GOSH CCC

Air Quality Assessment of Generators

17/01/2024
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(01)

NHS
Great Ormond Street Hospital for Children
NHS Foundation Trust

RSK

RSK GENERAL NOTES

Project No.: 445482-01 (00)

Title: Air Quality Assessment of Backup Generators

Client: John Sisk and Son Limited on behalf of the Great Ormond Street Hospital for Children NHS Foundation Trust

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Status: FINAL

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Date:	06th February 2024	Date:	06th February 2024

Contents

1 INTRODUCTION

1.1 Background

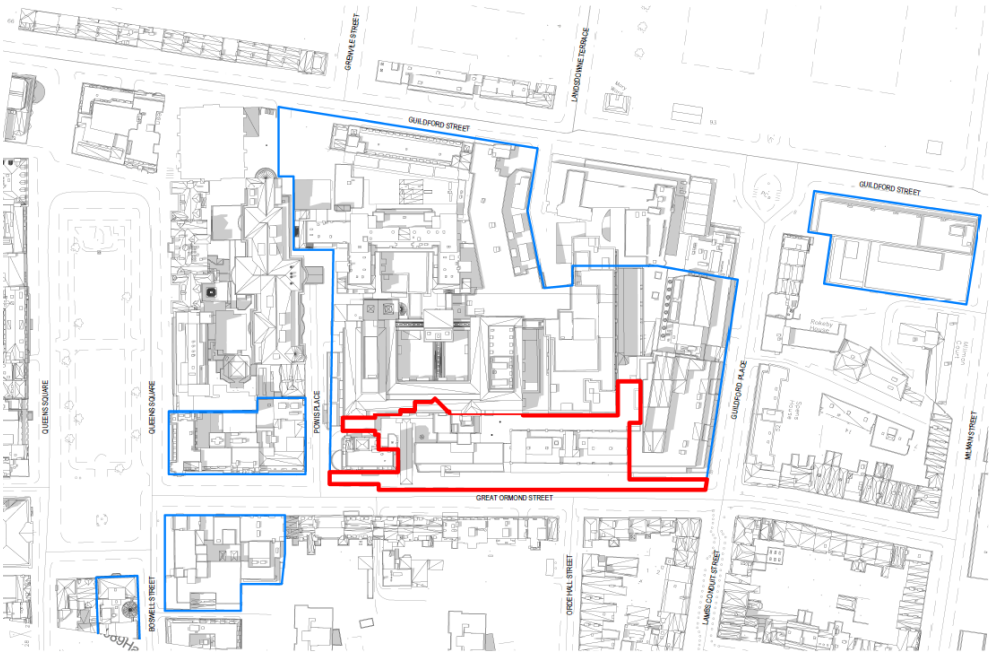
This air quality assessment has been prepared on behalf of the Applicant, Great Ormond Street Hospital for Children NHS Foundation Trust (referred to hereafter as the 'Applicant') in collaboration with the appointed design and build contractor John Sisk & Son (Holdings) Ltd (referred to hereafter as Sisk) to support an application to the London Borough of Camden (LBC) for full planning permission and conservation area consent for the redevelopment of the Great Ormond Street Hospital (GOSH) Frontage Building and Entrance on Great Ormond Street WC1N 3JH X (referred to hereafter as the 'site'), to provide a new Children's Cancer Centre (CCC).

RSK Environment Ltd (RSK) was commissioned to undertake an assessment of the potential air quality impacts associated with the proposed backup generators proposed as part of the redevelopment of the Frontage Building for the Great Ormond Street Hospital Children's Cancer Centre (GOSHCCC).

RSK has previously prepared an air quality assessment focused on the construction phase impacts and operational phase impacts related to transport emissions for the proposed redevelopment of the GOSHCCC (report ref: 443998/AQ/01 (03)).

The following report is focused on the proposed backup generators and existing emission sources and the potential impact of these on the users of the GOSHCCC and surrounding buildings. Therefore, this report should be read in conjunction with the original air quality assessment (report ref: 443998/AQ/01 (03)) for a full air quality assessment of the proposed development.

Figure 1.1: Application Site Location



2 LEGISLATION, PLANNING POLICY & GUIDANCE

2.1 Key Legislation

2.1.1 Air Quality Strategy

UK air quality policy is published under the umbrella of the Environment Act 1995, Part IV and specifically Section 80, the National Air Quality Strategy. The latest *Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air*, published in July 2007 sets air quality standards and objectives for ten key air pollutants to be achieved between 2003 and 2020.

The EU Air Quality Framework Directive (1996) established a framework under which the EU could set limit or target values for specified pollutants. The directive identified several pollutants for which limit or target values have been, or will be set in subsequent 'daughter directives'. The framework and daughter directives were consolidated by Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, which retains the existing air quality standards and introduces new objectives for fine particulates ($PM_{2.5}$).

The Clean Air Strategy 2019 supersedes the policies outlined in the 2007 strategy. This latest strategy aims to have a more joined-up approach, outlining actions the Government plans to take to reduce emissions from transport, homes, agriculture and industry. However, the air quality objectives remain as previously detailed within the 2007 strategy.

2.1.2 Air Quality Standards

The air quality standards (AQSs) and air quality objectives (AQOs) in the United Kingdom are derived from EC directives and are adopted into English law via the Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002. The Air Quality Limit Values Regulations 2003 and subsequent amendments implement the Air Quality Framework Directive into English Law. The European Union (Withdrawal) Act retains existing EU environmental provisions in the UK. Directive 2008/50/EC was translated into UK law in 2010 via the Air Quality Standards Regulations 2010.

The relevant[1] standards for England and Wales to protect human health are summarised in Table 2.1.

Table 2.1: Air Quality Objectives Relevant to the Proposed Development

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit ($\mu g/m^3$)
Nitrogen dioxide (NO_2)	1 calendar year	-	40
	1 hour	18	200

[1] Relevance, in this case, is defined by the scope of the assessment.

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m^3)
Fine particles (PM_{10})	1 calendar year	-	40
	24 hours	35	50
Fine particles ($PM_{2.5}$)	1 year	-	20
Carbon Monoxide (CO)	Maximum daily running 8 hour mean	-	10,000
Sulphur Dioxide (SO_2)	24 hours	3	125
	1 hour	24	350
	15 minutes	35	266

2.1.3 The Environment Act

The Environment Act (2021) introduces a commitment to create a legally binding duty on government to reduce the concentrations of fine particulate matter ($PM_{2.5}$) in ambient air.

<u>The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023</u>

The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 was published on 31st January 2023, and came into force the following day. The 2023 Regulations introduce a reduced long-term annual average Air Quality Objective for $PM_{2.5}$ of 10 µg/m^3 by 2040, a reduction from the current Air Quality objective of 20 µg/m^3 set out within the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020. Additionally, the 2023 Regulations introduce an interim target of 12 µg/m^3 by January 2028 and 35% reduction in average population exposure by 2040, with an interim target of a 22% reduction by January 2028, both compared to a 2018 baseline.

2.2 Planning Policy

The land use planning process is a key means of improving air quality, particularly in the long term, through the strategic location and design of new developments. Any air quality concern that relates to land use and its development can, depending on the details of the proposed development, be a material consideration in the determination of planning applications.

2.2.1 National Planning Policy Framework

In December 2023 the revised National Planning Policy Framework (NPPF) was published, superseding the previous NPPF with immediate effect. The NPPF includes a presumption in favour of sustainable development.

Section 15 of the NPPF deals with Conserving and Enhancing the Natural Environment, and states that the intention is that the planning system should prevent '*development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability*' and goes on to state that '*new development* [should be] *appropriate for its location' and 'the likely effects*

(including cumulative effects) of pollution on health, living conditions and the natural environment, as wells as the potential sensitivity of the site or wider area to impacts that could arise from the development.'

With specific regard to air quality, the NPPF states that: *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

2.2.2 Regional Planning Policy

In March 2021 the latest version of the London Plan was published. Policy **SI 1 Improving air quality** states:

"A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C *Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:*

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D *In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.*

E *Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development."*

The Sustainable Design and Construction Supplementary Planning Document (SDC SPG)

The SDC SPG, which was adopted in 2014 to accompany the London Plan, provides detail on how air quality and air quality neutral assessments should be undertaken. It also sets minimum target emissions standards for CHP and biomass boilers and includes recommendations for reducing the impacts of point sources on local air quality.

The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, 2014 ('the MOL SPG')

Following an assessment of the impacts of fugitive dust and emissions on local air quality, the MOL SPG (which was adopted in 2014 to accompany the London Plan) report outlines a mechanism for assigning mitigation measures proportionate to the dust 'risks' identified. The MOL SPG recommends that the latest version of the IAQM construction dust guidance is followed to undertake the risk assessment; therefore this document has also been listed below.

2.2.3 Local Planning Policy

Camden Local Plan

Policy CC4 Air Quality of the LBC 2017 Local Plan states the following:

"The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution

and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan."

Camden Planning Guidance: Air Quality (2021)

The Air Quality Supplementary Planning Guidance adopted in 2021 provides information on key air quality issues and support Local Plan Policy CC4 Air quality (outlined above).

2.3 Best Practice Guidance Documents

2.3.1 Local Air Quality Management Review and Assessment Technical Guidance

The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their air quality review and assessment work. This guidance, referred to in this document as the Local Air Quality Management Technical Guidance (Defra, 2022) ('LAQM TG.22'), has been used to identify locations where exposure can be considered 'relevant'. This is important as Directive 2008/50/EC indicates that the AQOs should not be applied at any locations situated within areas where members of the public do not have access and there is no fixed habitation.

2.3.2 Land-Use Planning & Development Control: Planning for Air Quality

Environmental Protection UK's (EPUK) and the IAQM jointly published a revised version of the guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' in 2017 (herein the 'EPUK-IAQM 2017 guidance') to facilitate consideration of air quality within local development control processes. It provides a framework for air quality considerations, promoting a consistent approach to the treatment of air quality issues within development control decisions.

The guidance includes methods for undertaken an air quality assessment and an approach for assessing the significance of effects. The guidance note is widely accepted as an appropriate reference method for this purpose.

3 ASSESSMENT SCOPE

3.1 Overall Approach

The approach taken for assessing the potential air quality and odour impacts of the application site may be summarised as follows:

- Baseline characterisation of local air quality;
- Advanced dispersion modelling assessment of air quality impacts of the backup generators: and
- Consideration of possible mitigation measures, where appropriate.

3.2 Baseline Characterisation

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources.

A desk-based study has been undertaken using data obtained from continuous and diffusion tube monitoring stations maintained by LBC and estimated background data from the LAQM Support website maintained by Defra. Background concentrations have been mapped by Defra at a grid resolution of 1x1km for the whole of the UK. Consideration has also been given to potential sources of air pollution and any AQMAs in the vicinity of the application site.

3.3 Operational Phase Air Assessment

3.3.1 Emission Sources

3.3.1.1 Proposed Sources

The proposed development comprises three emergency backup generators. The generators are arranged N+1, meaning two of the generators will be running while one on standby. The generators will not be used on a regular basis and only operate during emergency and during maintenance checks.

It is estimated by the client that the emergency generators will operate 3 hours per month for maintenance checks, of which one generator will operate at any one time. Additional to this, it is estimated that two generators will run on three additional occasions for a period up to 24 hours. Therefore, it is estimated that the generators will operate for a total of 108 hours per year.

Based on the above, generally during testing, only one generator will be operating. At most, two generators will operate at any one-time during emergency. Therefore, the modelling within this report is based on two generators operating at any one time.

To assess long term impacts of the operation of the generators, the model output has been scaled to be representative of 108 hours of operation.

The 8-hour CO concentrations have been assessed based on continuous operation, for a conservative assessment.

To assess compliance with the hourly mean NO_2 AQO, the 90.02nd percentile of hourly mean NO_2 concentrations was modelled for this assessment. The hourly mean NO_2 concentrations is typically assessed as the 99.79th percentile, to account for the allowed 18 exceedances per annum which is relevant to continuous operation throughout the year. However, as the generators are only operating 108 hours per year, the 99.79th percentile is not considered representative for this assessment. Therefore, the 90.02nd percentile of the hourly mean NO_2 has been modelled. This percentile indicates that there is only a 1% likelihood that the hourly mean AQO would be exceeded more than the permissible 18 times per annum, should the generator operate for 108 hours per annum. The method used has been drawn from the Laxen (2017) guidance. This was considered more appropriate than applying a variable emissions profile, as it allows for meteorological conditions over an entire year to be appropriately captured.

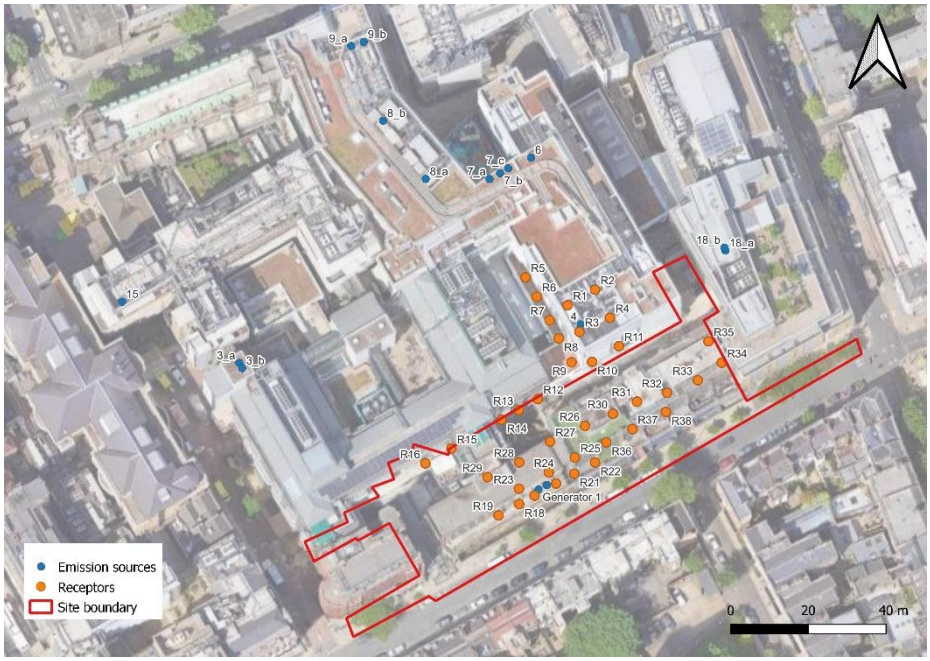
To assess compliance with the daily mean PM_{10} AQO, the 16.16th percentile of hourly daily mean PM_{10} concentrations was modelled for this assessment. This percentile indicates that there is only a 1% likelihood that the daily mean AQO would be exceeded more than the permissible 35 times per annum, should the generators operate for 108 hours per annum.

The emission characteristics for the generators are summarised in Table 3.1. The input data have been provided by the client. Location of proposed generators is shown in Figure 3.1.

Table 3.1: Emissions Characteristics for Proposed Generators

ID	Source	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temp (°C)	Emission rates (g/s)		
						NO_x	PM_{10}	CO
Proposed	Emergency Generators (Two)	63	0.3	42.9	474	5.7	0.1	0.5

Figure 3.1: Location of Emission Sources and Receptors



3.3.1.2 *Existing Sources*

Based on the information provided, it is understood that there are several CHPs, boilers and generators existing at the development site.

The existing emission sources other than the existing generators have been modelled to be operating continuously throughout the year. However, the existing generators are anticipated to operate up to 16 hours per year. As discussed above, to assess compliance with the hourly mean NO_2 AQO of existing generators, the 28.88th percentile of hourly mean NO_2 concentrations was modelled for this assessment. It is noted that the 28.88th percentile is derived from the operational time of 20 hours per year, which is more than the planned 16 hours per year.

To assess compliance with the daily mean PM_{10} AQO, the 16.16th percentile of hourly daily mean PM_{10} concentrations was modelled for this assessment. This percentile indicates that there is only a 1% likelihood that the daily mean AQO would be exceeded more than the permissible 35 times per annum, should the generators operate for 16 hours per annum.

The emission characteristics for the existing sources are summarised in Table 3.12. The input data have been provided by the client. Location of existing sources is shown in Figure 3.1.

Table 3.2: Emissions Characteristics for Existing Emission Sources

ID	Source	No. of units modelled	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temp (°C)	Emission rates (g/s)			
							NO_x	CO	PM_{10}	SO_2
3	Generator Flues	2	45.63	0.25	50.42	500	3.96	1.05	0.04	N.A
4	Generator Flues	1	68.59	0.35	44.82	460	9.03	2.39	0.09	N.A
6	Boiler Flues	1	53.59	0.35	15.94	175	0.22	0.06	0.02	N.A
7	Boiler Flues	1	53.59	0.35	18.64	175	0.26	0.06	0.03	N.A
8	Generator Flues	1	54.09	0.35	44.82	460	9.03	2.39	0.09	N.A
9	CHP Flues	2	54.59	0.30	21.86	413	0.15	0.07	N.A	0.12
15	Generator Flues	1	58.59	0.30	43.01	480	5.38	1.42	0.05	N.A
18	Generator Flues	2	48.68	0.25	44.82	460	9.03	2.39	0.09	N.A

3.3.2 Modelling Software

The model used in this study is UK Atmospheric Dispersion Modelling System (ADMS) Version 6.0.0.1. ADMS is a steady-state atmospheric dispersion model that is based on modern atmospheric physics. It can include treatment of both surface and elevated sources and both simple and complex terrain. The model calculates downwind pollutant concentration in the surrounding area for each hour of the day and night over an appropriate period. Statistics on the frequency and concentration of pollutants at the receptor sites are based upon the hourly calculations.

3.3.3 Meteorological Data

Hourly sequential meteorological data were employed in the dispersion model. The data were recorded in 2019-2021 at the Heathrow Airport meteorological station. Bedford meteorological station is located approximately 24km to the west of the application site and is considered most representative of conditions at the site.

The windroses derived from the 2019 to 2021 datasets are presented in Appendix A. The predominant wind direction was from the southwest.

3.3.4 Discrete Receptors

Pollution concentrations were predicted at locations associated with openable windows, air intakes and discrete human receptor points on the proposed roof terrace of the

GOSHCCC. Table 3.3 detail the discrete receptors modelled. Location of receptors is shown in Figure 3.1

Table 3.3: Discrete Receptors Included in the Model

Receptor ID	Receptor Name	X	Y	Height (m)
R1	Air intake1	530530	182073	52.6
R2	Air intake2	530537	182077	52.6
R3	Air intake3	530533	182066	52.6
R4	Air intake4	530541	182070	52.6
R5	Openable window1	530519	182080	43.6
R6	Openable window2	530522	182075	43.6
R7	Openable window3	530525	182069	43.6
R8	Openable window4	530528	182065	43.6
R9	Openable window5	530531	182059	43.6
R10	Openable window6	530536	182059	43.6
R11	Openable window7	530543	182063	43.6
R12	Openable window8	530522	182049	40.7
R13	Openable window9	530517	182046	40.7
R14	Openable window10	530513	182044	40.7
R15	Openable window11	530500	182036	40.7
R16	Openable window12	530493	182033	40.7
R17	Proposed intake1	530521	182024	55.6
R18	Proposed intake2	530517	182022	55.6
R19	Proposed intake3	530512	182019	55.6
R20	Proposed intake4	530527	182027	55.6
R21	Proposed intake5	530532	182030	55.6
R22	Proposed intake6	530537	182033	55.6
R23	Roof garden1	530517	182026	59.5
R24	Roof garden2	530525	182030	59.5
R25	Roof garden3	530532	182034	59.5

Receptor ID	Receptor Name	X	Y	Height (m)
R26	Roof garden4	530534	182042	59.5
R27	Roof garden5	530525	182038	59.5
R28	Roof garden6	530518	182033	59.5
R29	Roof garden7	530509	182029	59.5
R30	Roof garden 8	530542	182045	59.5
R31	Roof garden 9	530548	182048	59.5
R32	Roof garden 10	530556	182051	59.5
R33	Roof garden 11	530564	182054	59.5
R34	Roof garden 12	530570	182058	59.5
R35	Roof garden 13	530566	182064	59.5
R36	Roof garden 14	530540	182038	59.5
R37	Roof garden 15	530547	182041	59.5
R38	Roof garden 16	530555	182046	59.5

3.3.5 Buildings

To capture the potential influence of buildings/structures on the dispersion profile of point source emissions (e.g. building 'downwash' effects), significant buildings as part of the application site were included. The parameters of the modelled buildings are summarised in Table 3.4 below.

Table 3.4: Buildings Included in the Model

Building location	Length (m)	Width (m)	Height (m)
Proposed Building 1	5.2	94.6	52.6
Proposed Building 2	57.6	94.6	57.6
Proposed Building 3	3.7	21.4	58.0
Building West	15.1	23.1	47.7
Premier Inn Clinic	30.7	44.6	52.6
Premier Inn Clinic 2	17.5	9.8	52.6
Variety Building	48.2	73.2	43.6

Building East 1	20.0	28.9	39.4
Building East 2	22.4	29.4	39.4
MSCB 1	26.0	66.2	52.6
MSCB 2	16.1	8.2	52.6
Southwood 1	65.3	17.8	52.6
Southwood 2	16.1	15.7	52.6
Southwood 3	10.5	16.4	52.6

3.3.6 Terrain

Digital terrain has been included in the assessment to account for the topographical features.

3.3.7 Processing of Results

NO_x emitted to the atmosphere as a result of combustion will consist largely of nitric oxide (NO). Once released into the atmosphere, NO is oxidised to NO_2, which is of concern with respect to health and other impacts. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as O_3. The dispersion modelling exercise predicts concentrations of NO_x which subsequently require conversion to NO_2. The long- and short-term predicted NO_x process contributions (PCs) have been converted to the respective NO_2 concentrations using the approach outlined below, utilising 'worst case' conversion criteria referenced by the Environment Agency[2]:

- Predicted NO_2 annual average concentration = 70% of the predicted annual average NO_x concentration; and,
- Predicted NO_2 hourly average concentrations = 35% of the predicted 99.79th percentile of hourly average NO_x concentrations.

3.4 Uncertainties and Assumptions

The following uncertainties and assumptions have been made in the air quality assessment:

- In the absence of measured air quality data for CO and SO_2 at the proposed development location, estimated background data from the Defra LAQM website were used in the assessment. In reality, baseline air quality levels vary with time and location but in the absence of on-site baseline monitoring data, the assumption that the baseline concentrations obtained from the above-mentioned data source is applicable to the site location, is considered appropriate;
- There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that wind conditions measured at Heathrow Airport meteorological monitoring

[2] Environment Agency, (n.d.). CONVERSION RATIOS FOR NOX AND NO_2.

station for the years 2019 to 2021 were representative of wind conditions at the site; and

- There is an element of uncertainty in all measured and modelled data. All values presented within the report are best possible estimates.

4 BASELINE CHARACTERISATION

4.1 Presence of AQMAs

The proposed development site is located within the LBC Borough-wide AQMA. The LBC AQMA was declared in 2002 due to exceedances of annual mean NO_2 and 24- hour mean PM_{10} AQOs.

4.2 Baseline Monitoring Data

According to the 2022 LBC Annual Status Report, there are 76 locations within 1km of the site which monitor NO_2, PM_{10} and/or $PM_{2.5}$ using either automatic 'reference method' monitors or passive NO_2 diffusion tubes. An AQMesh indicative automatic monitor, measuring NO_2 and $PM_{2.5}$, has also been installed along Great Ormond Street as part of the Breathe London programme.

Monitored annual mean NO_2 concentrations are presented in Table 4.1 below. It shows generally high results with many sites exceeding the NO_2 air quality standard. Monitored annual mean NO_2 concentrations at the three urban background are all below the annual mean NO_2 AQO, however monitored annual mean NO_2 concentrations at the roadside locations are above the annual mean NO_2 AQO. It should be noted that the monitoring data from 2020 should be treated with caution as pollution levels were greatly impacted by the Covid-19 restrictions.

Table 4.1: LBC Monitoring sites Within 1km from the Proposed Development Site

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
BB	Great Ormond Street Hospital	Roadside	0.0	-	-	-	38.4*	**40.2****	24.49***	24.45
CAM208	Torrington-Tavistock/Midland-Judd 30 - Guildford Street	Roadside	0.2	-	-	**45.54**	**46.49**	31.39	-	-
CAM182	Torrington-Tavistock/Midland-Judd 4 - Grenville Street	Roadside	0.2	-	-	**45.73**	**43.83**	31.97	27.61	29.57
CAM212	Torrington-Tavistock/Midland-Judd 34 - Southampton Row	Roadside	0.3	-	-	**56.02**	**51.48**	33.98	-	-
CAM181	Torrington-Tavistock/Midland-Judd 3 - Bernard Street	Roadside	0.3	-	-	**43.16**	**41.53**	31.02	-	-
CAM180	Torrington-Tavistock/Midland-Judd 2 - Guildford Street (west end)	Roadside	0.3	-	-	**56.93**	**54.13**	36.64	-	-
CAM179	Torrington-Tavistock/Midland-Judd 1 - Herbrand Street	Roadside	0.3	-	-	**53.4**	**49.02**	34.71	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration (µg/m^3)						
				2016	2017	2018	2019	2020	2021	2022
CAM59	Grays Inn Road South 2 - John Street	Roadside	0.3	-	-	-	-	-	25.29	26.31
CAM183	Torrington-Tavistock/Midland-Judd 5 - Russell Square south	Roadside	0.3	-	-	**45.65**	**41.53**	29.93	-	-
CAM60	Grays Inn Road South 3 - Roger Street	Roadside	0.4	-	-	-	-	-	27.86	30.53
BL0	London Bloomsbury (Russell Square Gardens)	Urban Background	0.4	**42**	38	36	32	28	27	26
CAM50	Farringdon 4 - Grays Inn Road/Calthorpe Street	Roadside	0.4	-	-	**51.12**	**46.62**	27.96	29.35	29.69
CAM58	Grays Inn Road South 1 - Northington Street / King's Mews	Roadside	0.4	-	-	-	-	-	23.53	24.59
CAM209	Torrington-Tavistock/Midland-Judd 31 - Bloomsbury Square	Roadside	0.4	-	-	**71.25**	**60.36**	40.34	-	-
CAM72	St. George's Gardens (prev.	Urban Background	0.4	31.31	34.83	26.67	25.22	-	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
	'Wakefield Gardens')									
CAM56	Farringdon 10 - Grays Inn Road/Wren Street	Roadside	0.4	-	-	-	-	25.57	24.26	23.08
CAM185	Torrington-Tavistock/Midland-Judd 7 - Woburn Place	Roadside	0.4	-	-	**70.46**	**64.49**	**43.26**	-	-
CAM193	Torrington-Tavistock/Midland-Judd 15 - Handel Street	Roadside	0.4	-	-	**41.26**	36.2	26.79	-	-
CAM191	Torrington-Tavistock/Midland-Judd 13 - Marchmont Street	Roadside	0.4	-	-	**45.55**	**40.05**	32.09	-	-
CAM192	Torrington-Tavistock/Midland-Judd 14 - Hunter Street	Roadside	0.4	-	-	**52.22**	**41.05**	30.41	-	-
CAM184	Torrington-Tavistock/Midland-Judd 6 - Russell Square nouth	Roadside	0.5	-	-	**53.78**	**46.98**	31.62	-	-
CAM61	Grays Inn Road South 4 - Elm Street	Roadside	0.5	-	-	-	-	-	27.3	28.69
CAM214	Torrington-	Roadside	0.5	-	-	**52.36**	**44.64**	29.57	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
	Tavistock/Midland-Judd 36 - Great Russell Street									
CAM190	Torrington-Tavistock/Midland-Judd 12 - Coram Street	Roadside	0.5	-	-	**49.73**	**45.74**	37.09	-	-
CAM49	Farringdon 3 - Calthorpe Street	Roadside	0.5	-	-	**43.12**	37.79	25.98	24.07	27.77
CAM73	St. George's Gardens East	Urban Background	0.5	-	-	-	28.31	22.47	17.23	19.21
CAM194	Torrington-Tavistock/Midland-Judd 16 - Tavistock Place/Regent's Square	Roadside	0.5	-	-	**48.34**	**41.15**	28.63	27.95	26.66
CAM186	Torrington-Tavistock/Midland-Judd 8 - Bedford Way	Roadside	0.5	-	-	**51.49**	**49.25**	34.82	-	-
CAM30	HSS Phase 4&5 18 - Christopher Hatton - Mount Pleasant	Roadside	0.5	-	-	-	-	-	33.33	33.7
CAM187	Torrington-Tavistock/Midland-Judd 9 - Montague Place	Roadside	0.5	-	-	**42.69**	**40.69**	29.53	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
CAM189	Torrington-Tavistock/Midland-Judd 11 - Tavistock Place	Roadside	0.5	-	-	**46.58**	**39.95**	32.22	29.64	29.67
CAM213	"Torrington-Tavistock/Midland-Judd 35 - High Holborn (199-206)"	Roadside	0.6	-	-	**58.99**	**50.14**	33.17	-	-
CAM57	Farringdon 11 - Grays Inn Road South	Roadside	0.6	-	-	-	-	27	27.17	29.55
CAM195	Torrington-Tavistock/Midland-Judd 17 - Marchmont Street	Roadside	0.6	-	-	**46.2**	**37.89**	32.3	-	-
CAM196	Torrington-Tavistock/Midland-Judd 18 - Leigh Street	Roadside	0.6	-	-	**46.69**	38.61	30.07	27.2	26.21
CAM55	Farringdon 9 - Grays Inn Road North	Roadside	0.6	-	-	-	-	28.35	30.11	30.21
CAM54	Farringdon 8 - Warner Street	Roadside	0.7	-	-	**42.98**	36.01	24.66	23.9	24.95
CAM197	Torrington-Tavistock/Midland-Judd 19 - Sandwich Street	Roadside	0.7	-	-	**43.54**	36.89	27.54	-	-
CAM188	Torrington-	Roadside	0.7	-	-	**45.57**	38.82	25.42	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
	Tavistock/Midland-Judd 10 - Keppel Street									
CAM86	Bloomsbury Street	Kerbside	0.7	**72.2**	**71.18**	**59.43**	**49.6**	29.52	32.91	30.8
CAM210	Torrington-Tavistock/Midland-Judd 32 - St. Joseph's Roman Catholic Primary School (Macklin Street)	Roadside	0.7	-	-	37.27	36.26	25.42	-	-
CAM228	WEP 13 - Bedford Square (7A)	Roadside	0.7	-	-	**64.88**	**50.5**	28.04	30.77	-
CAM79	Tavistock Gardens	Urban Background	0.7	39.68	**46.18**	35.35	33.9	26.78	22.2	23.91
CAM48	Farringdon 2 - Frederick Street	Roadside	0.7	-	-	38.97	32.93	23.97	23.88	24.48
CAM53	Farringdon 7 - Lloyd Baker Street	Roadside	0.7	-	-	**42.8**	37.01	26.27	25.09	23.85
CAM227	WEP 12 - Bloomsbury Street (1)	Roadside	0.7	-	-	**92.31**	**77.5**	36.93	43.92	-
CAM52	Farringdon 6 - Summers Street	Roadside	0.7	-	-	37.17	32.7	23.77	22.22	23.46
CAM199	Torrington-Tavistock/Midland-Judd 21 - Judd Street	Roadside	0.8	-	-	**53.85**	**42.17**	31.74	-	-
CAM15	HSS Phase 4&5 3	Roadside	0.8	-	-	-	-	-	24.09	24.31

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)						
				2016	2017	2018	2019	2020	2021	2022
	- Ecole Jeannine Manuel - Bedford Square north (opposite side to school)									
CAM198	Torrington-Tavistock/Midland-Judd 20 - Hastings Street	Roadside	0.8	-	-	**42.6**	37.74	26.85	-	-
CAM211	"Torrington-Tavistock/Midland-Judd 33 - High Holborn (174-177)"	Roadside	0.8	-	-	**58.48**	**54.81**	35.46	-	-
CAM204	Torrington-Tavistock/Midland-Judd 26 - Upper Woburn Place	Roadside	0.8	-	-	**68.26**	**59.37**	43.16	37.01	37.27
CAM16	HSS Phase 4&5 4 - Argyle Primary School - Tonbridge Street	Roadside	0.8	-	-	-	-	-	24.91	24.22
CAM13	HSS Phase 4&5 1 - Ecole Jeannine Manuel - Bedford Square south (outside school)	Roadside	0.8	-	-	-	-	-	22.95	22.62
CAM51	Farringdon 5 - Ray Street/Herbal Hill	Roadside	0.8	-	-	39.14	33.42	22.9	23.04	22.53
CAM47	Farringdon 1 - Acton Street	Roadside	0.8	-	-	**55.49**	**48.27**	30.91	34.82	32.26

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration (µg/m^3)						
				2016	2017	2018	2019	2020	2021	2022
CAM203	Torrington-Tavistock/Midland-Judd 25 - Duke's Road	Roadside	0.8	-	-	**50.38**	**42.3**	31	-	-
CAM226	WEP 11 - Shaftesbury Avenue (109)	Roadside	0.8	-	-	**64.71**	**56.5**	33.81	39.55	-
CAM233	WEP 18 - Bedford Square (41)	Roadside	0.8	-	-	**46.55**	39.8	27.89	26.02	-
CAM201	Torrington-Tavistock/Midland-Judd 23 - Bidborough Street	Roadside	0.8	-	-	**48.48**	**41.84**	28.07	-	-
CAM202	Torrington-Tavistock/Midland-Judd 24 - Mabledon Place	Roadside	0.8	-	-	**57.55**	**47.56**	36.25	-	-
CAM229	WEP 14 - Gower Street (89)	Roadside	0.9	-	-	**57.51**	**45.7**	26.95	32.03	-
CAM14	HSS Phase 4&5 2 - Ecole Jeannine Manuel - Bedford Avenue between Adeline Place and Morwell Street (LC5)	Roadside	0.9	-	-	-	-	-	26.2	27.04
CAM205	Torrington-Tavistock/Midland-Judd 27 -	Roadside	0.9	-	-	**50.69**	**44.64**	33.24	-	-

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration (µg/m^3)						
				2016	2017	2018	2019	2020	2021	2022
	Endsleigh Street									
CAM70	Euston Road	Kerbside	0.9	-	-	-	**70.65**	**53.68**	**56.9**	**50.64**
CAM231	WEP 16 - Gordon Street (20)	Roadside	0.9	-	-	**43.71**	**40.3**	31.46	30.56	-
CAM232	WEP 17 - Euston Road (137)	Roadside	0.9	-	-	**74.74**	**69.6**	**47.21**	**46.08**	-
CAM71	Euston Road LAQN colocation	Roadside	0.9	-	-	-	**65.28**	**46.57**	**46.49**	**43.15**
CD9	Euston Road	Roadside	0.9	**88**	**83**	**82**	**70**	**43**	**48**	**45**
CAM221	WEP 6 - Alfred Place (9)	Roadside	0.9	-	-	38.46	35.5	27.99	26.96	-
CAM223	WEP 8 - Tottenham Court Road (24-27)	Roadside	0.9	-	-	**69.44**	**71.8**	**55.42**	**42.02**	-
CAM252	Shaftesbury 12 - Earlham Street East	Roadside	0.9	-	-	-	-	27.67	25.18	25.59
CAM215	Torrington-Tavistock/Midland-Judd 37 - UCL Department of Chemistry - Christopher Ingold Building (Gordon Street)	Roadside	0.9	-	-	**44.12**	**40.04**	31.17	-	-
CAM80	Endsleigh Gardens	Roadside	0.9	-	-	-	**49.45**	35.32	34.32	30.15

Site ID	Site Description	Site Type	Approx. Distance from Site (km)	Annual Mean NO_2 Concentration (µg/m^3)						
				2016	2017	2018	2019	2020	2021	2022
CAM238	WEP 23 - Tottenham Court Road (279)	Roadside	0.9	-	-	-	**57.8**	**47.93**	**43.47**	-
CAM224	WEP 9 - Tottenham Court Road (279)	Roadside	0.9	-	-	**70.66**	-	-	-	-
CAM220	WEP 5 - Tottenham Court Road (216)	Roadside	0.9	-	-	**57.75**	-	-	-	-
Air Quality Strategy (AQS) Objective				**40**						

Note: BB – Breathing Buildings monitor installed along Great Ormond Street. * Data measured from 5th May – 31st December 2019. **Data measured from 1st January to 30th November 2020. ***Data measured from 28th January to 31st December 2021

4.3 LAQM Background Data

In addition to the local monitoring data, estimated background air quality data available from the LAQM-Tools website, may also be used to establish likely background air quality conditions at the proposed development site.

This website provides estimated annual average background concentrations of NO_2, PM_{10} and $PM_{2.5}$ on a 1km^2 grid basis. Table 4.2 identifies estimated annual average background concentrations for the grid square containing the application site for years from 2023 to 2024. No exceedances of the NO_2, PM_{10} or $PM_{2.5}$ AQO are predicted. As background concentrations are predicted to fall with time, background concentrations in future years would not be expected to exceed their respective annual mean standards.

Table 4.2: Estimated Background Annual Average NO_2, PM_{10} and $PM_{2.5}$ Concentrations at the Proposed Development Site

Assessment Year	Estimated Annual Average Pollutant Concentrations Derived from the LAQM Support Website (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
2023	34.8	19.0	12.1
2024	34.1	18.8	11.9
Air Quality Objective	**40**	**40**	**20**

Notes: Presented concentrations for 1km^2 grid centred on 530500, 182500.

4.3.1 Background Air Quality Data Used in the Modelling

Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were taken from the nearby automatic monitor (BL0). This monitoring location is classed as 'urban background' and considered to be representative of conditions at the proposed development site and receptor locations. Monitoring data from 2022 has been used in this assessment.

Given that there are currently no nearby representative background monitoring locations for CO and SO_2, background air quality data has been obtained from the Defra LAQM Support website, which provides estimated annual average background concentrations of CO and SO_2 on a 1 km^2 grid basis.

The background concentrations included in the dispersion modelling assessment are presented in **Error! Reference source not found.**

Table 4.3: Background Concentrations Included in the Assessment

NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	CO (mg/m^3)	SO_2 (µg/m^3)
26	17	9	0.67	4.57

5 ASSESSMENT OF IMPACTS

A detailed dispersion modelling assessment of the potential air quality impact from the operation of the emergency generators and existing emission sources has been carried out to assess pollution concentrations at locations associated with openable windows, air intakes and discrete human receptor points on the proposed roof terrace of the GOSHCCC and neighbouring buildings.

5.1 Particulate Matter

Particulate Matter (PM_{10})

The predicted annual mean and daily mean PM_{10} concentrations at all the assessed discrete receptors would not exceed the relevant AQO.

Table 5.1 shows the maximum annual mean PM_{10} at each discrete receptor point across the three meteorological years considered. All predicted total annual mean PM_{10} concentrations (PECs) are below the annual mean PM_{10} AQO at the discrete receptors.

Table 5.2 shows he maximum 16.16th percentile daily mean PM_{10} at each discrete receptor location across the three meteorological years considered for proposed generators, while 16.16th percentiles are adopted for the generators in existing sources. 90.41th percentiles are used for non-generator emission sources which operate continuously throughout the year. All predicted daily mean PM_{10} concentrations (PECs) are below the daily mean PM_{10} AQO at all discrete receptors.

Table 5.1: Predicted Annual Mean PM_{10} Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	<0.01	<1%	0.97	2%	17.98	45%
R2	0.01	<1%	1.03	3%	18.03	45%
R3	<0.01	<1%	0.83	2%	17.83	45%
R4	<0.01	<1%	0.89	2%	17.90	45%
R5	0.01	<1%	0.71	2%	17.72	44%
R6	0.01	<1%	0.73	2%	17.73	44%
R7	0.01	<1%	0.74	2%	17.75	44%
R8	0.01	<1%	0.76	2%	17.76	44%
R9	0.01	<1%	0.71	2%	17.72	44%
R10	0.01	<1%	0.62	2%	17.63	44%
R11	0.01	<1%	0.61	2%	17.62	44%
R12	0.01	<1%	0.58	1%	17.59	44%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R13	<0.01	<1%	<0.01	<1%	17.00	43%
R14	<0.01	<1%	<0.01	<1%	17.00	43%
R15	<0.01	<1%	<0.01	<1%	17.00	43%
R16	<0.01	<1%	<0.01	<1%	17.00	43%
R17	<0.01	<1%	0.63	2%	17.63	44%
R18	<0.01	<1%	0.64	2%	17.64	44%
R19	<0.01	<1%	0.65	2%	17.65	44%
R20	<0.01	<1%	0.63	2%	17.63	44%
R21	<0.01	<1%	0.63	2%	17.63	44%
R22	<0.01	<1%	0.65	2%	17.65	44%
R23	<0.01	<1%	0.96	2%	17.96	45%
R24	<0.01	<1%	0.94	2%	17.94	45%
R25	<0.01	<1%	0.96	2%	17.96	45%
R26	0.03	<1%	1.15	3%	18.18	45%
R27	<0.01	<1%	1.13	3%	18.13	45%
R28	<0.01	<1%	1.12	3%	18.12	45%
R29	<0.01	<1%	1.14	3%	18.15	45%
R30	0.05	<1%	1.22	3%	18.26	46%
R31	0.05	<1%	1.29	3%	18.34	46%
R32	0.05	<1%	1.27	3%	18.32	46%
R33	0.04	<1%	1.19	3%	18.24	46%
R34	0.04	<1%	1.17	3%	18.21	46%
R35	0.04	<1%	1.38	3%	18.42	46%
R36	0.03	<1%	1.01	3%	18.04	45%
R37	0.05	<1%	1.08	3%	18.13	45%
R38	0.05	<1%	1.14	3%	18.19	45%
AQO	**40 µg/m^3**					
Bold and underlined text indicates an exceedance						

Table 5.2: Predicted Daily Mean PM_{10} Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	<0.01	<1%	3.83	8%	37.83	76%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R2	<0.01	<1%	4.06	8%	38.06	76%
R3	<0.01	<1%	3.06	6%	37.06	74%
R4	<0.01	<1%	3.22	6%	37.22	74%
R5	<0.01	<1%	2.69	5%	36.90	74%
R6	<0.01	<1%	2.67	5%	36.87	74%
R7	<0.01	<1%	2.63	5%	36.86	74%
R8	0.27	1%	2.56	5%	36.83	74%
R9	0.27	1%	2.02	4%	36.29	73%
R10	0.28	1%	1.72	3%	36.00	72%
R11	0.27	1%	1.77	4%	36.04	72%
R12	0.29	1%	2.57	5%	36.86	74%
R13	<0.01	<1%	<0.01	<1%	34.00	68%
R14	<0.01	<1%	<0.01	<1%	34.00	68%
R15	<0.01	<1%	<0.01	<1%	34.00	68%
R16	<0.01	<1%	<0.01	<1%	34.00	68%
R17	<0.01	<1%	2.11	4%	36.11	72%
R18	<0.01	<1%	2.17	4%	36.17	72%
R19	<0.01	<1%	2.19	4%	36.19	72%
R20	<0.01	<1%	2.07	4%	36.07	72%
R21	<0.01	<1%	1.98	4%	35.98	72%
R22	<0.01	<1%	1.86	4%	35.86	72%
R23	<0.01	<1%	3.37	7%	37.37	75%
R24	<0.01	<1%	3.39	7%	37.39	75%
R25	<0.01	<1%	3.42	7%	37.42	75%
R26	<0.01	<1%	3.88	8%	37.88	76%
R27	<0.01	<1%	4.22	8%	38.22	76%
R28	<0.01	<1%	3.95	8%	37.95	76%
R29	<0.01	<1%	3.90	8%	37.90	76%
R30	<0.01	<1%	3.80	8%	37.80	76%
R31	<0.01	<1%	4.23	8%	38.23	76%
R32	<0.01	<1%	4.15	8%	38.15	76%
R33	<0.01	<1%	3.62	7%	37.62	75%
R34	<0.01	<1%	3.34	7%	37.34	75%
R35	<0.01	<1%	3.86	8%	37.86	76%
R36	<0.01	<1%	3.27	7%	37.27	75%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R37	<0.01	<1%	3.42	7%	37.42	75%
R38	<0.01	<1%	3.61	7%	37.61	75%
AQO	**50 µg/m^3**					
Bold and underlined text indicates an exceedance						

As detailed above, with the operation of the application site, annual mean and daily mean PM_{10} concentrations at nearby receptors are predicted to be below the air quality objectives.

Particulate Matter ($PM_{2.5}$)

The predicted annual mean $PM_{2.5}$ concentrations at all the assessed discrete receptors would not exceed the relevant AQO.

It is assumed that the predicted $PM_{2.5}$ concentration is 70% of modelled PM_{10} concentration for conservative approach.

Table 5.3 shows the maximum annual mean $PM_{2.5}$ at each discrete receptor point across the three meteorological years considered. All predicted total annual mean $PM_{2.5}$ concentrations (PECs) are below the annual mean $PM_{2.5}$ AQO at the discrete receptors.

Table 5.3: Predicted Annual Mean $PM_{2.5}$ Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	<0.01	<1%	0.68	3%	9.68	48%
R2	<0.01	<1%	0.72	4%	9.72	49%
R3	<0.01	<1%	0.58	3%	9.58	48%
R4	<0.01	<1%	0.63	3%	9.63	48%
R5	0.01	<1%	0.50	2%	9.50	48%
R6	0.01	<1%	0.51	3%	9.51	48%
R7	0.01	<1%	0.52	3%	9.53	48%
R8	0.01	<1%	0.53	3%	9.53	48%
R9	0.01	<1%	0.50	2%	9.50	48%
R10	<0.01	<1%	0.43	2%	9.44	47%
R11	<0.01	<1%	0.43	2%	9.43	47%
R12	<0.01	<1%	0.41	2%	9.41	47%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R13	<0.01	<1%	0.00	0%	9.00	45%
R14	<0.01	<1%	0.00	0%	9.00	45%
R15	<0.01	<1%	0.00	0%	9.00	45%
R16	<0.01	<1%	0.00	0%	9.00	45%
R17	<0.01	<1%	0.44	2%	9.44	47%
R18	<0.01	<1%	0.45	2%	9.45	47%
R19	<0.01	<1%	0.45	2%	9.45	47%
R20	<0.01	<1%	0.44	2%	9.44	47%
R21	<0.01	<1%	0.44	2%	9.44	47%
R22	<0.01	<1%	0.45	2%	9.45	47%
R23	<0.01	<1%	0.67	3%	9.67	48%
R24	<0.01	<1%	0.66	3%	9.66	48%
R25	<0.01	<1%	0.67	3%	9.67	48%
R26	0.02	<1%	0.81	4%	9.83	49%
R27	<0.01	<1%	0.79	4%	9.79	49%
R28	<0.01	<1%	0.78	4%	9.78	49%
R29	<0.01	<1%	0.80	4%	9.80	49%
R30	0.03	<1%	1.22	6%	10.25	51%
R31	0.04	<1%	1.29	6%	10.32	52%
R32	0.03	<1%	1.27	6%	10.30	52%
R33	0.03	<1%	1.19	6%	10.22	51%
R34	0.03	<1%	1.17	6%	10.20	51%
R35	0.03	<1%	1.38	7%	10.41	52%
R36	0.02	<1%	1.01	5%	10.03	50%
R37	0.03	<1%	1.08	5%	10.11	51%
R38	0.03	<1%	1.14	6%	10.17	51%
AQO	**20 µg/m^3**					
Bold and underlined text indicates an exceedance						

5.2 Nitrogen Dioxide

Table 5.4 shows the maximum annual mean NO_2 at each discrete receptor point across the three meteorological years considered. All predicted total annual mean NO_2 concentrations (PECs) are below the annual mean NO_2 AQO objective level at the discrete receptors.

	PC (proposed generators) (µg/m3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m3)	PC as % of Objective (existing sources)	PEC (µg/m3)	PEC as % of Objective
R1	0.14	<1%	7.86	20%	34.00	85%
R2	0.22	1%	8.23	21%	34.44	86%
R3	0.11	<1%	6.74	17%	32.85	82%
R4	0.19	<1%	7.18	18%	33.37	83%
R5	0.26	1%	6.48	16%	32.74	82%
R6	0.25	1%	6.48	16%	32.73	82%
R7	0.27	1%	6.56	16%	32.83	82%
R8	0.29	1%	6.54	16%	32.84	82%
R9	0.29	1%	5.87	15%	32.16	80%
R10	0.30	1%	5.20	13%	31.50	79%
R11	0.30	1%	5.16	13%	31.45	79%
R12	0.31	1%	5.19	13%	31.49	79%
R13	<0.01	<1%	<0.01	<1%	26.00	65%
R14	<0.01	<1%	<0.01	<1%	26.00	65%
R15	<0.01	<1%	<0.01	<1%	26.00	65%
R16	<0.01	<1%	<0.01	<1%	26.00	65%
R17	<0.01	<1%	5.23	13%	31.23	78%
R18	<0.01	<1%	5.27	13%	31.27	78%
R19	<0.01	<1%	5.31	13%	31.31	78%
R20	<0.01	<1%	5.22	13%	31.22	78%
R21	<0.01	<1%	5.26	13%	31.26	78%
R22	<0.01	<1%	5.40	13%	31.40	79%
R23	<0.01	<1%	7.91	20%	33.91	85%
R24	<0.01	<1%	7.89	20%	33.89	85%
R25	0.12	<1%	8.04	20%	34.16	85%
R26	1.15	3%	9.56	24%	36.70	92%
R27	0.12	<1%	9.37	23%	35.48	89%
R28	0.01	<1%	9.17	23%	35.17	88%
R29	0.13	<1%	9.30	23%	35.43	89%
R30	1.84	5%	10.01	25%	37.86	95%
R31	2.02	5%	10.47	26%	38.50	96%

	PC (proposed generators) (µg/m3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m3)	PC as % of Objective (existing sources)	PEC (µg/m3)	PEC as % of Objective
R32	1.94	5%	10.25	26%	38.19	95%
R33	1.73	4%	9.63	24%	37.36	93%
R34	1.53	4%	9.50	24%	37.03	93%
R35	1.54	4%	11.11	28%	38.65	97%
R36	1.23	3%	8.43	21%	35.65	89%
R37	1.86	5%	8.92	22%	36.78	92%
R38	1.96	5%	9.30	23%	37.26	93%
AQO	**40 µg/m3**					
Bold and underlined text indicates an exceedance						

Table 5.5 shows the maximum 90.02nd percentile hourly mean NO_2 at each discrete receptor point across the three meteorological years considered for proposed generators, while 28.88th percentiles are adopted for the generators in existing sources. 99.79th percentiles are used for non-generators sources which operate continuously throughout the year. Most predicted hourly mean NO_2 concentrations (PECs) are below the hourly mean NO_2 AQO objective level, with the exception of R26 at the roof garden. Further exceedances of the 90.02nd percentile hourly mean NO_2 are predicted at 59.5m height (breathing height of receptors at the roof garden) as shown in the contour plots for the 90.02nd percentile hourly mean NO_2 concentrations in Appendix B. It should be acknowledged that the generators will only operate during emergency, estimated as three instances of 24 hours per year. The modelled 90.02nd percentile hourly mean NO_2 concentration presented within this report is therefore considered to show worst case scenario, and potentially be overly conservative of actual conditions.

Whilst no long-term exceedances of the NO_2 AQO were predicted, exceedances of short term NO_2 AQO have been predicted, and mitigation measures are recommended in Section 6 of this report.

Table 5.4: Predicted Annual Mean NO_2 Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	0.14	<1%	7.86	20%	34.00	85%
R2	0.22	1%	8.23	21%	34.44	86%
R3	0.11	<1%	6.74	17%	32.85	82%
R4	0.19	<1%	7.18	18%	33.37	83%
R5	0.26	1%	6.48	16%	32.74	82%
R6	0.25	1%	6.48	16%	32.73	82%
R7	0.27	1%	6.56	16%	32.83	82%
R8	0.29	1%	6.54	16%	32.84	82%
R9	0.29	1%	5.87	15%	32.16	80%
R10	0.30	1%	5.20	13%	31.50	79%
R11	0.30	1%	5.16	13%	31.45	79%
R12	0.31	1%	5.19	13%	31.49	79%
R13	<0.01	<1%	<0.01	<1%	26.00	65%
R14	<0.01	<1%	<0.01	<1%	26.00	65%
R15	<0.01	<1%	<0.01	<1%	26.00	65%
R16	<0.01	<1%	<0.01	<1%	26.00	65%
R17	<0.01	<1%	5.23	13%	31.23	78%
R18	<0.01	<1%	5.27	13%	31.27	78%
R19	<0.01	<1%	5.31	13%	31.31	78%
R20	<0.01	<1%	5.22	13%	31.22	78%
R21	<0.01	<1%	5.26	13%	31.26	78%
R22	<0.01	<1%	5.40	13%	31.40	79%
R23	<0.01	<1%	7.91	20%	33.91	85%
R24	<0.01	<1%	7.89	20%	33.89	85%
R25	0.12	<1%	8.04	20%	34.16	85%
R26	1.15	3%	9.56	24%	36.70	92%
R27	0.12	<1%	9.37	23%	35.48	89%
R28	0.01	<1%	9.17	23%	35.17	88%
R29	0.13	<1%	9.30	23%	35.43	89%
R30	1.84	5%	10.01	25%	37.86	95%
R31	2.02	5%	10.47	26%	38.50	96%
R32	1.94	5%	10.25	26%	38.19	95%
R33	1.73	4%	9.63	24%	37.36	93%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R34	1.53	4%	9.50	24%	37.03	93%
R35	1.54	4%	11.11	28%	38.65	97%
R36	1.23	3%	8.43	21%	35.65	89%
R37	1.86	5%	8.92	22%	36.78	92%
R38	1.96	5%	9.30	23%	37.26	93%
AQO	**40 µg/m^3**					
Bold and underlined text indicates an exceedance						

Table 5.5: Predicted Hourly Mean NO_2 Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC* (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC** (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	17.53	9%	62.07	31%	131.60	66%
R2	34.48	17%	64.11	32%	150.59	75%
R3	12.85	6%	53.10	27%	117.95	59%
R4	30.98	15%	54.65	27%	137.62	69%
R5	25.79	13%	75.36	38%	153.15	77%
R6	25.50	13%	77.61	39%	155.11	78%
R7	25.82	13%	73.77	37%	151.58	76%
R8	26.08	13%	65.83	33%	143.90	72%
R9	26.08	13%	40.63	20%	118.71	59%
R10	26.25	13%	27.51	14%	105.76	53%
R11	26.12	13%	27.67	14%	105.79	53%
R12	26.31	13%	61.88	31%	140.19	70%
R13	0.00	0%	0.00	0%	52.00	26%
R14	0.00	0%	0.00	0%	52.00	26%
R15	0.00	0%	0.00	0%	52.00	26%
R16	0.00	0%	0.00	0%	52.00	26%
R17	0.00	0%	41.25	21%	93.25	47%
R18	0.00	0%	41.32	21%	93.32	47%
R19	0.00	0%	38.75	19%	90.75	45%
R20	0.00	0%	44.09	22%	96.09	48%
R21	0.00	0%	46.03	23%	98.03	49%
R22	0.03	0%	46.73	23%	98.77	49%

Location	PC* (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC** (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R23	0.00	0%	81.24	41%	133.24	67%
R24	0.00	0%	87.59	44%	139.59	70%
R25	16.30	8%	94.16	47%	162.46	81%
R26	**202.45**	**101%**	113.43	57%	**367.88**	**184%**
R27	9.85	5%	105.72	53%	167.57	84%
R28	0.01	0%	94.66	47%	146.67	73%
R29	0.18	0%	87.78	44%	139.95	70%
R30	**334.14**	**167%**	118.74	59%	**504.88**	**252%**
R31	**369.11**	**185%**	123.01	62%	**544.12**	**272%**
R32	**368.41**	**184%**	134.26	67%	**554.67**	**277%**
R33	**329.38**	**165%**	142.75	71%	**524.14**	**262%**
R34	**290.25**	**145%**	121.30	61%	**463.55**	**232%**
R35	**289.40**	**145%**	130.83	65%	**472.22**	**236%**
R36	**210.73**	**105%**	100.45	50%	**363.18**	**182%**
R37	**335.53**	**168%**	105.53	53%	**493.06**	**247%**
R38	**365.36**	**183%**	109.05	55%	**526.41**	**263%**
AQO	**200 µg/m^3**					
* 90.02 percentile is adopted ** 28.88 and 99.79 percentile is adopted for generators and non-generator for existing emission respectively						
Bold and underlined text indicates an exceedance						

5.3 Carbon Monoxide

The predicted maximum daily running 8 hour mean CO concentrations at all the assessed discrete receptors would not exceed the relevant AQO.

Table 5.6 shows the maximum daily running 8 hour mean CO at each discrete receptor point across the three meteorological years considered.

All predicted total maximum daily running 8 hour mean CO concentrations (PECs) are below the AQO objective level at the discrete receptors.

Table 5.6: Predicted Maximum Daily Running 8 Hour Mean CO Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (mg/m^3)	PC as % of Objective (existing sources)	PEC (mg/m^3)	PEC as % of Objective
R1	0.01	<1%	1.20	12%	2.56	26%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (mg/m^3)	PC as % of Objective (existing sources)	PEC (mg/m^3)	PEC as % of Objective
R2	0.01	<1%	1.87	19%	3.23	32%
R3	0.01	<1%	1.39	14%	2.74	27%
R4	0.01	<1%	2.28	23%	3.63	36%
R5	0.01	<1%	0.21	2%	1.56	16%
R6	0.01	<1%	0.20	2%	1.55	15%
R7	0.01	<1%	0.20	2%	1.55	16%
R8	0.01	<1%	0.21	2%	1.56	16%
R9	0.01	<1%	0.21	2%	1.56	16%
R10	0.01	<1%	0.21	2%	1.55	16%
R11	0.01	<1%	0.21	2%	1.56	16%
R12	0.00	<1%	0.14	1%	1.49	15%
R13	0.00	<1%	0.00	0%	1.34	13%
R14	0.00	<1%	0.00	0%	1.34	13%
R15	0.00	<1%	0.00	0%	1.34	13%
R16	0.00	<1%	0.00	0%	1.34	13%
R17	0.00	<1%	0.61	6%	1.95	20%
R18	0.00	<1%	0.55	6%	1.90	19%
R19	0.00	<1%	0.48	5%	1.82	18%
R20	0.00	<1%	0.68	7%	2.03	20%
R21	0.00	<1%	0.78	8%	2.12	21%
R22	0.00	<1%	1.03	10%	2.38	24%
R23	0.00	<1%	0.65	7%	2.00	20%
R24	0.00	<1%	0.77	8%	2.12	21%
R25	0.01	<1%	0.90	9%	2.25	23%
R26	0.04	<1%	1.10	11%	2.48	25%
R27	0.01	<1%	0.87	9%	2.22	22%
R28	0.00	<1%	0.70	7%	2.05	20%
R29	0.02	<1%	0.58	6%	1.94	19%
R30	0.05	<1%	1.29	13%	2.68	27%
R31	0.05	<1%	1.78	18%	3.18	32%
R32	0.04	<1%	2.24	22%	3.63	36%
R33	0.04	<1%	3.66	37%	5.04	50%
R34	0.03	<1%	3.82	38%	5.20	52%
R35	0.04	<1%	6.15	62%	7.53	75%
R36	0.04	<1%	1.05	11%	2.44	24%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (mg/m^3)	PC as % of Objective (existing sources)	PEC (mg/m^3)	PEC as % of Objective
R37	0.05	1%	1.43	14%	2.83	28%
R38	0.05	<1%	1.93	19%	3.32	33%
AQO	**10 mg/m^3**					
Bold and underlined text indicates an exceedance						

5.4 Sulphur Dioxide

Table 5.7 shows the 99.19 percentile daily mean SO_2 at each discrete receptor point across the three meteorological years considered. All predicted 99.19 percentile daily mean PM_{10} concentrations (PECs) are below the daily mean SO_2 AQO at all discrete receptors.

Table 5.8 the 99.73 percentile hourly mean SO_2 at each discrete receptor point across the three meteorological years considered. All predicted 99.73 percentile hourly mean SO_2 concentrations (PECs) are below the hourly mean SO_2 AQO at all discrete receptors.

Table 5.9 the 99.99 percentile 15-minute mean SO_2 at each discrete receptor point across the three meteorological years considered. All 99.99 percentile 15-minute mean SO_2 concentrations (PECs) are below the 15-minute mean SO_2 AQO at all discrete receptors.

Table 5.7: Predicted 99.19 Percentile Daily Mean SO_2 Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	0	0%	14.32	11%	23.46	19%
R2	0	0%	13.09	10%	22.23	18%
R3	0	0%	13.06	10%	22.20	18%
R4	0	0%	11.48	9%	20.62	16%
R5	0	0%	7.57	6%	16.71	13%
R6	0	0%	7.55	6%	16.69	13%
R7	0	0%	7.43	6%	16.57	13%
R8	0	0%	7.28	6%	16.42	13%
R9	0	0%	7.06	6%	16.20	13%
R10	0	0%	7.12	6%	16.26	13%
R11	0	0%	7.08	6%	16.22	13%
R12	0	0%	5.14	4%	14.28	11%
R13	0	0%	<0.01	<1%	9.14	7%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R14	0	0%	<0.01	<1%	9.14	7%
R15	0	0%	<0.01	<1%	9.14	7%
R16	0	0%	<0.01	<1%	9.14	7%
R17	0	0%	7.72	6%	16.86	13%
R18	0	0%	7.87	6%	17.01	14%
R19	0	0%	7.92	6%	17.06	14%
R20	0	0%	8.52	7%	17.66	14%
R21	0	0%	9.16	7%	18.30	15%
R22	0	0%	10.27	8%	19.41	16%
R23	0	0%	12.11	10%	21.25	17%
R24	0	0%	12.17	10%	21.31	17%
R25	0	0%	14.94	12%	24.08	19%
R26	0	0%	18.34	15%	27.48	22%
R27	0	0%	15.12	12%	24.26	19%
R28	0	0%	13.28	11%	22.42	18%
R29	0	0%	12.83	10%	21.97	18%
R30	0	0%	17.43	14%	26.57	21%
R31	0	0%	16.64	13%	25.78	21%
R32	0	0%	15.43	12%	24.57	20%
R33	0	0%	14.09	11%	23.23	19%
R34	0	0%	13.54	11%	22.68	18%
R35	0	0%	14.73	12%	23.87	19%
R36	0	0%	16.50	13%	25.64	21%
R37	0	0%	15.75	13%	24.89	20%
R38	0	0%	15.14	12%	24.28	19%
AQO	**125 µg/m^3**					
Bold and underlined text indicates an exceedance						

Table 5.8: Predicted 99.73 Percentile Hourly Mean SO_2 Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	0	0%	27.92	8%	37.06	11%
R2	0	0%	26.39	8%	35.53	10%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R3	0	0%	25.15	7%	34.29	10%
R4	0	0%	23.04	7%	32.18	9%
R5	0	0%	17.41	5%	26.55	8%
R6	0	0%	16.13	5%	25.27	7%
R7	0	0%	15.32	4%	24.46	7%
R8	0	0%	14.70	4%	23.84	7%
R9	0	0%	13.97	4%	23.11	7%
R10	0	0%	13.66	4%	22.80	7%
R11	0	0%	13.53	4%	22.67	6%
R12	0	0%	11.98	3%	21.12	6%
R13	0	0%	<0.01	<1%	9.14	3%
R14	0	0%	<0.01	<1%	9.14	3%
R15	0	0%	<0.01	<1%	9.14	3%
R16	0	0%	<0.01	<1%	9.14	3%
R17	0	0%	22.74	6%	31.88	9%
R18	0	0%	23.09	7%	32.23	9%
R19	0	0%	22.83	7%	31.97	9%
R20	0	0%	23.82	7%	32.96	9%
R21	0	0%	23.88	7%	33.02	9%
R22	0	0%	24.98	7%	34.12	10%
R23	0	0%	40.12	11%	49.26	14%
R24	0	0%	41.63	12%	50.77	15%
R25	0	0%	45.70	13%	54.84	16%
R26	0	0%	52.68	15%	61.82	18%
R27	0	0%	48.11	14%	57.25	16%
R28	0	0%	43.66	12%	52.80	15%
R29	0	0%	41.75	12%	50.89	15%
R30	0	0%	48.88	14%	58.02	17%
R31	0	0%	50.92	15%	60.06	17%
R32	0	0%	55.83	16%	64.97	19%
R33	0	0%	46.91	13%	56.05	16%
R34	0	0%	43.64	12%	52.78	15%
R35	0	0%	47.14	13%	56.28	16%
R36	0	0%	46.51	13%	55.65	16%
R37	0	0%	45.92	13%	55.06	16%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R38	0	0%	47.74	14%	56.88	16%
AQO	**350 µg/m^3**					
Bold and underlined text indicates an exceedance						

Table 5.9: Predicted 99.99 Percentile 15-minute Mean SO_2 Concentrations at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	0	0%	41.10	15%	50.24	19%
R2	0	0%	41.37	16%	50.51	19%
R3	0	0%	39.02	15%	48.16	18%
R4	0	0%	36.74	14%	45.88	17%
R5	0	0%	22.38	8%	31.52	12%
R6	0	0%	20.06	8%	29.20	11%
R7	0	0%	19.15	7%	28.29	11%
R8	0	0%	18.44	7%	27.58	10%
R9	0	0%	17.53	7%	26.67	10%
R10	0	0%	17.31	7%	26.45	10%
R11	0	0%	16.96	6%	26.10	10%
R12	0	0%	15.33	6%	24.47	9%
R13	0	0%	<0.01	<1%	9.14	3%
R14	0	0%	<0.01	<1%	9.14	3%
R15	0	0%	<0.01	<1%	9.14	3%
R16	0	0%	<0.01	<1%	9.14	3%
R17	0	0%	46.05	17%	55.19	21%
R18	0	0%	42.79	16%	51.93	20%
R19	0	0%	42.03	16%	51.17	19%
R20	0	0%	46.70	18%	55.84	21%
R21	0	0%	47.00	18%	56.14	21%
R22	0	0%	61.10	23%	70.24	26%
R23	0	0%	98.15	37%	107.29	40%
R24	0	0%	103.13	39%	112.27	42%
R25	0	0%	108.77	41%	117.91	44%
R26	0	0%	138.57	52%	147.71	56%
R27	0	0%	119.86	45%	129.00	48%

Location	PC (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R28	0	0%	114.03	43%	123.17	46%
R29	0	0%	107.69	40%	116.83	44%
R30	0	0%	115.99	44%	125.13	47%
R31	0	0%	113.12	43%	122.26	46%
R32	0	0%	105.60	40%	114.74	43%
R33	0	0%	102.14	38%	111.28	42%
R34	0	0%	99.52	37%	108.66	41%
R35	0	0%	109.03	41%	118.17	44%
R36	0	0%	127.80	48%	136.94	51%
R37	0	0%	103.48	39%	112.62	42%
R38	0	0%	94.69	36%	103.83	39%
AQO	**266 µg/m^3**					
Bold and underlined text indicates an exceedance						

6 MITIGATION MEASURES & RESIDUAL IMPACTS

The assessment predicts that the operational phase of the proposed development will have residual impact on local air quality. Emissions from proposed generator can be reduced by the employment of mitigation measures appropriate to the development project such as using renewable fuel instead of diesel for generators. Also, it is recommended that the access to the roof garden is prohibited during the operation of proposed generators to minimize the impact on sensitive receptors.

The area on the roof garden where exceedance of the AQOs were predicted are shown in contour plots placed in Appendix B of this report. No air inlets are recommended within the area shown with red colour in the contour plots at the 59.5 meter and above.

Furthermore, sensitive runs for various stack height of proposed generators have been conducted. The results from the initial model runs show that if the stack height of proposed generators can be adjusted to 74m while there is no change of stack height for existing sources, there will be no exceedances in hourly mean NO_2 Concentrations at any of the sensitive receptors. Table 6.1 shows the maximum 90.02nd percentile hourly mean NO_2 at each discrete receptor point across the three meteorological years considered for proposed generators, while 28.88th percentiles are adopted for the generators in existing sources and 99.79th percentiles are used for non-generators sources.

Table 6.1: Predicted Hourly Mean NO_2 Concentrations at the stack height of 65m at Discrete Receptors, Highest Results Selected between 2019-2021 for Each Receptor

Location	PC* (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC** (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R1	0.01	<1%	62.07	31%	114.08	57%
R2	0.07	<1%	64.11	32%	116.18	58%
R3	<0.01	<1%	53.10	27%	105.10	53%
R4	0.02	<1%	54.65	27%	106.67	53%
R5	7.28	4%	75.43	38%	134.71	67%
R6	7.28	4%	77.67	39%	136.96	68%
R7	7.44	4%	73.86	37%	133.30	67%
R8	7.53	4%	65.83	33%	125.36	63%
R9	7.53	4%	40.62	20%	100.16	50%
R10	7.53	4%	27.50	14%	87.03	44%
R11	7.53	4%	27.66	14%	87.19	44%
R12	7.56	4%	61.90	31%	121.47	61%

Location	PC* (proposed generators) (µg/m^3)	PC as % of Objective (proposed generators)	PC** (existing sources) (µg/m^3)	PC as % of Objective (existing sources)	PEC (µg/m^3)	PEC as % of Objective
R13	<0.01	<1%	<0.01	<1%	52.00	26%
R14	<0.01	<1%	<0.01	<1%	52.00	26%
R15	<0.01	<1%	<0.01	<1%	52.00	26%
R16	<0.01	<1%	<0.01	<1%	52.00	26%
R17	<0.01	<1%	41.25	21%	93.25	47%
R18	<0.01	<1%	41.32	21%	93.32	47%
R19	<0.01	<1%	38.75	19%	90.75	45%
R20	<0.01	<1%	44.09	22%	96.09	48%
R21	<0.01	<1%	46.03	23%	98.03	49%
R22	<0.01	<1%	46.73	23%	98.73	49%
R23	<0.01	<1%	81.24	41%	133.24	67%
R24	<0.01	<1%	87.59	44%	139.59	70%
R25	<0.01	<1%	94.16	47%	146.16	73%
R26	<0.01	<1%	113.43	57%	165.43	83%
R27	<0.01	<1%	105.72	53%	157.72	79%
R28	<0.01	<1%	94.66	47%	146.66	73%
R29	<0.01	<1%	87.78	44%	139.78	70%
R30	<0.01	<1%	118.74	59%	170.74	85%
R31	0.08	<1%	123.01	62%	175.09	88%
R32	0.93	<1%	134.26	67%	187.19	94%
R33	4.33	2%	142.75	71%	199.09	100%
R34	9.91	5%	121.30	61%	183.21	92%
R35	10.82	5%	130.83	65%	193.65	97%
R36	<0.01	<1%	100.45	50%	152.45	76%
R37	<0.01	<1%	105.53	53%	157.53	79%
R38	0.40	<1%	109.05	55%	161.45	81%
AQO	**200 µg/m^3**					

* 90.02 percentile is adopted

** 28.88 and 99.79 percentile is adopted for generators and non-generator for existing emission respectively

Bold and underlined text indicates an exceedance

7 CONCLUSIONS

An air quality assessment of the potential air quality impacts associated with the proposed backup generators proposed as part of the redevelopment of the Frontage Building for the GOSHCCC has been undertaken with reference to existing air quality in the area and relevant legislation, policy and guidance.

A detailed dispersion modelling assessment has been undertaken to assess NO_2, CO, PM_{10} and SO_2 emissions from the operation of the proposed backup generators and existing emission sources at locations associated with openable windows, air intakes and discrete human receptor points on the proposed roof terrace of the GOSHCCC and neighbouring buildings.

Concentrations of NO_2, PM_{10}, CO and SO_2 were predicted at the most relevant receptor locations using ADMS 6. The air quality impacts of the backup generators on existing and proposed receptors have been assessed. The predicted PM_{10}, CO and SO_2 concentrations at all assessed receptors would not exceed the relevant air quality standards. The annual mean NO_2 is not predicted to exceed the relevant air quality standard at any sensitive receptor locations.

The hourly mean NO_2 concentration is predicted to exceed the air quality objective across parts of the roof garden. Mitigation measures are recommended in this report (Section 6). With the implementation of an appropriate selection of mitigation measures, the residual effects from the proposed development are considered to be not significant.

8 REFERENCES

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APPENDIX A
WIND ROSES

Figure A-1: 2019 Windrose from Heathrow Airport Meteorological Station

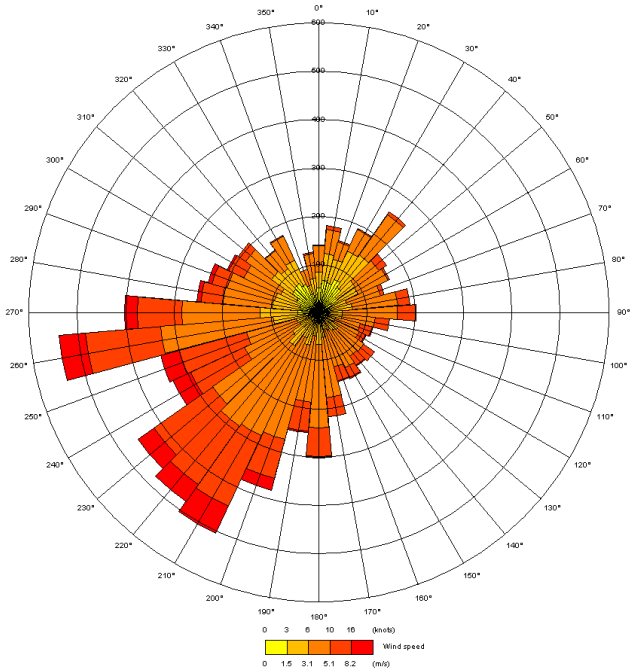


Figure A-2: 2020 Windrose from Heathrow Airport Meteorological Station

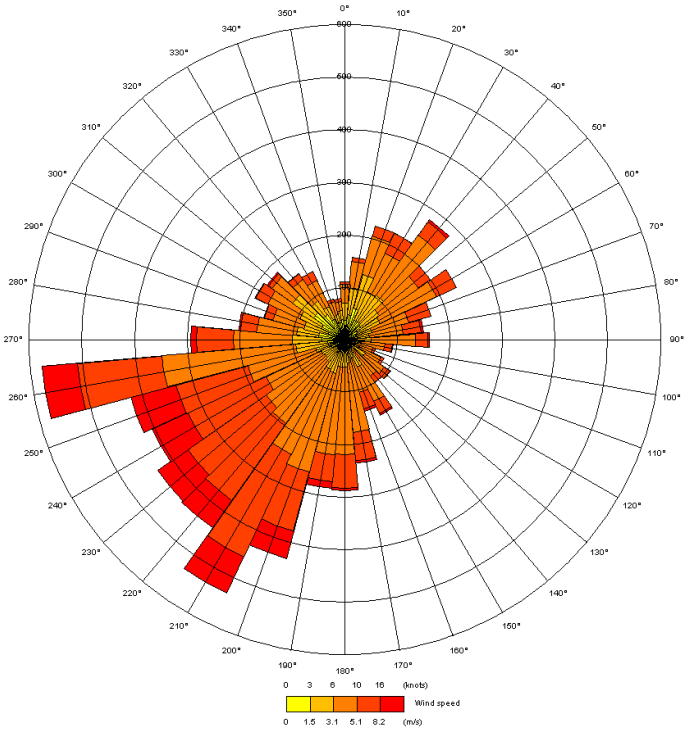
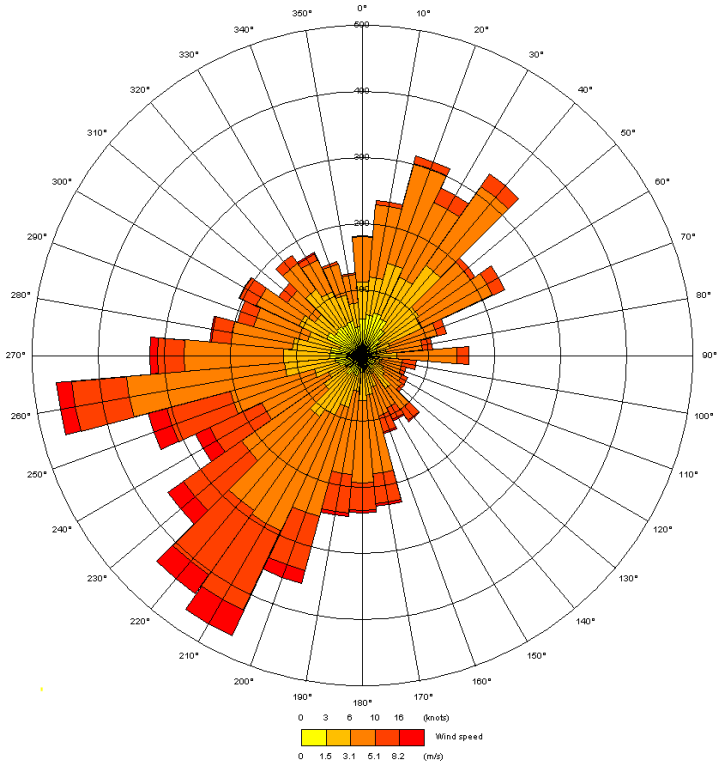


Figure A-3: 2021 Windrose from Heathrow Airport Meteorological Station



APPENDIX B
CONTOUR PLOTS

Figure B-1: Predicted hourly mean NO_2 concentration (µg/m^3) (PEC) at 59.5m

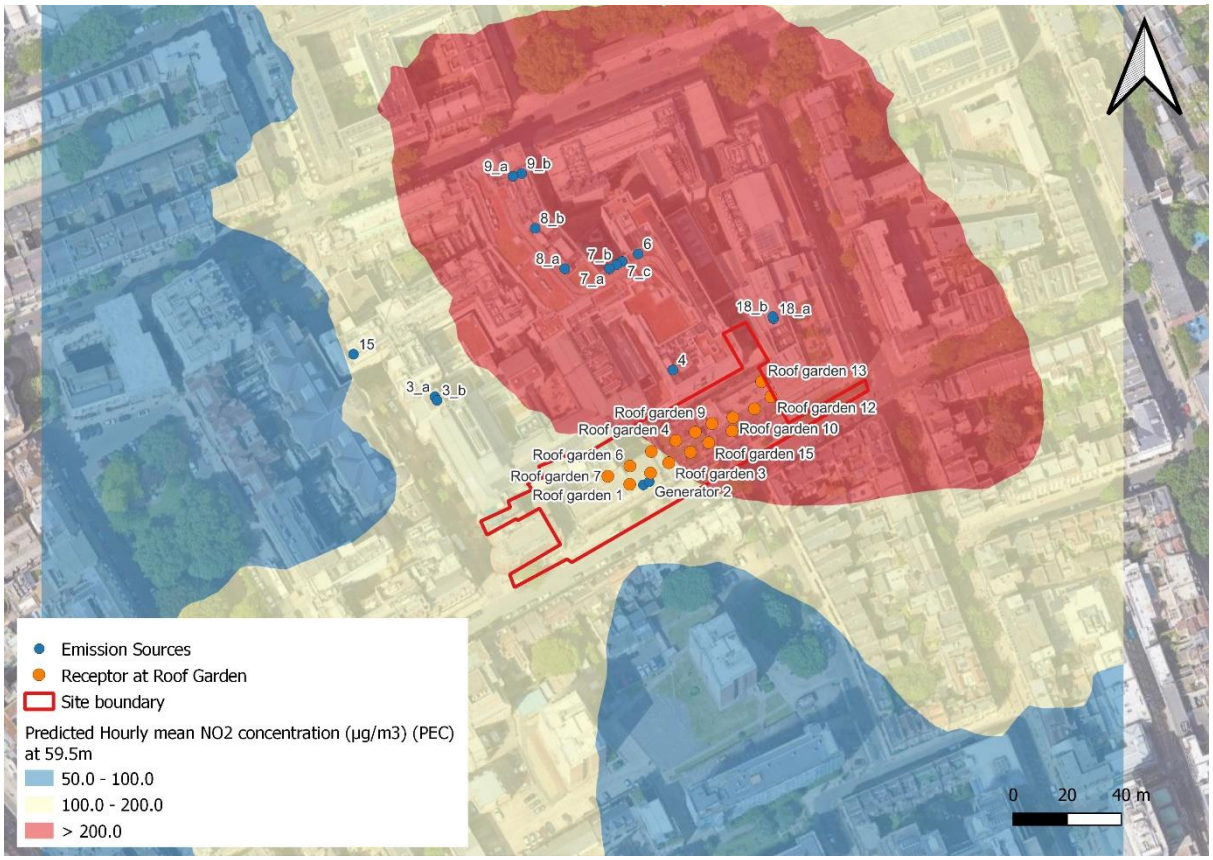


Figure B-2: Predicted Annual mean NO_2 concentration (µg/m^3) (PEC) at 59.5m