.07	0.2%	18.1	45.2%	0.07	0.3%	11.4	57.2%
HR32	0.09	0.2%	18.1	45.2%	0.09	0.4%	11.5	57.3%
HR34	0.09	0.2%	18.1	45.2%	0.09	0.5%	11.5	57.3%
HR35	0.12	0.3%	18.1	45.3%	0.12	0.6%	11.5	57.4%
HR37	0.16	0.4%	18.2	45.4%	0.16	0.8%	11.5	57.7%
HR41	0.23	0.6%	18.2	45.6%	0.23	1.2%	11.4	57.1%
HR42	0.25	0.6%	18.3	45.6%	0.25	1.3%	11.4	57.2%
HR44	0.24	0.6%	18.2	45.6%	0.24	1.2%	11.4	57.1%
HR45	0.20	0.5%	18.2	45.5%	0.20	1.0%	11.4	57.0%
HR47	0.16	0.4%	18.2	45.4%	0.16	0.8%	11.4	56.8%
HR52	0.07	0.2%	18.1	45.2%	0.07	0.4%	11.4	57.1%
HR53	0.17	0.4%	18.2	45.4%	0.17	0.9%	11.7	58.4%
HR54	0.19	0.5%	18.2	45.5%	0.19	1.0%	11.7	58.5%
HR55	0.15	0.4%	18.2	45.4%	0.15	0.8%	12.2	61.1%
HR56	0.13	0.3%	18.1	45.3%	0.13	0.7%	12.2	61.0%
HR57	0.11	0.3%	18.1	45.3%	0.11	0.5%	12.2	60.8%
HR58	0.13	0.3%	18.1	45.3%	0.13	0.7%	12.2	61.0%

Table A-22: OM – PM_{10} and $PM_{2.5}$ Annual Impacts (72-hour outage)

ID	Annual PM_{10} PC (µg/m³)	PM_{10} PC as % of AQAL	Annual $PM_{2.5}$ PC (µg/m³)	$PM_{2.5}$ PC as % of AQAL
HR1	<0.01	<0.1%	<0.01	<0.1%
HR3	<0.01	<0.1%	<0.01	<0.1%
HR6	<0.01	<0.1%	<0.01	<0.1%
HR7	<0.01	<0.1%	<0.01	<0.1%
HR8	<0.01	<0.1%	<0.01	<0.1%
HR9	<0.01	<0.1%	<0.01	<0.1%
HR12	<0.01	<0.1%	<0.01	<0.1%

ID	Annual PM_{10} PC ($\mu g/m^3$)	PM_{10} PC as % of AQAL	Annual $PM_{2.5}$ PC ($\mu g/m^3$)	$PM_{2.5}$ PC as % of AQAL
HR13	<0.01	<0.1%	<0.01	<0.1%
HR14	<0.01	<0.1%	<0.01	<0.1%
HR16	<0.01	<0.1%	<0.01	<0.1%
HR25	<0.01	<0.1%	<0.01	<0.1%
HR29	<0.01	<0.1%	<0.01	<0.1%
HR30	<0.01	<0.1%	<0.01	<0.1%
HR31	<0.01	<0.1%	<0.01	<0.1%
HR32	<0.01	<0.1%	<0.01	<0.1%
HR34	<0.01	<0.1%	<0.01	<0.1%
HR35	<0.01	<0.1%	<0.01	<0.1%
HR37	<0.01	<0.1%	<0.01	<0.1%
HR41	<0.01	<0.1%	<0.01	<0.1%
HR42	<0.01	<0.1%	<0.01	<0.1%
HR44	<0.01	<0.1%	<0.01	<0.1%
HR45	<0.01	<0.1%	<0.01	<0.1%
HR47	<0.01	<0.1%	<0.01	<0.1%
HR52	<0.01	<0.1%	<0.01	<0.1%
HR53	<0.01	<0.1%	<0.01	<0.1%
HR54	<0.01	<0.1%	<0.01	<0.1%
HR55	<0.01	<0.1%	<0.01	<0.1%
HR56	<0.01	<0.1%	<0.01	<0.1%
HR57	<0.01	<0.1%	<0.01	<0.1%
HR58	<0.01	<0.1%	<0.01	<0.1%

Appendix B Isopleth Plots

LON1 Phase B Environmental Permit Variation Application

Air Emissions Risk Assessment, LON1B, Dagenham

NTT Global Data Centers EMEA Limited

SLR Project No.: 410.V61547.00001

26 July 2024

B.1 Maintenance Schedule Model

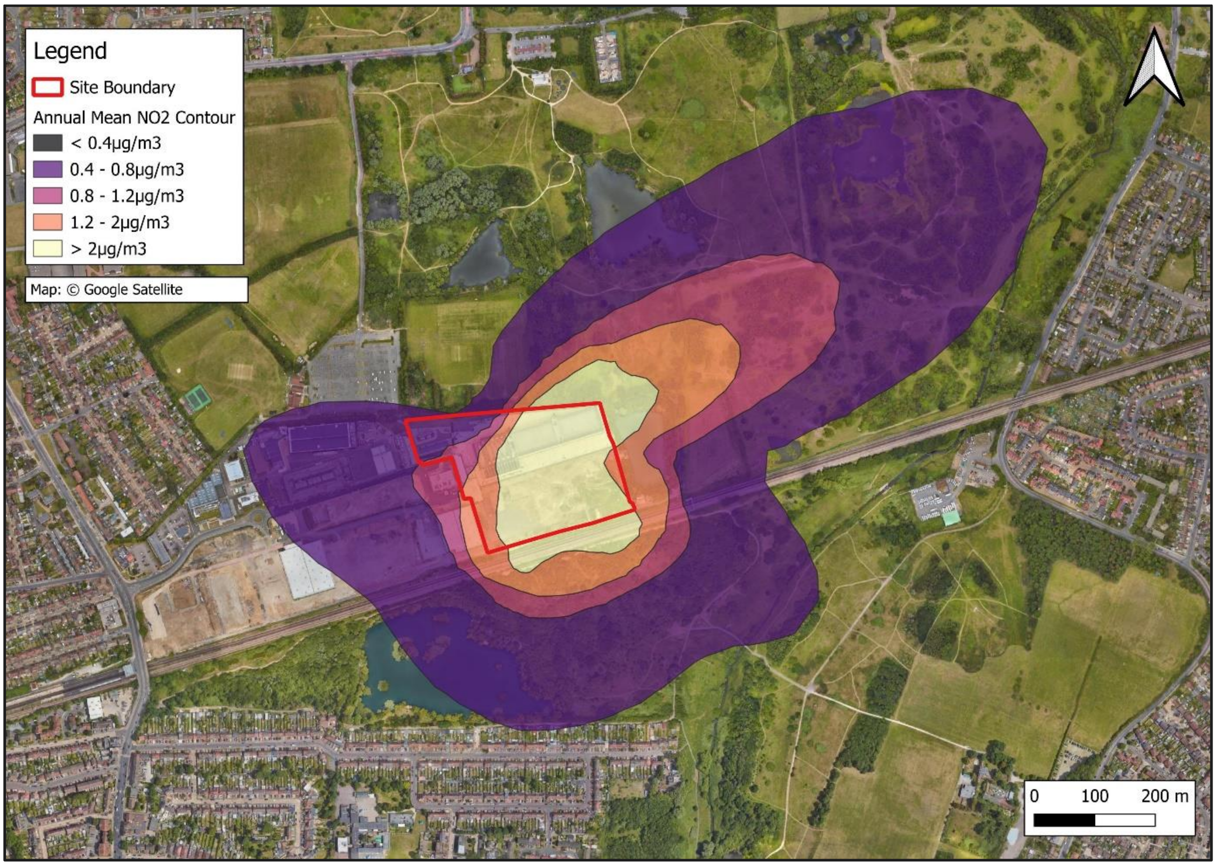

Figure B-1: MSM Annual Mean NO_2 Contour

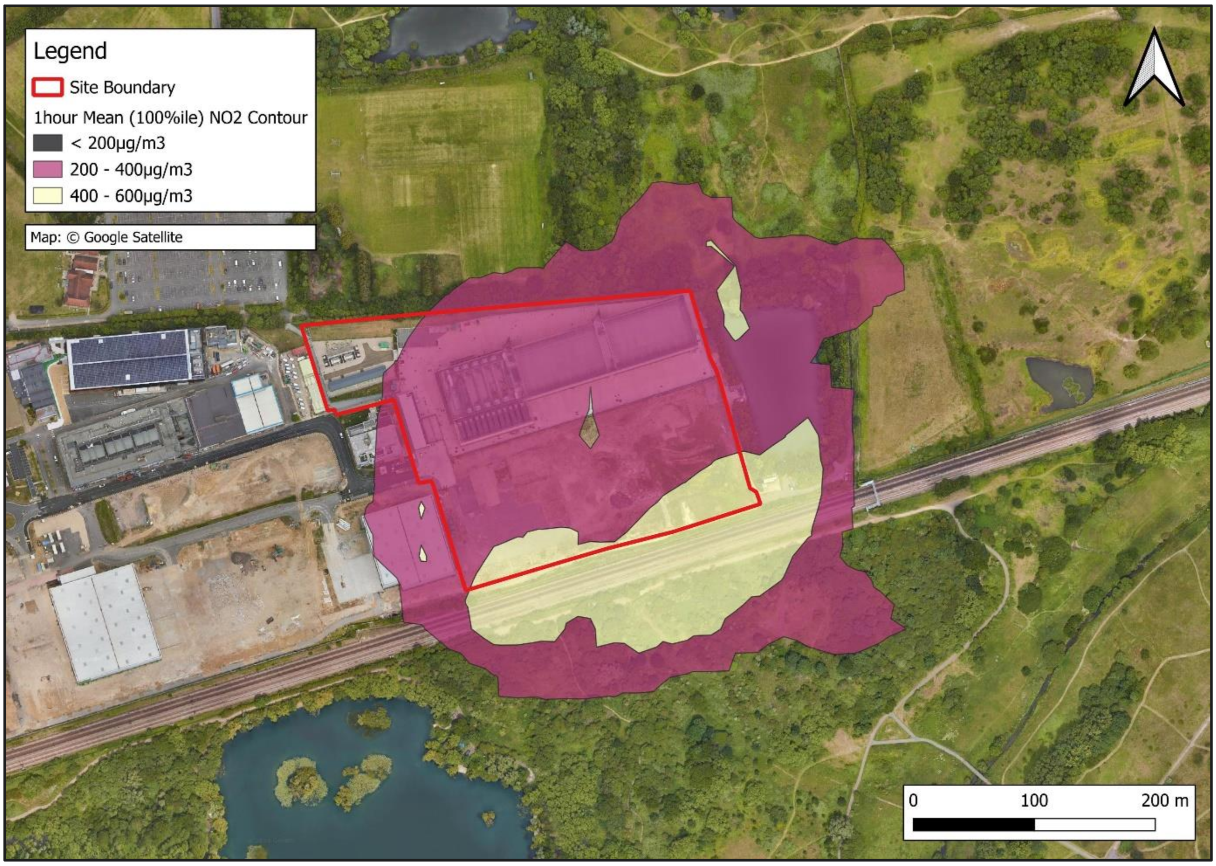

Figure B-2: MSM 1-hour Mean Maximum (100%ile) NO_2 Contour

Figure note: Probability exceedance of either AQAL or AEGL-1 is less than 1% therefore no probability contour is presented.

B.2 Outage Model

Figure B-3: 72-hour Outage Scenario – Probability of Exceeding AEGL-1

Figure note:
<1 exceedance represents a <2% probability of exceeding the AEGL-1 based on 72-hour outage
<3 exceedances represent a <6% probability of exceeding the AEGL-1 based on 72-hour outage
>3 exceedances represent a >6% probability of exceeding the AEGL-1 based on 72-hour outage

Figure B-4: 1-hour Outage Scenario – Probability of Exceeding AEGL-1

Figure note:
<36 exceedances represent a <1% probability of exceeding the AEGL-1 based on 1-hour outage
<176 exceedances represent a <5% probability of exceeding the AEGL-1 based on 1-hour outage
>176 exceedances represent a >5% probability of exceeding the AEGL-1 based on 1-hour outage

Appendix C Dispersion Modelling Checklist

LON1 Phase B Environmental Permit Variation Application

Air Emissions Risk Assessment, LON1B, Dagenham

NTT Global Data Centers EMEA Limited

SLR Project No.: 410.V61547.00001

26 July 2024

Item	Yes/No	Details
Location map	Y	Figure 4-1 and Figure 4-2
Site plan	Y	Figure 3-1 and Figure 4-1
Pollutants modelled and relevant AQALs	Y	Section 2.2 and 2.3
Details of modelled scenarios	Y	Section 5.2
Details of relevant ambient concentrations	Y	Section 4.2 and 4.4
Model description and justification	Y	Section 3.1.1
Special model treatment used	Y	Section 3.2 and 3.3
Table of emission parameters used	Y	Table 5-3
Details of modelled domain and receptors	Y	Section 3.1.2 and 4.3
Details of meteorological data used	Y	Section 3.1.6 and 4.6
Details of terrain treatment	Y	Section 3.1.3
Details of building treatment	Y	Section 3.1.4
Details of modelling deposition	Y	Section 3.3
Model uncertainty and sensitivity	Y	Section 3.1.1 and 5.2
Assessment of impacts	Y	Section 6.0 and Appendix A
Contour plots	Y	Appendix B
Model files	Y	Appendix D

Appendix D Model Files (electronic only)

LON1 Phase B Environmental Permit Variation Application

Air Emissions Risk Assessment, LON1B, Dagenham

NTT Global Data Centers EMEA Limited

SLR Project No.: 410.V61547.00001

26 July 2024

Making Sustainability Happen