AECOM

Hillingdon Hospital Air Quality Assessment

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Quality information

Prepared by	Checked by	Verified by	Approved by
Hiren Nakum & Liam McGurk	Zadie Astill	Patrick Froggatt	Paul Stannard
Graduate Air Quality Consultant	Principal Air Quality Scientist	Lead Verifier	Regional Director

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Prepared by:

AECOM Limited
Sunley House
4 Bedford Park, Surrey
Croydon CRO 2AP
United Kingdom

T: +44 20 8639 3500
aecom.com

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1. Introduction

1.1 This air quality assessment has been prepared by AECOM Limited (AECOM) to accompany hybrid planning application being submitted by the Applicant, Hillingdon Hospitals NHS Foundation Trust, to the London Borough of Hillingdon (LBH) for the Hillingdon Hospital, Pield Heath Rd, Uxbridge UB8 3NN site (the 'Site').

1.2 The proposal comprises of:

- FULL application seeking planning permission for demolition of existing buildings and redevelopment of the site to provide the new Hillingdon Hospital, multi-storey car park and mobility hub, vehicle access, highways works, associated plant, generators, substation, new internal roads, landscaping and public open space, utilities, servicing area, surface car park/ expansion space, and other works incidental to the proposed development.
- OUTLINE planning application (all matters reserved, except for access) for the demolition of buildings and structures on the remaining site (excluding the Grade II Furze and Tudor Centre) for a mixed-use development comprising residential (Class C3) and supporting Commercial, Business and Service uses (Class E), new pedestrian and vehicular access; public realm, amenity space, car and cycling parking.

1.3 Hillingdon Hospital is located to the south of Pield Heath Road, bound by Royal Lane to the west, and Colham Green Road to the east within the Brunel Ward. The site comprises a ten storey block built in the 1960s and a mix of other hospital buildings scattered across the site. Many of the acute beds are in single storey wards built in the 1940s, which are in very poor condition. The remainder of the site consists mainly of surface level car parking, interspersed with pockets of landscaping. The Site falls within the Air Quality Management Area (AQMA) designated by LBH.

1.4 The full detailed planning application, termed the 'Proposed Development' in this report, consists of:

- Replacement hospital building (79,603.6 sqm GIA) of basement, ground plus seven storeys on the western extent of the site incorporating a linked mobility hub and multi storey car park (MSCP) for 781 car spaces;
- High quality landscaping buffer fronting Royal Lane;
- New bus stop arrangements and improved connections to the hospital on Pield Heath Road;
- Large central green open space for use by the hospital and wider community; and
- 161 surface level car parking spaces with the ability to cater for up to 14,000 sqm of expansion space for future hospital expansion (if required).

1.5 The existing hospital buildings are to be retained until the new hospital is completed, after which the old hospital buildings will be demolished as the department are transferred to the new building. Once the old hospital buildings are cleared, the land they occupied will be redeveloped to provide a mixed use residential development for which outline planning permission is sought consisting of:

- Up to 33,870 sqm of residential, comprising 327 dwellings;
- Plots – P01, P02, P04 (mixed use blocks with supporting provision of 800 sqm of town centre uses (Use Class E) at ground floor level).
- Up to 302 car parking spaces, and 515 cycle parking spaces.
- Improved permeability and public access routes through the site; and
- High quality public realm and landscaped gardens throughout the site.

1.6 This assessment has been undertaken to consider the potential air quality impacts during the construction and subsequent operation of the Proposed Development. Therefore, the effects of the Proposed Development are considered within the main assessment while the outline development has been included as a cumulative scenario. The extent of the study area are shown in Figure 1 of Appendix A.

1.7 The Proposed Development does not contain an energy centre, with all heat requirement being provided by air and ground source heat pumps. However, all hospitals require an alternative or supplementary electrical energy source available within 15 seconds to avoid compromise of the healthcare treatment. Four standby rated diesel generator sets are, therefore, to be located to the south of the new hospital building which will provide emergency back-up power generation to the hospital building in the event of a power failure.

1.8 This assessment takes account of current policy and technical guidance for the assessment of changes to the concentrations of air pollutants, specifically fugitive dust emissions, nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$).

Scope of Assessment

1.9 This report presents the results of the assessment, the scope of which was as follows:

- A review of background air quality and existing local air quality within the Borough and in particular in the vicinity of the Site;
- A review of relevant legislation and air quality planning policy;
- Three months' NO_2 diffusion tube monitoring survey (undertaken at ten locations);
- Review of sensitive locations in the vicinity of the site and the selection of potentially sensitive receptors for inclusion in the assessment;
- Qualitative assessment of demolition and construction dust during the construction phase. These impacts are assessed qualitatively with reference to the London Mayor's Supplementary Planning Guidance (SPG) on the Control of Dust and Emissions during Construction and Demolition [1];
- Quantitative assessment of potential impacts as a result of changes in road traffic emissions associated with the opening of the Proposed Development using the ADMS-Roads dispersion model to predict changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations at existing sensitive receptors, as these pollutants are most likely to exceed UK Air Quality Strategy (AQS) objectives. Modelling has been undertaken for the following scenarios:
  - Base Year 2019;
  - Without Scenario: future year 2027 without the Proposed Development,
  - With Scenario: future year 2027 including operational traffic associated with the Proposed Development; and
  - With Cumulative Scenario: future year 2027 including operational traffic associated with the Proposed Development and outline development.
- Quantitative assessment of likely impacts on local air quality from emissions arising from the testing of the emergency stand-by diesel generators (using the AERMOD dispersion model);
- Completion of an Air Quality Neutral assessment in accordance with the London Plan Air Quality Neutral Guidance (consultation draft, Nov 2021) [2] in order to determine whether the Proposed Development is 'air quality neutral';
- Air Quality Damage Cost assessments to estimate the equivalent monetary 'damage cost' value of development-related emissions during the operational phase of the Proposed Development; and
- An assessment of the suitability of the site for its planned use in terms of air quality.

2. Planning Policy and Legislation

2.1 There are national, regional (i.e. London) and local policies for the control of air pollution, and local action plans for the management of local air quality in the LBH. The achievement of such policies and plans are matters that may be a material consideration for planning authorities, when making decisions for individual planning applications. In addition, there is regional air quality related guidance that has relevance to the Proposed Development and this assessment.

Legislation

The Air Quality Standards Regulations

2.2 The principal air quality legislation within the United Kingdom is the Air Quality Standards Regulations (as amended 2016) [3], including amendments 'The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 [4].

2.3 The UK is no longer a member of the European Union, however, some types of EU legislation such as Regulations and Decisions, are directly applicable as law in an EU Member State. This meant that, as a Member State, these types of legislation applied automatically in the UK, under section 2(1) of the European Communities Act 1972 (c.68), without any further action required by the UK. These types of legislation are published by the Publications Office of the European Union on the EUR-Lex website. This legislation is now published on legislation.gov.uk as 'legislation originating from the EU'.EU

2.4 Other types of EU legislation, such as Directives, are indirectly applicable, which means they require a Member State to make domestic implementing legislation before becoming law in that State. Legislation as it applied to the UK on 31st December 2020 is now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies. The Clean Air for Europe (CAFE) programme consolidated and replaced (with the exception of the 4th Daughter Directive) preceding EU directives with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC ('EU Air Quality Framework Directive') [5]. This directive is transcribed into UK legislation by the Air Quality Standards Regulations 2010 which came into force on 11th June 2010 [6]. The 2010 Regulations were amended by the Air Quality Standards Regulations 2016, which came into force on 31st December 2016 [3]. The limit values defined therein are legally-binding and are considered to apply everywhere (with the exception of the carriageway and central reservation of roads and any locations where the public do not have access).

Environment Act (2021)

2.5 The Environment Act 2021 [7] amends the Environment Act 1995 [8]. On 9th November 2021, the Act was approved after being first introduced to Parliament in January 2020 to address environmental protection and the delivery of the Government's 25-year environment plan following Brexit. It includes provisions to establish a post-Brexit set of statutory environmental principles and ensure environmental governance through an environmental watchdog, the Office for Environmental Protection (OEP). Part IV of the Environment Act (2021) requires the Government to produce a national AQS which contains standards, objectives and measures for improving ambient air quality. The AQS proposes for the Secretary of State to publish a report reviewing the AQS every five years (as a minimum and with yearly updates to Parliament). The AQS also included a proposal that the government set two targets by October 2022: the first on the amount of $PM_{2.5}$ pollutant in the ambient air (the figure and deadline for compliance remain unspecified) and a second long-term target set at least 15 years ahead to encourage stakeholder investment.

National Air Quality Strategy

2.6 The UK National AQS was initially published in 2000 [9], under the requirements of the Environment Act. An addendum was published in 2003 [10] which tightened several of the existing objectives and introduced a new objective. A revised AQS was published in 2007 [11] which set objectives for key pollutants as a tool to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive.

The current assessment criteria applicable to the protection of human health and Local Air Quality Management (LAQM) are outlined in the UK's AQS 2007. Under the LAQM regime, local authorities have a duty to carry out regular assessments of air quality against the AQS objective values and if it is unlikely that the AQS objective values will be met in the given timescale, they must designate an AQMA and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. It is not unusual for the boundary of an AQMA to include within it, relevant locations where air quality is not at risk of exceeding an AQS objective. The AQS objective values for the pollutants of relevance to this assessment are presented in Table 2-1.

Table 2-1. Key National Air Quality Strategy Objective

Pollutant	Objective (µg/m³)	Averaging Period	Not to be Exceeded More Than
Nitrogen dioxide (NO_2)	40	Annual	Not applicable
	200	1-hour	18 times per year (i.e. 99.79th percentile)
Particulate matter (PM_{10})	40	Annual	Not applicable
	50	24-hour	35 times per year (i.e. 90.4th percentile)
Particulate matter ($PM_{2.5}$)[1]	20	Annual	Not applicable
Sulphur dioxide (SO_2)	266	15-minute mean	35 times a year (i.e. 99.9th percentile)
	350	1-hour	24 times a year (99.73rd percentile)
	125	24-hour	3 times a year, (99.18th percentile)
Carbon monoxide (CO)	10,000	Running 8-hour average	Not applicable

Note: The air quality objective for $PM_{2.5}$ was amended to its 'Stage 2' value following the publication of 'The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

Clean Air Strategy

2.7 In 2019, the UK government released its Clean Air Strategy 2019 [12], part of its 25 Year Environment Plan. The Strategy places greater emphasis on improving air quality in the UK than has been seen before and outlines how this is to be achieved (including the development of new enabling legislation). In recent years air quality management has primarily focused on NO_2, and its principal source in the UK, road traffic. However, the Clean Air Strategy broadens the focus to other areas, including domestic emissions from wood burning stoves and from agriculture. This shift in emphasis is part of a goal to reduce the levels of $PM_{2.5}$ in the air to below the World Health Organisation guideline level; far lower than the current EU limit value.

2.8 The Clean Air Strategy included the provision of a clear effective guidance on how AQMAs, Clean Air Zones (CAZ) and Smoke Control Areas interrelate and how they can be used by local government to tackle pollution. The UK Clean Air Strategy sets the following reduction target:

– Nitrogen oxides (NO_x) - reduce emissions against the 2005 baseline by 55% by 2020 and by 73% by 2030.

– $PM_{2.5}$ - reduce emissions against the 2005 baseline by 30% by 2020 and 46% by 2030.

2.9 It is noted within the Clean Air Strategy document that the "current legislative framework has not driven sufficient action at a local level". New legislation will seek to shift the focus towards prevention of exceedances rather than tackling pollution when limits have been surpassed. The shift of focus encourages more of a proactive rather than reactive policy framework at regional and local levels on air quality.

National Planning Policy Framework

2.10 The National Planning Policy Framework (NPPF) was published on 27th March 2012, and updated on several occasions – the most recent of these being on 20th July 2021 [13] and sets out the Government's environmental, economic and social planning policies for England and how these are expected to be applied. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 8 and 15). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

2.11 Policies and objectives which are of particular relevance to local air quality are summarised below:

Paragraph 105 of the NPPF states that:

"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

2.12 Air quality is considered to be an important element of the natural environment. On conserving and enhancing the natural environment, Paragraph 174 states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by: …e) preventing new and existing 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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality …"

2.13 Air quality in the UK is managed through the LAQM regime using national objectives. The effect of a proposed development on the achievement of such policies and plans may be a material consideration by planning authorities when making decisions for individual planning applications. Paragraph 186 of 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."

2.14 The different roles of a planning authority and a pollution control authority are addressed by the NPPF in paragraph 188:

"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

National Planning Practice Guidance (PPG)

2.15 The Planning Practice Guidance (PPG) [14] was updated on 1st November 2019 with specific reference to air quality to support the (NPPF) National Planning Practice Framework. The most recent update to the PPG was in June 2021, but this did not affect air quality related content. The PPG states that the planning system should consider the potential effect of new developments on air quality where relevant limits have been exceeded or are near the limit. Concerns also arise where the development is likely to adversely affect the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife). In addition, air quality may also be considered to be material if the Proposed Development would be particularly sensitive to poor air quality in its vicinity.

2.16 When deciding whether air quality is relevant to a planning application the PPG states that the following criteria may be required to be taken into consideration by:

- *"the 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*

- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality."*

2.17 On how detailed an air quality assessment needs to be, the PPG states:

"Assessments should be proportionate to the nature and scale of the development proposed and the level of concern about air quality... Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented."

A Green Future: Our 25 Year Plan to Improve the Environment

2.18 The 25 Year Environment Plan, published in January 2018 [15], sets out the actions the UK Government will take to help the natural world regain and retain good health. This references several actions that are being taken to improve air quality, most notably the publication of the Clean Air Strategy (referenced earlier) and tighter controls on Medium Combustion Plant. Emphasis is also placed on the 'Future of Mobility', in the establishment of flexible regulatory framework to encourage new modes of transport and encouraging opportunities to move toward zero emission transport.

2.19 The 25 Year Environment Plan reinforces the demand for high environmental standards for all new build development. Resilient buildings and infrastructure will more readily adapt to a changing climate, and by extension have a lesser impact on local air quality.

Regional Policy

The London Plan – Spatial Development Strategy for Greater London

2.20 The Mayor's London Plan (2021) [16] represents a spatial development strategy for Greater London. It is the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital. It forms part of the development plan for Greater London. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

2.21 Policy Sustainable Infrastructure 1 (SI1) 'Improving Air Quality' states:

"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.

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.*

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.*

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.

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."

2.22 The policy Sustainable Infrastructure 1 (SI3) 'Energy Infrastructure also states:

"Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1. *the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:*
   a. *connect to local existing or planned heat networks*
   b. *use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)*
   c. *use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)*
   d. *use ultra-low NOx gas boilers*
2. *CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality*
3. *where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.*

2.23 The London Plan also notes that whilst developments meeting Air Quality Neutral benchmarks is necessary to control the growth in London's regional emissions, this will not always suffice to prevent unacceptable local impacts, as these may be affected by other factors such as: the location of emission sources, the rate of emissions (as opposed to the annual quantum) and the layout of the development in relation to the surrounding area. Development related impacts such as concentrating emissions, increasing exposure or preventing dispersion in particular locations, therefore, need to be assessed and mitigated if required.

2.24 It is noted that the GLA will produce guidance in order to assist developers and boroughs in identifying measures and best practice to inform the preparation of statements for developments taking an air quality positive approach. At time of writing, this guidance is available as pre-consultation draft only and has, therefore, not been formally adopted.

London Environment Strategy

2.25 The London Environment Strategy was published by the Mayor of London in May 2018 [17] and sets out the Mayor's vision of London's environment to 2050. The London Environment Strategy includes a number of policies and aspirations, with an accompanying implementation plan, setting out actions the Mayor is prioritising for the next five years to help implement the aims of this strategy. These aspirations include establishing and achieving new, tighter air quality targets for a cleaner London, meeting World Health Organization (WHO) health-based guidelines by 2030 by transitioning to a zero emission London.

2.26 In line with the Mayor of London's commitment to achieve the WHO guidelines [18] for particular matter, these are provided in Table 2-2 for reference. However, it should be noted that this is currently an aspirational target and is not set out in London policy.

Table 2-2. WHO 2021 Air Quality Guidelines

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances
PM_{10}	Annual Mean	15 µg/m³ (Limit value)	None
	24-hour Mean	45 µg/m³ (Limit value)	99th percentile (3-4 exc. Days/year)
$PM_{2.5}$	Annual Mean	5 µg/m³ (Limit value)	None
	24-hour Mean	15 µg/m³ (Target value)	99th percentile (3-4 exc. Days/year)

2.27 Chapter 4 of the Strategy relates to air quality. This chapter of the Strategy supersedes the 2010 Mayor's Air Quality Strategy and sets the ambitious target for London to have the best air quality of any major world city by 2050 and goes further than the previous strategy by requiring larger developments to be 'air quality positive' whilst all new development in London must be at least air quality neutral.

Mayor's Air Quality Positive pre-consultation guidance (2021)

2.28 The Mayors Air Quality Positive (AQP) pre-consultation guidance [19] is currently marked as draft on the London Assembly website. The London Assembly website notes that guidance marked as draft has not yet been adopted with a formal consultation on the AQP guidance not anticipated until summer 2022.

2.29 The AQP guidance states that:

> "*For large-scale development, it is expected that air quality expertise has been engaged throughout the design process in order to maximise the potential benefits. The air quality positive approach is not an assessment in its own right, it instead brings together a range of evidence in support of a planning application to show how air quality has been considered holistically. Development design teams should identify opportunities to deliver an air quality positive development in combination with addressing other requirements of London Plan policies at an early stage, such as those relating to transport and energy. This guidance considers measures that contribute to the delivery of an air quality positive scheme*".

Mayor's Air Quality Neutral guidance (2021)

2.30 The Air Quality Neutral (AQN) guidance was initial introduced within the GLA's Sustainable Design and Construction SPG (2014) [20] which required that developments be designed so that they were at least 'air quality neutral'. The Sustainable Design and Construction SPG was superseded with the publication of the London Plan 2021 and a new, consultation draft, of the AQN guidance issued in November 2021 [2]. The draft 2021 AQN includes lower, more stringent, building emission benchmarks and transport emission are based on trip rates rather than vehicle emissions, however, it is broadly similar to the previous assessment methodology.

Air Quality Focus Areas

2.31 The Greater London Authority (GLA) has identified 187 Air Quality Focus Areas (AQFA) across London [21]. These are regions which exceed the NO_2 annual mean target and have relevant human exposure. These areas try to address concerns raised by boroughs when implementing their air quality reviews and forecasts. The GSTT Triangle Development is within the London Borough of Lambeth along Lambeth Palace road, and is not sited within an AQFA. The site is within 1 km of the following two AQFAs which are illustrated in Figure 1 of Appendix A:

– Uxbridge Road Corridor, and

– Uxbridge Town Centre

The Control of Dust and Emissions during Construction and Demolition SPG

2.32 In April 2014, the Mayor of London published a revised Sustainable Design and Construction SPG [1]. This document provides guidance to councils, developers and consultants on implementation of relevant policies contained in the London Plan and the Mayor's Air Quality Strategy in order to reduce emissions of dust and nitrogen oxides from demolition and construction activities in London.

2.33 Chapter 4 of the SPG sets out the methodology to undertake a dust risk assessment, and Chapter 5 presents dust and emissions control measures to apply in order to control/reduce emissions from construction sites.

2.34 Non-Road Mobile Machinery (NRMM) is identified as a significant emissions source in the SPG, and NRMM to be used on any construction sites in Greater London need to comply with the latest European emission standards, as set out in the SPG. This policy is enforced through the planning process and compliance with the NRMM standards should be secured by local authorities as a planning condition or a section 106 agreement. If emissions of NRMM are unknown, developers will be required to provide a written statement of their commitment and ability to meet these standards as part of an Air Quality Statement. An inventory of all NRMM should be kept, stating the emission limits for all equipment, and made available to local authority officers.

London Local Air Quality Management Policy Guidance (2019)

2.35 The London Local Air Quality Management (LLAQM) relates to Part IV of the 1995 Environment Act, and sets out the London authorities' local air quality management functions, together with the Mayor's responsibilities and statutory guidance from the Department for the Environment, Food and Rural Affairs (Defra). The Policy Guidance [22] and the accompanying Technical Guidance LLAQM.TG(19) [23] are the documents to which the boroughs must have regard.

2.36 The purpose of the LLAQM system is to put in place a framework that gives confidence to boroughs, the Mayor, and the Secretary of State that they are properly fulfilling their Part IV duties.

London Local Air Quality Management Technical Guidance (2019)

LLAQM.TG(19) [23] has been prepared by the GLA to support London boroughs in carrying out their duties under the Environment Act 1995 and connected regulations. It supersedes all previous LAQM guidance applicable to London boroughs. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

Local Policy

London Borough of Hillingdon Local Plan

2.37 Part 1 of LBH's Local Plan, Strategic Policies, was adopted in November 2012 and provides the planning vision and strategy for the Borough [24]. Policy EM8: Land, Water, Air and Noise has the greatest relevance to the assessment, as it requires that development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors.

2.38 It also requires that all major development within the designated AQMA should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum.

2.39 Policies on employment, environment improvements, built environment, climate change and travel (Heathrow Airport) make reference to impact on air quality and is also referenced within Policy EM1 (Climate Change Adaptation and Mitigation) states that:

"The Council will ensure that climate change mitigation is addressed at every stage of the development process by;

5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions."

2.40 Policy EM8 (Land, Water, Air and Noise) states that:

"All development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors.

All major development within the Air Quality Management Area (AQMA) should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum.

The Council seeks to reduce the levels of pollutants referred to in the Government's National Air Quality Strategy and will have regard to the Mayor's Air Quality Strategy. London Boroughs should also take account of the findings of the Air Quality Review and Assessments and Actions plans, in particular where Air Quality Management Areas have been designated.

The Council has a network of Air Quality Monitoring stations but recognises that this can be widened to improve understanding of air quality impacts. The Council may therefore require new major development in an AQMA to fund additional air quality monitoring stations to assist in managing air quality improvements."

2.41 Part 2 of the LBH Local Plan, Development Management Policies, was adopted on January 2020 and sets the overarching vision, strategic objectives and policies for development in Hillingdon [25]. The Local Plan Part 2 identifies a number of spatial development issues across the Borough including accommodating population growth, achieving economic prosperity, tackling climate change, infrastructure provision, community cohesion, and creating and maintaining attractive and distinctive places.

2.42 Policy DMEI 1: Living Walls and Roofs and on-site Vegetation states that all development proposals are required to comply with the following:

(a) "All major development should incorporate living roofs and/or walls into the development. Suitable justification should be provided where living walls and roofs cannot be provided; and

(b) Major development in Air Quality Management Areas must provide onsite provision of living roofs and/or walls. A suitable offsite contribution may be required where onsite provision is not appropriate."

2.43 Policy DMEI 14: Air Quality states:

(a) *"Development* proposals should demonstrate appropriate reductions in emissions to sustain compliance with and contribute towards meeting EU limit values and national air quality objectives for pollutants.

(b) *Development* proposals should, as a minimum:

i) Be at least "air quality neutral";

ii) *Include sufficient mitigation to ensure there is no unacceptable risk from air pollution to sensitive receptors, both existing and new; and*

iii) *Actively contribute towards the improvement of air quality, especially within the Air Quality Management Area."*

Hillingdon Strategic Infrastructure Plan

2.44 The Hillingdon Strategic Infrastructure Plan [26] sets out the council's strategy for transport and connectivity. This principle considers enabling a shift to walking and cycling, cleaner air transport from Heathrow, travel via river, improving public transport, low and zero emission vehicles, Ultra Low Emission Zone and develop infrastructure management strategies such as;

- *"Projects that are essential for planning permission*
- *Projects that are necessary for sustainable growth*
- *Projects that are desirable for placemaking."*

Hillingdon Air Quality Action Plan

2.45 LBH adopted its current AQAP in 2019 [27]. The plan includes priority measures and actions for a period of five years until 2024. The plan sets out air quality actions to improve air quality and protect local residents, including:

- *"Promoting and delivering energy efficiency and energy supply retrofitting projects in workplaces and homes through EFL retrofit programmes such as RE:NEW and RE:FIT and through borough carbon offset funds;*
- *Council procurement policies to promote use of cleaner vehicle technologies via contract tendering process;*
- *Reducing emissions from council fleets;*
- *Discouraging unnecessary idling by taxis and other vehicles;*
- *Provision of infrastructure to support walking and cycling"*

Hillingdon Air Quality SPG

2.46 LBH published an Air Quality Development Plan [28] aimed to developers which states its expectations regarding air quality in planning applications. The Air Quality SPG includes an indicative list of planning conditions or Section 106 obligations which could be applied to reduce impacts on air quality, and a list of design principles to adopt to minimize impact on air quality such as traffic reduction and low emission strategies, sustainable building design, heating and energy supply and reducing dust impacts.

Hillingdon Planning Obligations SPG

2.47 LBH published a Planning Obligations SPG [29] aimed to highlight guidance on planning obligations in Hillingdon for those in the submission and determination of planning applications. This document references the Air Quality SPG above.

Other Relevant Policy, Standards and Guidance

Defra LAQM Technical Guidance 2016 (revised 2018)

2.48 The Defra LAQM Technical Guidance 2016 (revised 2018) [30] guidance issued under Part IV of the Environment Act 1995 [8] is designed to help local authorities with their LAQM duties. The guidance sets out the general approach to use and detailed technical guidance to guide local authorities through the Review and Assessment process for the all regions of the UK excluding London, and contains additional technical information than the shorter LLAQM.TG(19) document.

EPUK and IAQM Planning Guidance

2.49 When determining the significance of the air quality assessment results with the Proposed Development, this assessment follows the non-statutory best practice guidance relating to air quality and development control published by EPUK and IAQM [31]. The guidance ensures that air quality is adequately considered during land-use planning and development control process and is applicable to assessing the effect of changes in exposure of members of the public consequential to residential and mixed-use developments. This is of particular importance in urban areas where air quality is of a poorer standard. The guidance states that:

> *"Land-use planning can play a critical role in improving local air quality. At the strategic level, spatial planning can provide for more sustainable transport links between the home, workplace, educational, retail and leisure facilities, and identify appropriate areas for potentially polluting industrial development. For an individual development proposal, there may be associated emissions from transport or combustion processes providing heat and power."*

3. Background Air Quality

Local Air Quality Management

3.1 The Proposed Development is located within the administrative boundary of the LBH. In 2003, LBH declared an AQMA encompassing the southernmost two thirds of the Borough on the basis that concentrations of NO_2 were in exceedance of the annual mean national ambient air quality objective for this pollutant. In the immediate vicinity of the Site, the main source of pollution is considered to be related to emissions from road traffic, although there are additionally contributions from local energy generation, industry and other (non-road) transportation sources.

3.2 To assess the significance of any new development proposal (in terms of air quality), it is necessary to identify and understand the baseline air quality conditions in and around the study area. This provides a reference against which any potential changes in air quality can be assessed.

3.3 To identify the existing air quality conditions, a review of publicly available information has been undertaken, including the latest local authority air quality reports, monitoring data, and background concentration maps. This section presents the results of the review.

3.4 LBH's first AQAP was published and adopted in 2004, which set out measures to improve air quality in the AQMA. An updated AQAP, Hillingdon's AQAP 2019-2024 [27] reinforced that road transport emissions are the major source of air pollution in the Borough, and set out updated measures for reducing these.

3.5 The LBH's most recently published LAQM Annual Status Report (ASR) [32] presents information for 2020, indicating that there has been a reduction in annual mean NO_2 concentration at most sites across borough compared to the previous assessment year, though it is highlighted that this is likely to have been influenced by the COVID-19 pandemic and associated impacts on travel.

3.6 LBH has ten AQFA's which lie along major transport corridors (A40/South Ruislip, A40/Long Lane, A40/Swakeleys Road, Ossie Garvin to Southall Park, Heathrow Area, Hayes, Uxbridge Road Corridor, Uxbridge Town Centre, West Drayton/Yiewsley, and M4 Focus Area).

Local Air Quality Monitoring Data

3.7 A review of existing baseline air quality has been undertaken using information available from LBH's 2020 ASR [32]. LBH operates 11 automatic continuous monitors which measure NO_2 and PM_{10} as well as undertaking NO_2 monitoring at 55 locations across the borough using passive diffusion tubes.

3.8 None of the automatic continuous monitors are located within 1 km of the Proposed Development, however, there are three background sites, detailed in Table 3-1, that are located within 5 km of the site. Due to the distance from the site these monitoring locations are not considered representative of air quality in the vicinity of the Proposed Development but have instead been used to gauge the accuracy of the Defra mapped background data discussed later. It should be noted that while LBH report the HIL automatic monitor as being at an Urban Background site, it is located within 2.5 m of a road and 30 m from the M4 and, therefore, will be heavily influenced by road emissions and cannot be used to determine background air quality.

Table 3-1. Monitored Urban Background Concentrations at Automatic Monitors located within 5 km of the Proposed Development

Site ID	Name	Pollutant	X	Y	Location Type	Distance to Site (km)	Annual Mean Concentration (μg/m³)				
							2016	2017	2018	2019	2020
HIL	London Hillingdon	NO_2	506951	178605	Urban Background	3	**51**	**53**	**46**	**45**	28
SIPS	Hillingdon Spa	NO_2	507325	177282	Urban Background	4.3	35	34	30	30	19
HIL4	London Harmondsworth Osiris	PM_{10}	505671	177605	Urban Background	4.2	16	14	16	14	15
		$PM_{2.5}$					6	7	6	5	7

Source: LBH ASR 2020.

Numbers in bold show the concentrations exceeding the annual mean objective value and those bold and underlined may exceed the hourly mean objective value.

3.9 LBH also undertakes diffusion tube monitoring at ten locations within 2 km of the Site. The pollutant concentrations recorded by monitoring locations within 2 km of the Proposed Development are set out in Table 3-2 and their locations are illustrated in Figure 2 of Appendix A. With the exception of HILL24 in 2017, all ten diffusion tube locations recorded NO_2 concentrations below the AQS objectives over the past five years.

Table 3-2. Monitored NO_2 Concentrations at Diffusion Tubes within 2 km of the Proposed Development

Site ID	X	Y	Location Type	Distance to Site (km)	Annual Mean NO_2 Concentration (μg/m³)				
					2016	2017	2018	2019	2020
HILL04	507617	182506	Roadside	0.8	26.8	28.2	28.5	27.8	22.6
HILL05	506989	181920	Roadside	<0.1	32.3	36.1	33.4	34.1	27.4
HILL13	505731	180288	Roadside	1.7	25.8	26.9	29.5	27.9	19.9
HILL19	506108	180493	Urban Background	1.3	32.0	37.0	35.0	34.6	27.1
HILL21	507141	179628	Urban Background	2	29.6	34.7	34.9	32.3	23.4
HILL24	506035	183611	Roadside	1.7	35.5	**40.0**	36.9	34.7	27.6
HD49	508651	182274	Roadside	1.6	20.9	26.5	23.6	21.7	-
HD51	506335	180263	Roadside	1.5	29.3	32.9	30.6	26.4	-
HD52	505159	183232	Roadside	2.0	30.0	34.0	35.3	26.5	-
HD207	507580	179812	Urban Background	1.9	24.9	33.3	37.1	28.4	-

Source: LBH ASR 2020.

DT = Diffusion Tube, CM = Continuous Monitor. Numbers in bold show the concentrations exceeding the annual mean objective value and those bold and underlined may exceed the hourly mean objective value.

Site Specific Monitoring

3.10 Additional diffusion tube monitoring was undertaken by AECOM as part of site-specific monitoring around the Hospital for a 3-month period in 2021. The results for 2021 have been annualised are provided below in Table 3-3. For further details on annualisation, see Appendix B.

Table 3-3. Annual Mean 2021 NO_2 Concentrations for locations around Hillingdon Hospital

Site ID	X	Y	Location Type	Annual Mean 2021 NO_2 Concentration (μg/m³)*
DT1	507122	181882	Roadside	24.3
DT2	506688	181947	Roadside	23.7
DT3	507098	181721	Roadside	27.7

Site ID	X	Y	Location Type	Annual Mean 2021 NO_2 Concentration (µg/m^3)*
DT4	506568	181286	Roadside	19.3
DT5	506543	182319	Roadside	25.3
DT6	506921	181944	Roadside	31.7
DT7	507410	182151	Roadside	22.9
DT8 (Co-located with Hill 05 DT)	506989	181920	Roadside	20.5
DT9	508428	181668	Urban Background	18.1
DT10 co-location with HI1 CM)	510843	184913	Roadside	26.3

*DT = Diffusion Tube, CM = Continuous Monitor. Numbers in bold show the concentrations exceeding the annual mean objective value and those bold and underlined may exceed the hourly mean objective value. *Concentrations have been annualised.*

Background Air Quality Data

3.11 A large number of small sources of air pollutants exist, which individually may not be significant, but collectively, over a large area, need to be considered in the modelling process. Pollutant emissions from these sources contribute to background air quality, which when added to modelled emissions allow the total ambient pollutant concentration to be predicted.

3.12 Background data for NO_2, PM_{10} and $PM_{2.5}$ concentrations for 2019 have been sourced from Defra's 2018-based background maps [33] for receptors within the nearest 1 km by 1 km grid squares. Table 3-4 presents a comparison between mapped background pollutant concentrations and monitored concentrations at the urban background automatic continuous monitor locations in 2019. Note the HIL automatic monitor is not included as a suitable background site for this comparison, due to it being in close proximity of the M4 motorway and the likelihood of it being heavily influenced by these road emissions.

Table 3-4. Defra Mapped versus Monitored Pollutant Concentrations in 2019

Monitoring Location	Defra Grid Square	Pollutant	Monitored Background Concentration (µg/m^3)	Mapped Background Concentration (µg/m^3)
SIPS (CM)	507500, 177500	NO_2	30.0	29.9
HIL4 (CM)	505500, 177500	PM_{10}	14.0	16.7
		$PM_{2.5}$	5.0	11.3

DT = Diffusion Tube, CM = Continuous Monitor.

3.13 The comparison in Table 3-4 shows that the mapped and monitored pollutant concentrations are broadly similar and, as such, it is considered appropriate to use the Defra mapped background data to establish background air quality at the receptor locations modelled within this study.

3.14 The mapped background concentrations for the 1 km grid square that the Site falls within is presented in Table 3-5. For those grid squares where all primary A roads are included in the model, these have been taken out of the background to avoid double counting.

Table 3-5. Defra Mapped Pollutant Concentrations for the Site in 2019 and 2027

Defra Grid Square	Pollutant	2019 Mapped Annual Mean Background Concentration (µg/m^3)	2019 Short-term Concentrations (µg/m^3)	2027 Mapped Annual Mean Background Concentration (µg/m^3)	2027 Short-term Concentrations (µg/m^3)
506500, 181500	NO_2	20.9	41.7	16.2	32.4
	PM_{10}	16.2	32.4	14.9	29.8
	$PM_{2.5}$	11.1	22.1	10.1	20.2

Note: As is customary in the absence of detailed data to support the derivation of short-term background pollutant concentrations, and in alignment with guidance published by the UK Environment Agency [34], indicative short-term background concentrations have been derived by doubling the known long-term background concentrations.

3.15 The emergency generators will emit SO_2 and CO in addition to NO_2 and $PM_{10}/PM_{2.5}$. LBH does not undertake monitoring for these pollutants. Defra mapped background data for SO_2 and CO is only available for a 2001 base year and, as such, the 2001 data, presented in Table 3-6, has been used in this assessment, with no adjustment for future reductions in background levels, which is a conservative approach.

Table 3-6. Defra Mapped SO_2 and CO Concentrations for the Site in 2001

Defra Grid Square	Pollutant	Mapped Annual Mean Background Concentration (µg/m^3)	Short-term Concentrations (µg/m^3)
506500, 181500	SO_2	4.6	9.2
	CO	432	864

Note: As is customary in the absence of detailed data to support the derivation of short-term background pollutant concentrations, and in alignment with guidance published by the UK Environment Agency [34], indicative short-term background concentrations have been derived by doubling the known long-term background concentrations.

4. Methodology

Introduction

4.1 There is currently no statutory guidance on the methodology for air quality impact assessments. However, several non-statutory bodies have published their own guidance relating to the assessment of air quality within the planning context.

4.2 The key air quality impacts associated with the Proposed Development are:

- Fugitive emissions of particulate matter from the construction activities;
- Traffic related emissions associated with the construction phase of the Proposed Development;
- Traffic related emissions associated with the operational phase of the Proposed Development; and
- Emissions from diesel generator exhausts associated with the operational phase of the Proposed Development.

4.3 The following sections provide details of the approach taken to assess the change in air quality as a result of the Proposed Development as well as how the significance of any change has been assessed. Receptors potentially sensitive to air quality have been identified through review of mapping and aerial photography of the area surrounding the Proposed Development.

Construction Phase Dust and PM_{10} Impacts

Construction Phase Emissions - Traffic Impacts

4.4 Local air quality is considered unlikely to be significantly affected during the construction phase of the Proposed Development as a result of vehicle emissions. Whilst construction vehicle numbers could exceed the EPUK/IAQM guidance (a change of HDV flows of more than 25 AADT inside of an AQMA) during peak construction works, any impacts would be considered short term and temporary in nature and therefore not significant.

Fugitive Emissions of Particulate Matter

4.5 Particulate matter in the air is made up of particles of a variety of sizes, and the concept of a 'size fraction' is used to describe particulates with sizes in a defined range. These definitions are based on the collection efficiency of specific sampling methods and each of the size fractions is especially associated with different types of impacts. In this assessment the term 'dust' is used to mean particulate matter in the size fraction 1 µm – 75 µm in diameter. The size fraction called 'PM_{10}' is composed of material with an aerodynamic diameter of less than 10 µm in diameter and overlaps with the size fraction for dust.

4.6 AQS objectives for PM_{10} have been set for the protection of human health and the term PM_{10} is only used in this assessment when referring to the potential impact of emissions of particulate matter from demolition and construction activities on human health. The short term, 24-hour mean objective for airborne concentrations of PM_{10} is the appropriate AQS objective for assessing the potential impact on health of short-term fugitive emissions from demolition and construction sites.

4.7 Dust impacts are considered in terms of the change in airborne concentration and the change in the rate of deposition of dust onto surfaces. The IAQM adopts a broad definition of dust that includes the potential for changes in airborne concentration, changes in deposition rates and the risk to human health and public amenity, when considering the significance of effects from emissions of fugitive particulate matter (PM). In this assessment, specific reference is made to the impacts associated with specific size fractions (dust, PM_{10}), before considering the overall effect on receptors using an approach that is consistent with the IAQM's guidance [35].

4.8 The nature of the impact varies between different types of receptor. In general, receptors associated with higher baseline dust deposition rates are less sensitive to impacts, such as farms, light and heavy industry or outdoor storage facilities. In comparison some hi-technology industries or food processing plants operate under clean air conditions and increased airborne particulate matter concentrations may have an increased economic cost associated with the extraction of more material by plant air filtration units.

4.9 Fugitive emissions (i.e. emissions which are not associated with a single fixed release point) of airborne particulate matter are readily produced through the action of abrasive forces on materials. A qualitative construction dust risk assessment has been undertaken in accordance with the Mayors SPG [1].

4.10 Activities on construction sites with the potential to generate dust and emissions can be categorised into four types of activities, which are:

- Demolition – any activities associated with the removal of existing structures on site;
- Earthworks – includes the processes of soil-stripping, ground-levelling, excavation and landscaping;
- Construction – any activities relating to the provision of new structures on site; and
- Trackout – the transport of dust and dirt from the construction site onto the public road network where it may be deposited and re-suspended by traffic using the network.

4.11 The potential for dust emissions has been assessed for each activity that is likely to take place. The guidance has been used to assess the risk and significance of any impacts associated with the construction phase and to identify appropriate mitigation measures to be adopted to reduce any potential impacts.

4.12 A detailed assessment is required where a sensitive human receptor is located within 50 m from the site boundary and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s) or if there is a relevant ecological receptor within 50 m of the site boundary or within 50 m of the route (s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s). Due to the central location of the site, there are a number of sensitive human receptors located within 50 m of the site boundary and hence the assessment is required. There are no relevant ecological receptors within 50 m of either the site boundary or construction routes.

4.13 The first step of the detailed assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:

- The scale and nature of the works, which determines the potential dust emission magnitude; and
- The sensitivity of the area.

4.14 These factors are combined following criteria set out in the guidance to give an estimate of the risk of dust impacts occurring.

4.15 The emphasis of the regulation and control of construction dust should be the adoption of good working practices as standard. Good practice is a process that is informed by the assessment, which seeks to avoid the potential for adverse effects. This approach assumes that this environmental management, beyond those mitigation measures inherent in the proposed design, will be implemented during works to ensure potential significant adverse effects do not occur.

4.16 Site-specific mitigation for each of the four potential activities is then determined based on the risk of dust impacts identified. These measures are either ‘highly recommended’, ‘desirable’ or ‘not required’, depending on the level of risk identified. For general mitigation measures, the highest risk category should be applied. For example, if the site is medium risk for earthworks and construction, but a high risk for demolition and track-out, the general measures applicable to a high-risk site should be applied.

4.17 Professional judgment is employed to examine the residual dust effects assuming mitigation is undertaken to determine significance. It is expected that best practice mitigation measures will be documented within a Construction Environmental Management Plan (CEMP) (or equivalent) and agreed with LBH prior to the commencement of construction works and secured by an appropriately worded planning condition. With effective mitigation and management commensurate with the level of risk identified in the construct dust assessment, the residual dust effects during demolition and construction works are generally considered to be ‘not significant’.

Methodology for Determining Demolition and Construction Effects

4.18 Construction activities associated with the Proposed Development have the potential to generate dust emissions that could result in dust soiling and/or air quality impacts at nearby sensitive receptors. The main impacts that may occur due to construction phase activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions; and
- Elevated PM_{10} concentrations as a result of dust-generating activities on site.

4.19 A qualitative assessment has been undertaken to assess the significance of any effects on sensitive receptors associated with the demolition and construction phase. The assessment is based on the Mayor's SPG [1] and considers potential sources of emissions on the basis of the four main activity groupings (Demolition, Earthworks, Construction and Trackout).

4.20 For each activity group the following steps are applied with respect to identifying the potential effects, before coming to an overall conclusion about the significance of the effects predicted. The approach to the assessment involves the following process:

- Identify the nature, duration and location of activities being carried out;
- Establish the risk of significant effects occurring as a result of these activities;
- Review the proposed or embedded mitigation against good site practice;
- Identify additional mitigation measures, if necessary, to reduce the risk of a significant adverse effect occurring at receptors; and
- Summarise the overall effect of the works with respect to fugitive emissions of particulate matter and then report the significance of the effects.

4.21 The emphasis of the regulation and control of demolition and construction dust should be the adoption of good working practices as standard. Good practice is a process that is informed by the assessment, which seeks to avoid the potential for adverse effects. This approach assumes that this environmental management, beyond those mitigation measures inherent in the proposed design, will be implemented during works to ensure potential significant adverse effects do not occur.

4.22 Examples of accepted good site practice are set out in the Mayor's SPG. It has been assumed that good site practices will be utilised on-site when assessing potential dust impacts. A list of proposed mitigation measures required to reduce the potential impact to low risk has been presented in Section 6.

4.23 The potential for dust emissions has been assessed for each activity that is likely to take place. The guidance has been used to assess the risk and significance of any impacts associated with the construction phase and to identify appropriate mitigation measures to be adopted to reduce any potential impacts.

4.24 An assessment is required where a sensitive human receptor is located within 50 m from the site boundary and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

4.25 The first step of the assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:

- The sensitivity of the area, which is dependent on the number of sensitive receptors within certain distance bands of the Site (illustrated in illustrated in Figure 4 of Appendix A) and whether assessing nuisance, human health or ecological impacts.
- The scale and nature of the works, which determines the potential dust emission magnitude; and

4.26 As described in the Mayor SPG [1], a demolition / construction dust receptor is defined as:

> *"…a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust.*

When assessing the impact of dust emissions generated during construction works, receptors are defined as the nearest potentially sensitive receptor to the boundary of the Site in each direction. These receptors have the potential to experience impacts of greater magnitude due to emissions of particulate matter generated by the works, when compared with other more distant receptors, or less sensitive receptors. Moreover, receptors located within 50 m of routes to be used by construction vehicles might be impacted by dust originating from the track-out of material onto the road, and as such have been considered in this assessment."

4.27 The SPG provides criteria, reproduced in Table 4-1, in order to determine the sensitivity of the area to dust soiling effects and the health effects of PM_{10}.

Table 4-1. Construction Dust Receptor Sensitivities

Receptor/Impact	Sensitivity examples		
	High sensitivity	Medium sensitivity	Low sensitivity
Human perception of dust soiling effects	Enjoy a high level of amenity; appearance / aesthetics / value of property would be diminished by soiling; receptor expected to be present continuously / regularly; e.g. residential / museums / car show rooms / commercial horticulture	Enjoy a reasonable level of amenity; appearance / aesthetics / value of property could be diminished by soiling; receptor not expected to be present continuously / regularly; e.g. parks / places of work	Enjoyment of amenity not reasonably expected; appearance / aesthetics / value of property not diminished by soiling; receptors are transient / present for limited period of time; e.g. playing fields, farmland, footpaths, short term car parks* & roads
PM_{10} health effects	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (daily AQS objective). Indicative examples include residential properties. Hospitals, schools and residential care homes.	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (daily AQS objective). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	Locations where human exposure is transient. Indicative examples include public footpaths, playing fields, parks and shopping streets
Ecological dust deposition effects	Locations with an international or national designation and the designated features may be affected by dust soiling; or Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain. Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or Locations with a national designation where the features may be affected by dust deposition. Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features

4.28 The GLA methodology requires that the level of significance is not just determined by the type of receptor but also the number of receptors that may be affected based on their distance from the Proposed Development site boundary. To do this the number of receptors within set distance bands from the site boundary (<20 m, 20–50 m, 50-100 m, 100-200 m and 200-350 m), illustrated in Figure 4 of Appendix A, are estimated and used to calculate the overall sensitivity of the area to dust soiling, human health and ecological effects.

4.29 For assessing the sensitivity of an area in terms of human health, the GLA methodology requires that in addition to the number of high/medium/low sensitivity receptors within each distance band, consideration is also given to the existing background PM_{10} concentration. The background PM_{10} concentration used to represent the study area is presented in Table 3-5.

4.30 These factors are combined to give an estimate of the risk of dust impacts occurring. Risks are described in terms of there being a low, medium or high risk of dust impact for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

4.31 Based on the threshold criteria and professional judgment, one or more of the groups of activities may be assigned a 'negligible' risk. Professional judgment is employed to examine the residual dust effects assuming mitigation is undertaken to determine significance.

4.32 The GLA guidance sets the magnitude of effects dependent on the scale of works that is being undertaken with respect to the key activities, demolition, earthworks, construction, and track-out. These are set out in Table 4-2.

Table 4-2. Magnitude Classes of Dust Emissions with Respect to Key Activities

Activity	Magnitude	Descriptor
Demolition	Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level.
	Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level.
	Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.
Earthworks	Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.
	Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes.
	Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.
Construction	Large	Total building volume >100,000 m^3, on site concrete batching, sandblasting.
	Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
	Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).
Trackout	Large	>50 Heavy Duty Vehicles (HDVs) (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;
	Medium	10 - 50 HDVs (>3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and
	Small	<10 HDV (>3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Construction Phase Non-Road Mobile Machinery

4.33 Emissions from construction NRMM will have the potential to increase NO_2 and PM_{10} concentrations locally when in use on the construction site associated with the Proposed Development. Experience of assessing the exhaust emissions from on-site plant (NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed [35].

4.34 The Mayors SPG [1] has put in place a strategy to address emissions from NRMM in the London area. In order to reduce emissions from NRMM, this equipment will need to meet set emission standards. Issued on 1st September 2015, NRMM of net power between 37 kW and 560 kW used in London has been required to meet emission standards, based upon engine emissions standards set in EU Directive 97/68/EC [36] and its subsequent amendments [37]. From 1st September 2020, NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum.

4.35 The Local Planning Authorities (LPAs) are responsible for the application and enforcement of this policy through the planning process, and the developers, as part of their Air Quality Dust Risk Assessment, will be required to provide a written statement of their commitment and ability to meet the NRMM standards.

4.36 Emissions from NRMM will be temporary and localised and will be controlled via the application of the NRMM standards and through best practice mitigation measures. For that reason, the construction phase NRMM emissions should not be significant. These emissions have not been modelled and are not considered any further in this assessment.

Operational Phase Assessment

Operational Phase Emissions - Traffic Impacts

4.37 The site is located within the Hillingdon AQMA and two AQFAs are approximately located to the 0.5 km to north east and 1 km to north west, therefore detailed modelling has been undertaken to consider the air quality impacts of the Proposed Development on sensitive receptors identified in the vicinity.

Road Traffic Emissions

4.38 The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and SO_2, carbon monoxide (CO), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_x, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. The presence of NO_2 in the atmosphere is associated with adverse effects on human health. The principal pollutants of concern in terms of air quality at sensitive receptors in the vicinity of the Proposed Development are NO_2, PM_{10} and $PM_{2.5}$, and, as such, these pollutants will be the focus of this assessment. Better emission control technology and fuel specifications are expected to reduce NO_x, PM_{10} and $PM_{2.5}$ emissions per vehicle in the long term especially given current government incentives to switch to hybrid and electric vehicles.

4.39 Although SO_2, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this assessment as none of these pollutants are at risk of exceeding the relevant AQS objective values.

4.40 This assessment follows current guidance for the determination of pollutant concentrations and uses emissions factors for road traffic calculated with the latest information as provided in Defra's Emissions Factors Toolkit (EFT) version 11.0 [38].

Traffic Data

4.41 Traffic surveys were undertaken in 2018 with additional surveys carried out in November 2021 to ensure the traffic flow represent pre-covid baselines. Traffic data was provided in the 24-hour Average Annual Daily Traffic (AADT) format for the following scenarios:

- 2019 Baseline Traffic;
- 2027 Future Baseline Traffic, 'Without' the Proposed Development;
- 2027 'With' the Proposed Development traffic; and
- 2027 Cumulative traffic including the Proposed Development and outline development.

4.42 The DFT (Department for Transport) count site along Uxbridge road was added for the 2019 baseline for verification purposes, with limited monitoring sites available. The traffic data for all the modelled roads is provided in Table 8-6, Appendix E.

Receptors

4.43 The AQS objective values for pollutants associated with road traffic were set by the Expert Panel of Air Quality Standards (and subsequently adopted as UK AQS Objectives) at a level below the lowest concentration at which the most sensitive members of society have been observed to be adversely affected by exposure to each pollutant. Therefore, all receptors that represent exposure of the public are of equal sensitivity as any member of the public could be present at those locations.

4.44 Commercial properties are not considered sensitive to changes in ambient pollutant concentrations and are legislated separately as part of occupational health and safety regulations. These are, therefore, not included in the assessment which focuses on residential buildings and sensitive receptors such as schools, hospitals and nursing homes.

4.45 NO_2, PM_{10} and $PM_{2.5}$ concentrations have been predicted at a number of receptor locations representing the closest sensitive buildings to the local road network affected by the Proposed Development. The receptors have been selected from aerial photography and publicly available mapping. Each of the receptors chosen represents the maximum level of exposure that could be experienced at other receptors in their vicinity. The air quality modelling is conducted at the lowest floor for exposure, typically ground floor. A full list of modelled receptors in detailed in Table 8-3 of Appendix C and illustrated in Figure 2 of Appendix A.

Model Input Data and Conditions

4.46 This assessment has used the dispersion model software 'ADMS-Roads' version 5.0.0.1 to quantify pollution levels at selected receptors due to road traffic emissions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies [39].

4.47 Details of general model conditions set up in ADMS-Roads are provided in Table 4-3. Some of these conditions are summarised in detail below.

Table 4-3. General ADMS-Roads Model Conditions

Variables	Model Inputs
Surface roughness at source	1.5 m
Surface roughness at Meteorological Site	0.5 m
Minimum Monin-Obukhov length for stable conditions	100 m
Terrain types	Flat
Receptor locations	x, y coordinates determined by GIS, z = various.
Emissions	NO_x, PM_{10}, $PM_{2.5}$
Emission factors	Defra EFT Version 11
Meteorological data	1 year (2019) hourly sequential data from London Heathrow meteorological station.
Receptors	Facades of selected receptors only.
Model output	Long-term (annual) and short-term (hourly) mean NO_x concentrations. NO_x to NO_2 conversion discussed later in assessment. Long-term (annual) mean PM_{10} concentrations. Long-term annual mean $PM_{2.5}$ concentrations.

Meteorological Data

4.48 One year (2019) of hourly sequential observation data from London Heathrow Airport meteorological station has been used in the roads modelling assessment. 2019 data has been used to correspond with the base year of assessment and model verification year. London Heathrow Airport is located approximately 5.5 km south of the Site and experiences meteorological conditions that are representative of those experienced within the study area. A windrose representation of the meteorological data is presented in Figure 3, Appendix A, and shows that the dominant direction of wind is from the south-west, as is typical for the UK. The wind speed ranges from 0-16 knots (0- ~8.2 m/s).

NO_x to NO_2 Conversion – Road Traffic

4.49 The proportion of NO_2 in NO_x varies greatly with location and time according to a number of factors including the amount of ozone available and the distance from the emission source.

4.50 Defra have produced a NO_x to NO_2 Calculator [40] spreadsheet tool which provides a methodology for converting modelled road NO_x concentrations to NO_2 concentrations for any given year up to 2030. This conversion methodology has been used for the purpose of this assessment for all scenarios as the best representation of the NO_2/NO_x relationship for the study area. The NO_x to NO_2 Calculator is v8.1 and is designed to be used in combination with Defra's 2018-reference year background maps and Emission Factors Toolkit version 11.0. The traffic mix option used was the 'All London traffic' option. The local authority area used was selected based on the location of the modelled receptors and diffusion tube locations.

Predicting the Number of Days in which the PM_{10} 24-hour Mean Objective is Exceeded

4.51 The guidance document LAQM.TG(03) [41] sets out the method by which the number of days in which the PM_{10} 24-hour objective is exceeded can be obtained based on a relationship with the predicted PM_{10} annual mean concentration. The most recent guidance, LAQM.TG(16) and LLAQM.TG(16), suggest no change to this method. As such, the formula used within this assessment is:

No. of Exceedances = 0.0014 * C^3 + 206/C - 18.5

Where C is the annual mean concentration of PM_{10}.

4.52 An annual mean PM_{10} concentration of 32 $\mu g/m^3$ is, therefore, broadly equivalent to 35 days of exceedance; and as such, if the predicted annual mean is less than 32 $\mu g/m^3$ the short-term (daily) PM_{10} AQS objective can be considered to have been achieved.

Exceedance of the Short Term NO_2 Objective

4.53 Research projects completed on behalf of Defra and the Devolved Administrations, have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 $\mu g/m^3$. In 2003, Laxen and Marner [42] concluded:

"…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 $\mu g/m^3$ and above."

4.54 The findings presented by Laxen and Marner are further supported by AEAT [43] who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

"Local authorities should continue to use the threshold of 60 $\mu g/m^3$ NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective."

4.55 This means that where predicted concentrations are below 60 $\mu g/m^3$, it can be concluded that the hourly mean NO_2 objective (200 $\mu g/m^3$ NO_2 not more than 18 times per year) will be likely achieved.

Model Verification of Road Contribution to Pollutant Concentrations

4.56 Predicted results from an air quality dispersion model may differ from measured concentrations for a number of reasons, including uncertainties associated with traffic flows and emissions factors, meteorology and limitations inherent to the modelling software. In light of this, and in accordance with advice in LAQM.TG(16), for roads-based air quality assessments it is best-practice to perform a comparison of modelled results with local monitoring data to minimise these modelling uncertainties. This provides a verification factor, by which the output of the ADMS-Roads model is adjusted, to gain greater confidence in the final results. The verification of the modelling output was carried out as prescribed in Chapter 7 of LLAQM.TG(19).

4.57 Available air quality monitoring sites in the local area were reviewed. There two diffusion tube sites within the study area, within LBH which could be used to verify the model. These are diffusion tubes Hill04 and Hill 05 which are illustrated in 1 of Appendix A and the choice of 2019 over 2021 is discussed further in the Appendix of this report.

4.58 An adjustment factor of 3.39 has been applied to all modelled results and is generally considered to be conservative in most cases. As there are no suitable roadside monitoring locations available to verify PM_{10} and $PM_{2.5}$ modelled concentrations, these have also been adjusted using a factor of 3.39.

Operational Phase Emissions - Stand-by Diesel Generators

4.59 This section describes the approach taken for the assessment of emissions associated with the operation of the proposed diesel-powered emergency generator sets.

4.60 When operating, diesel engines emit various air pollutants, including NOx (a generic term for NO and NO_2) and PM, among others. NO_x emissions are produced at high temperatures inside the combustion chamber, where excess oxygen reacts with nitrogen to form NO_x, mainly in the form of NO, which is then converted to NO_2 in the atmosphere. The presence of NO_2 in the atmosphere is associated with adverse effects on human health.

4.61 PM comprises soot, condensed unburnt hydrocarbons (such as fuel or lubricating oil), and any other condensed or solid particles, such as wear particles [44]. The majority of PM produced by diesel engines is fine (<1 µm in diameter) [45].

4.62 Each generator set is served by its own dedicated exhaust flue stack, located on top of the engine enclosure, which has been modelled as a point source emission using the AERMOD dispersion model. AERMOD is a new generation air quality modelling system, developed by the United States Environmental Protection Agency (US EPA) in collaboration with the American Meteorological Society. It is a straight-line, steady-state Gaussian plume model that can model the dispersion of pollutants over rural and urban areas, flat and complex terrain. AERMOD considers surface and elevated releases, and multiple sources including point, area and volume sources to determine ground level pollutant concentrations at specified receptor points.

4.63 AERMOD incorporates improved algorithms for convective and stable boundary layers for computing vertical profiles of wind, turbulence and temperature, and for the treatment of all types of terrain. AERMOD possesses the ability to construct vertical profiles of required meteorological variables, allowing improved modelling of the dispersion of pollutants, particularly vertical dispersion.

4.64 The AERMOD View software package, published by Lakes Environmental was used in conjunction with the latest currently-approved US EPA regulatory version of AERMOD at the time of starting the assessment (version 21112).

AERMOD Model Inputs

Emission Source Parameters

4.65 The key emission source parameters that have been used as inputs to the dispersion model are summarised in Table 4-4. All four generators are identical and discharges flue gases to atmosphere via a dedicated flue stack, i.e. one flue for each of the 4 generators, as such the emissions data is provided on a per generator basis.

Table 4-4. Details of Modelled Emission Sources (per Generator)

Parameter	Generator 1 to 4 (per unit)
Stack Height (above ground level)	6.86 m
Generator Enclosure Height (above ground level)	4.68 m (plus cooling fans 6.65 m)
Stack Location (X, Y co-ordinates)	Generator 1: 506706.77, 181725.96 Generator 2: 506708.62, 181727.52 Generator 3: 506708.97, 181733.26 Generator 4: 506710.96, 181734.76
Stack Exit Diameter	0.45 m
Exhaust Volumetric Flow	7.08 m^3/s
Stack Discharge Velocity	44.5 m/s
Stack Discharge Temperature	608 ºC
Duct O_2	7.0% vol (dry basis)
Duct H_2O	10% vol*
Normalised Volumetric Flow (15% O_2, dry, 1 atm, 0ºC)	4.60 Nm^3/s
NO_x emission concentration (normalised @ 15% O_2, dry, 1 atm, 0ºC)	1,188 Nm^3/s
NO_x Emissions	5.46 g/s
PM_{10}/$PM_{2.5}$ emission concentration (normalised @ 15% O_2, dry, 1 atm, 0ºC)	2 Nm^3/s
PM_{10}/$PM_{2.5}$ Emissions	0.01 g/s

Parameter	Generator 1 to 4 (per unit)
SO_x emission concentration (normalised @ 15% O_2, dry, 1 atm, 0ºC)	19 Nm^3/s
SO_x Emissions	0.09 g/s
CO emission concentration (normalised @ 15% O_2, dry, 1 atm, 0ºC)	40 Nm^3/s
CO Emissions	0.18 g/s
Operating Hours	14 hours per year (1 hour per month and 3 hours once per year)

* data not provided by manufacturer so exhaust water vapour has been estimated based on typical conditions for diesel generators

Generator Emission Modelling

4.66 The modelling has assumed that each generator operates permanently throughout the year to ensure that all meteorological conditions are considered including those that may result in very poor dispersion / higher predicted concentrations such as during stable conditions with lower wind speeds which tend to occur during the night.

4.67 Annual impacts are subsequently calculated by dividing the predicted annual mean concentration at each receptor by 8,760 (8,784 in leap years) and multiplying the resultant value by the actual operating hours per year (14 hours per year).

4.68 However, for the short-term impacts modelling emissions in this way provide a very much worst-case assessment, which is not realistic given the limited number of hours the generators will actually run. As such this approach provides a worst-case result and if the AQS objective is not exceeded the pollutant can be discounted from further consideration, however, if the AQS objective is exceeded this does not mean that the generators will, in reality, have a detrimental impact on air quality as they would only operate for 14 hours or <0.2% of the time period modelled.

4.69 The Environment Agency risk assessment screening criteria says that the Process Contribution (PC) and resultant Predicted Environmental Concentration (PEC) (modelled PC + background pollutant concentration) from a point source can be considered to have an insignificant impact where:

- Long-term PC <1% of the EAL, or the Long-term PEC <70% of the EAL for long term releases;
- Short-term PC <10% of the EAL, or the short-term PC is less than 20% of the EAL minus twice the long-term background concentration.

4.70 The EA's Risk Assessment guidance indicates that where an Environmental Standard is likely to be breached as a result of contributions from an installation, or where installation releases constitute a major proportion of the standard or objective, such releases are likely to be considered unacceptable.

4.71 To provide a more realistic assessment of whether the short-term EAL is likely to be exceeded or not, the Environment Agency recommends the use of Hypergeometric Distribution, which is a statistical method though which the likelihood that the EAL will be exceeded in a year can be determined [46]. This is assessed over a 20-year period with a 5% risk representing the likelihood that the AQS objective will be exceeded once in that 20 years (20 x 5% = 1 so 1/20), whereas a 10% risk represents a 1/10-year event (20 x 10% = 2 so 2/20 or 1/10).

4.72 The EA guidance provides the following risk characterisation:

- Probabilities of 1% or less indicate exceedances of the Environmental Standard are highly unlikely.
- A probability of less than 5% indicates exceedances are unlikely.
- Probabilities greater than or equal to 5% indicates there is potential for an exceedance during the 20-year assessment period and may not be considered acceptable on a case-by-case basis.

Building Downwash Effects

4.73 The dispersion of pollutants from modelled sources (particularly industrial point sources) may be affected by aerodynamic wakes generated by winds flowing around and over nearby buildings. Building wakes generally decrease the distance downwind at which pollutant plumes emitted from stacks come into contact with the ground. This may result in higher ground level pollutant concentrations closer to the emission source.

4.74 AERMOD includes the PRIME building wake algorithm and the Building Profile Input Program (BPIP) for entering the location and dimension of buildings where building wakes may influence dispersion characteristics. The proposed new hospital building, ambulance building and existing buildings off-site close to the generators have been included within the model. The location and height of each building has been derived from site layout plans, elevation drawings and publicly available aerial imagery.

Meteorological Data

4.75 Hourly sequential data from London Heathrow Airport meteorological station for the years 2015 to 2019 inclusive were used in the point modelling study. Multiple years are used when modelling point sources to ensure that all applicable meteorological conditions have been considered. Only the maximum predicted concentration at each receptor predicted using the five years of data is reported in this study. A visual representation of the meteorological data used in the assessment is shown in the wind roses presented in Figure 3, Appendix A. The wind roses demonstrate that the wind is predominantly from the south west.

Terrain

4.76 The site and surrounding area are relatively flat with little significant change in terrain height. As such, the effects of terrain of the dispersion of emissions have not been considered in the modelling.

Surface Roughness

4.77 A surface roughness of 1.5 m was used to represent the surface roughness of the land surrounding the site and fits the description of the landscape between the emission points and the closest sensitive receptors.

Specialised Model Treatments

4.78 Emissions have been modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is likely to result in an overestimation of impacts at receptors (i.e. environmentally conservative).

Oxides of Nitrogen to NO_2 Conversion

4.79 Emissions of NO_x from the project sources will mainly consist of NO at the point of release. NO is subsequently oxidised to form NO_2 following release from the flue stacks, with the proportion of NO_2 in the exhaust plume increasing with distance from the point of release. NO is a relatively innocuous substance, but it is of interest as a precursor to NO_2 through chemical reactions in the atmosphere.

4.80 Conversion of NO to NO_2 can be significant at downwind distances of up to 10 km from the project emission sources, in the case of large sources. However, the chemistry of this conversion is complex and subject to many influences (such as the primary NO_x-NO_2 ratio of the emission at source, locations of receptors in relation to the source, and the background concentrations of NO, NO_2 and ozone (O_3), and to a lesser extent background hydrocarbons); it is consequently difficult to accurately predict the rate of conversion of NO to NO_2.

4.81 The Defra NO_x to NO_2 calculation tool explicitly states that it is not to be used when considering emission from point sources such as the generator stacks. Instead the Environment Agency (EA), in its generic combustion source related guidance document [47], recommends applying the following conversion ratios to provide what it describes as a “worst-case scenario”:

– Long-term NO_x to NO_2 conversion: 70%; and

– Short-term NO_x to NO_2 conversion: 35%

4.82 The Environment Agency concedes however, that more case-specific conversion ratios may be used, provided that adequate justification is given. In a focused study relating specifically to evaluating short-term NO_2 impacts from diesel generators [48], the EA found that due to the very high NO_x emissions of diesel generator engines and the very high resulting process contributions (PCs), the amount of conversion is likely to be limited by the amount of available O_3 in the background. The study incorporated several tests and sensitivity analyses (including using actual background pollutant concentrations from the neighbouring suburb of Harlington), which concluded that a short-term conversion ratio of 15% was reasonable within approximately 500 m of the source. This conversion ratio was considered more likely to underestimate the impacts beyond 500 m from the source; however, it highlighted that it is within 500 m that potential exceedances would be more likely to occur. A 15% conversion ratio was therefore adopted for the study for modelling of hourly mean NO_2 concentrations[1].

Modelled Receptors

4.83 A total of 65 discrete cartesian receptors, detailed in Table 8-3 of Appendix C and illustrated in Figure 2 of Appendix A, were selected based on being representative of locations where people could be exposed to air pollutants arising from the operation of the Proposed Development across relevant time periods defined by the AQS objectives. An additional 409 receptors were modelled to represent the façade of each floor (ground to seventh floor) of the proposed hospital building, to allow an assessment of the effects of the generator emissions on the hospital building itself to be undertaken.

Method for Assessment of Significance

Air Quality Assessment of Significance

Air Quality Effects Descriptors

4.84 With regard to road traffic emissions, the change in pollutant concentrations with respect to future baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the "with" and "without" Development scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

4.85 For consideration of a change in annual mean concentration of a given magnitude, the EPUK and IAQM have published recommendations for describing the effects of such impacts at individual receptors as set out in Table 4-5 and Table 4-6 [31].

Table 4-5. Effects Descriptors at Individual Receptors – Annual Mean NO_2 and PM_{10}

Annual Mean Concentration at Receptor in Assessment Year		Change in Concentration Relative to AQAL[a]				
		0%	1%	2% – 5%	6% – 10%	> 10%
As % of AQAL	**NO_2 / PM_{10} (µg/m^3)[b]**	**<0.2 µg/m^3**	**0.2 – <0.6 µg/m^3**	**0.6 – <2.2 µg/m^3**	**2.2 – ≤4.0 µg/m^3**	**>4.0 µg/m^3**
≤75%	≤30.2	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94%	30.2 – 37.8	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102%	37.8 – 41.0	Negligible	Slight	Moderate	Moderate	Substantial
103% - 109%	41.0 – 43.8	Negligible	Moderate	Moderate	Substantial	Substantial
≥110%	≥43.8	Negligible	Moderate	Substantial	Substantial	Substantial

Notes: [a] The percentage change in pollutant concentration is calculated and rounded to the nearest whole number to make it clearer which column the impacts fall within. Changes of less than 0.5% are rounded down to zero and therefore described as negligible.

[b] Concentrations quoted were obtained from EPUK/IAQM [31].

[1] A sensitivity analysis was undertaken to consider the effects of applying this approach compared to the generic assumption of 35% NOx:NO_2 conversion ratio. This analysis found that implementing the 35% conversion ratio would not lead to predicted exceedances of the short-term NO_2 AQS objective at any of the modelled receptor locations.

Table 4-6. Effects Descriptors at Individual Receptors – Annual Mean $PM_{2.5}$

Mean Concentration at Receptor in Assessment Year	Change in Annual Mean Concentration of $PM_{2.5}$ (µg/m³) and Percentage (%) as a Proportion of the AQS Objective				
	0%	1%	2% – 5%	6% – 10%	> 10%
As % of AQAL	<0.1 µg/m³	0.1 – <0.4 µg/m³	0.4 – <1.4 µg/m³	1.4 – ≤2.5 µg/m³	>2.5 µg/m³
≤75%	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94%	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102%	Negligible	Slight	Moderate	Moderate	Substantial
103% - 109%	Negligible	Moderate	Moderate	Substantial	Substantial
≥110%	Negligible	Moderate	Substantial	Substantial	Substantial

4.86 A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.2 µg/m³ is considered to be so small as to be imperceptible. Concentrations that are 11% - 21%, 21% - 50% and greater than 50% of the objectives have small, moderate or large impacts, respectively. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

4.87 All of the relevant receptors have been selected to represent locations where people are likely to be present. The air quality objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered in the definition of the air quality objective values, and, therefore, no additional subdivision of human health receptors on the basis of building or location type is necessary.

Significance of Effects

4.88 The significance of the reported effects is then considered for the Proposed Development in overall terms. The potential for the Development to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered, if relevant, however the principal focus is any change to the likelihood of future achievement of the AQS objective values for the following pollutants:

– Annual mean NO_2 concentration of 40 µg/m³;

– Annual mean PM_{10} concentration of 40 µg/m³;

– Annual mean $PM_{2.5}$ concentrations of 20 µg/m³;

– 24-hour mean PM_{10} concentration of 50 µg/m³ not to be exceeded on more than 35 days per year; and

– 1-hour mean NO_2 concentration of 200 µg/m³ not to be exceeded on more than 18 times per year.

4.89 The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above, and as such, this assessment focuses on the likelihood of achievement of these objectives as a result of the Proposed Development.

4.90 In terms of the significance of any adverse impacts, an effect is reported as being either 'not significant' or as being 'significant'. If the overall effect of the development on local air quality or on amenity is found to be 'moderate' or 'substantial' this is deemed to be 'significant'. Effects found to be 'slight' are considered to be 'not significant', although they may be a matter of local concern. 'Negligible' effects are considered to be 'not significant'.

4.91 Where a single development can be judged in isolation, it is likely that a 'moderate' or 'substantial' impact will give rise to a significant effect and a 'negligible' or 'slight' impact will not have a significant effect, but such judgements are always more likely to be valid at the two extremes of impact severity. The EPUK/IAQM guidance also advises that for new occupants of a Proposed Development, the impacts are best described in relation to whether or not an air quality objective / limit value will be met or is at risk of not being met. An exceedance of the objective / limit value is likely to be considered significant.

4.92 The EPUK/IAQM guidance notes that overall significance is determined using professional judgement and should consider:

- The existing and future air quality in the absence of development;
- The extent of current and future population exposure to any air quality impacts associated with a Proposed Development;
- The influence and validity of any assumptions made in the assessment approach;
- The cumulative effects arising from other committed developments in the study area; and
- The introduction of new occupants into the Proposed Development and the levels of air pollution to which they are likely to be exposed.

Air Quality Neutral Assessment

4.93 An Air Quality Neutral Assessment has been undertaken using the latest information about the Proposed Development. The methodology and emission factors are taken from the GLA's consultation draft of the Air Quality Neutral guidance [2].The methodology assesses two sources of emissions: road traffic and energy production.

4.94 The Air Quality Neutral Assessment for the road traffic associated with the Proposed Development compares the road traffic related emissions against calculated benchmark values which are based upon the Gross Internal Area (GIA) (m^2) of each land use class and number of anticipated trips per year.

4.95 For building emissions, Building Emissions Benchmarks (BEB) for NO_x and PM_{10} are calculated using information relating to energy/heating supply and GIA (m^2) of each land use class.

Air Quality Damage Cost Calculation

4.96 The LBH requires that air quality damage cost calculations are undertaken for proposed developments, in order to provide an indication of the value of mitigation measures to be applied. The assessment has used guidance published by Defra [49].

Modelling Assumptions

4.97 The following assumptions have been considered in the dispersion modelling assessment:

- Road traffic emissions modelling has used traffic data provided by the project traffic consultants based on traffic counts undertaken in 2019 and factored to the assessment year (2027);
- Road traffic emissions related impact predictions have been checked against baseline monitoring data to capture and adjust for variations in model performance. By carrying out model verification and adjusting the results in line with measured concentrations according to Defra's published guidance, the uncertainty in the predictions for the current baseline is reduced;
- Receptors representative of the location of maximum exposure to air pollutants within an area have been selected to provide a conservative assessment;
- XY coordinates of emission sources, modelled building vertices, etc. are based on best approximation / interpretation from design drawings and publicly-available mapping, projected in ArcMap GIS software;
- Emission source data was derived from a manufacturer specification datasheet for a make / model of generator that could be used for the Proposed Development (though it is noted that the final selection of generator set had not been made at the time of compiling this assessment).
- The Environment Agency's recommends (for permitting rather than planning purposes) multiplying the calculated probability output from a hypergeometric analysis by a factor of 2.5 where the statistical method assumes independent and random operational hours and sources may include continuous operation of more than an hour. Notwithstanding that this is recommended for permitting, it was adopted for the current study to provide a conservative assessment.

5. Predicted Impacts

5.1 The following sections present the results of the dust assessment, air quality neutral assessment and air quality assessment at selected receptors, providing the predicted levels with and without the Development in place, and the differences due to the Development.

Construction Phase

Predicted Effects during Demolition and Construction

5.2 An Air Quality Dust Risk Assessment has been undertaken based on currently available information concerning construction phase activities, in accordance with Mayors SPG [1].

5.3 The residential properties and existing hospital buildings in close proximity to the Site and the construction routes are considered to be of high sensitivity with respect to impacts on both amenity and human health. All other receptors in the study area can be considered to be of medium sensitivity to impacts on both amenity and human health. Taking into account the proximity of sensitive receptors to the Site, and existing PM_{10} concentrations in the area, the study area as a whole is considered to be of a high sensitivity to impacts on dust soiling and medium for human health. It is estimated that there are >100 high-sensitivity receptors (i.e. residential properties, hospitals, schools and residential care homes) within 20 m of the site boundary and, therefore, the dust risk assessment will proceed focussing on human receptors.

5.4 There are no relevant ecological receptors (nationally designated sites) within 50 m of the site boundary, 50 m of the route used by construction traffic or within 500 m of the site entrance. Therefore, ecological receptors have been scoped out of the dust risk assessment.

Table 5-1. Sensitivity of Receptors

Area Affected	Sensitivity	Justification
Dust Soiling	High	There are over 100 high sensitivity receptors within 20 m of the site boundary (including the existing hospital buildings and residential properties). So, in accordance with the GLAs assessment criteria the area is high sensitivity in terms of dust soiling/nuisance.
Human Health	High	There are over 100 high sensitivity receptors within 20 m of the site boundary, however, annual mean PM_{10} concentrations are below 24 µg/m^3. So, in accordance with the GLAs assessment criteria the area is medium sensitivity in terms of health impacts.

Demolition

5.5 The development of the application site will require the demolition of the existing buildings on the site. Total building volume to be demolished is over 50,000 m^3 with the concrete comprising a large quantity of the material to be demolished. Demolition activities will also be occurring over 20 m above ground level. The potential dust emission magnitude for demolition activities is, therefore, considered to be large and, given the sensitivity of the area established in Table 5-1, the Proposed Development is considered to pose a high risk in terms of dust soiling and high risk in term of human health impacts if appropriate mitigation measures are not applied.

Earthworks

5.6 The Proposed Development site area is >10,000 m^2. The potential dust emissions magnitude associated with earthworks is estimated to be large. The Proposed Development is considered to pose a large risk in terms of dust soiling and medium risk in term of human health impacts if appropriate mitigation measures are not applied.

Construction

5.7 The building volume of the Proposed Development is >100,000m^3, so the potential dust emissions magnitude due to construction volume is classified as large. The Proposed Development is considered to pose a large risk in terms of dust soiling and medium risk in term of human health impacts if appropriate mitigation measures are not applied.

Trackout

5.8 The number of construction-related heavy-duty vehicle (HDV) movements generated by the Proposed Development has the potential to exceed 50 movements per day at its peak (~90 HDVs during Q4 2024[2]). Considering the size of the site, the potential dust emissions magnitude for trackout is conservatively assumed to be large. One proposed route[2] would be via the Uxbridge road corridor AQFA. The Proposed Development is considered to pose a high risk in terms of dust soiling and medium risk in term of human health impacts if appropriate mitigation measures are not applied.

Summary

5.9 The dust risk assessment is summarised in Table 5-2 and Table 5-3.

Table 5-2. Summary of Potential Dust Emission Magnitudes for Construction Phase Activities

Activity	Risk Magnitude	Justification
Demolition	Large	Total building volume to be demolished is over 50,000 m^3 with the hospital and associated buildings comprising a large quantity of the material to be demolished. Demolition activities will also be occurring over 20 m above ground level.
Earthworks	Large	Earthworks site area is >10,000 m^2 with some piling works for conservative estimated to be large risk magnitude.
Construction	Large	The construction volume is approximately >100,000 m^3 which would put construction at a risk magnitude of large.
Trackout	Large	The peak number of construction-related heavy-duty vehicle (HDV) movements generated by the Proposed Development may exceed 50 so the risk magnitude is considered to be large.

Table 5-3. Summary Dust Risk

Potential Impact	Risk of Dust Impacts			
	Demolition	Earthworks	Construction	Track out
Dust Soiling	High Risk	High Risk	High Risk	High Risk
Human Health	High Risk	Medium Risk	Medium Risk	Medium Risk

5.10 Overall, the Dust Risk Assessment conservatively identifies the Site as having a ‘high risk’ of causing impacts during demolition and construction activities on the site and mitigation measures consistent with a high-risk site should therefore be implemented. Proposed mitigation measures are, therefore presented in Table 6-1 of Section 6.

Operational Phase

5.11 Concentrations of NO_2, PM_{10}, and $PM_{2.5}$ have been predicted at 65 existing sensitive receptor locations across the study area to assess the potential air quality impacts of increased road traffic emissions during the future assessment year of 2027. The receptor locations have been selected based upon expected changes in road traffic volumes associated with the Proposed Development, and, where possible, to be representative of human exposure.

5.12 In additional a number of receptors have been selected at locations representative of the facade of the Proposed Development in order to assess the suitability of the site in terms of air quality for its intended use as well as to assess the short-term impacts of the generators on the facade of the hospital. Due to the extensive number of receptors modelled the full results tables from the modelling are included as Appendix

[2] Based on the estimated figures reported within the Outline Construction Logistics Plan for The Hillingdon Hospital Development (THHR_01-MMD-XX-XX-RP-U-6000 Revision P02 dated 22/02/2022) produced by Mott MacDonald.

F with the results of the modelling discussed in the following sections. Note that the generator results are based on the most conservative year of the five modelled (i.e. the one which predicts the highest results).

Traffic and Annual Generator Impacts

NO_2

5.13 The modelling presented in Table 8-7, Appendix F, takes account of annual NO_2 contributions from both road emissions associated with the Proposed Development and annual generator emissions (due to testing) to assess impacts at existing off-site receptors. The highest predicted annual mean NO_2 concertation occurs at Receptor R13, located at the junction of Pield Heath Road and Kingstone Lane to the north west of the Site, in both the 'Without' and 'With' Proposed Development scenarios (21.7 µg/m^3 and 21.5 µg/m^3 respectively). While the largest change in NO_2 concentrations as a result of the Proposed Development, 0.1 µg/m^3, occurs at Receptor R10 located on Pield Heath Road to the north east of the Site. Based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development can be described as "negligible" at all modelled sensitive receptor locations.

5.14 Likewise, in the 2027 cumulative scenario the highest predicted annual mean NO_2 concertation (21.7 µg/m^3) occurs at Receptor R13 'With' the cumulative development while the largest change, 0.4 µg/m^3, occurs at Receptor R10. Based on the EPUK / IAQM criteria, the predicted impacts due to the cumulative development can be described as "negligible" at all modelled sensitive receptor locations.

5.15 The proposed emergency generators are predicted to contribute a maximum of 0.1 µg/m^3 at any modelled existing receptor. This maximum contribution occurs at Receptor R61 which is representative of the Modular Ward North on the existing hospital site which will be replaced as part of the outline development. The generators are, therefore, not anticipated to have a significant annual impact on the outline development when that is brought forwards.

5.16 The maximum annual mean NO_2 concentration predicted at any receptor representative of the façade of the Proposed Development is 17.6 µg/m^3 and, as such the hospital site is considered suitable for its intended use. The modelled maximum NO_2 contribution from the emergency generators is predicted to occur on the third floor façade of the proposed hospital building, closest to the generators, where annual process contributions (PC's) are predicted to represent up to 1 µg/m^3.

5.17 As the annual NO_2 predicted concentrations are below 60 µg/m^3, the hourly NO_2 AQS objective is predicted to be achieved at all modelled receptor locations. It should be noted, however, that the short-term operations of the emergency generators have the potential to cause an exceedance of the AQS objective and, therefore, these will be considered separately later in this assessment.

PM_{10}

5.18 All of the predicted PM_{10} concentrations, presented in Table 8-8 Appendix F, are within the AQS objective at modelled receptors. As predicted annual PM_{10} concentrations are less than 32 µg/m^3, the daily AQS objective for PM_{10} is also anticipated to be achieved at all modelled receptor locations. The highest predicted annual mean PM_{10} concentration, 17.9 µg/m^3, is predicted at Receptor R36, located at the junction of the A437 and Lees Road, in the 'Without', 'With' and 'Cumulative' scenarios. The predicted change as a result of the Proposed Development is <0.1 µg/m^3 at all modelled receptors, as is the change associated with the cumulative development. Therefore, based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development can be described as "negligible" at all modelled sensitive receptor locations.

5.19 The WHO guideline values for annual PM_{10} (15 µg/m^3) is predicted to be exceeded at the majority of modelled receptors in both the 'Without' and 'With' scenarios. It should be noted that the 2019 Defra mapped background PM_{10} concentration used within this assessment, range from 14.9 to 15.5 µg/m^3 and, as such, already exceed the WHO guideline values irrespective of roadside vehicle emissions. The maximum predicted contributions (road traffic and generator emissions) from both the Proposed Development and Cumulative Development represents <0.1% of the WHO guideline value and, as such, the Proposed Development is not considered to have a significant effect on PM_{10} concentrations at any modelled receptor location when assessed against the WHO standard.

5.20 The maximum annual mean PM_{10} concentration predicted at any receptor, representative of the façade of the Proposed Development, is 15.2 µg/m^3. As predicted annual PM_{10} concentrations are less than 32 µg/m^3, the daily AQS objective for PM_{10} is anticipated to be achieved on the Site. The hospital site is, therefore, considered suitable for its intended use. The modelled maximum PM_{10} contribution from the emergency generators is predicted to occur on the third floor façade of the proposed hospital building, closest to the generators, where annual process contributions (PC's) are predicted to represent up to <0.1 µg/m^3.

$PM_{2.5}$

5.21 All of the predicted $PM_{2.5}$ concentrations, presented in Table 8-9 Appendix F, are within the AQS objective at modelled receptors. The highest predicted annual mean $PM_{2.5}$ concentration, 11.8 µg/m^3, is predicted at Receptor R36 in the 'Without', 'With' and 'Cumulative' scenarios. The predicted change as a result of the Proposed Development is <0.1 µg/m^3 at all modelled receptors, as is the change associated with the cumulative development. Therefore, based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development can be described as "negligible" at all modelled sensitive receptor locations.

5.22 The WHO guideline values for annual $PM_{2.5}$ (5 µg/m^3) is predicted to be exceeded at all modelled receptors in both the 'Without' and 'With' scenarios. It should be noted that the 2019 Defra mapped background $PM_{2.5}$ concentration used within this assessment, range from 10.0 to 10.4 µg/m^3 and, as such, already exceed the WHO guideline values irrespective of roadside vehicle emissions. The maximum predicted contributions (road traffic and generator emissions) from both the Proposed Development and Cumulative Development represents <0.1% of the WHO guideline value and, as such, the Proposed Development is not considered to have a significant effect on $PM_{2.5}$ concentrations at any modelled receptor location when assessed against the WHO standard.

5.23 The maximum annual mean $PM_{2.5}$ concentration predicted at any receptor, representative of the façade of the Proposed Development, is 10.3 µg/m^3. The hospital site is, therefore, considered suitable for its intended use. The modelled maximum $PM_{2.5}$ contribution from the emergency generators is predicted to occur on the third floor façade of the proposed hospital building, closest to the generators, where annual process contributions (PC's) are predicted to represent up to <0.1 µg/m^3.

Short-term Generator Emissions

Hourly Mean NO_2

5.24 The short-term modelling, presented in Table 8-10 of Appendix F, shows that based on a worst-case assumption that the emergency generators operate for a full 8,760 hours per year there is the potential that the 1-hour mean PEC (which represent the 99.79th percentile or 19th highest 1-hour NO_2 concentration) could exceed the AQS objective for NO_2 (200 µg/m^3 not to be exceeded more than 18 times per year) at Receptors R1, R7, R48 and R59 to R63. The modelled PECs at these receptors range from 210.3 µg/m^3 to 294.4 µg/m^3 with the highest concentration predicted at Receptor R62. These receptors are all located very close to the Site and show that the AQS could be exceeded if the emergency generators were to be operational for the 19 hours that coincide with the worst-case dispersion from the generator stacks, however, given that the generators will only be tested for up to 14 hours per year it is extremely unlikely.

5.25 To demonstrate how unlikely this is a statistical analysis of predicted hourly concentrations at Receptor R61 has been undertaken using the hypergeometric distribution methodology recommended by the Environment Agency. Receptor R61 has been modelled rather than R62, as while the highest 99.79th percentile is predicted at Receptor R62, there are more exceedances of the 200 µg/m^3 limit predicted in any one year at R61, making it more applicable when calculating the statistical likelihood that the AQS objective may be exceeded.

5.26 Using 2017 meteorological data (the year that gives the maximum concentration at Receptor R61) the statistical analysis of hourly modelled results show that based on the generators operating every hour of the year, the PEC could exceed 200 µg/m^3 up to 347 times (347 hours out of the total 8,760 hours of emissions modelled which represents 4% of the modelled hours), however, when the actual hours of operation are considered, i.e. the fact the generators will be tested for 14 hours, the statistical likelihood that the AQS objective would be exceeded is <0.1%, well below the 5% that the Environment Agency considers to represent a potential exceedance. In fact, the generators would have to operate for more than 287 hours each year before the statistical likelihood that the generators would exceed the AQS objective at Receptor R61 in a 20 year period would exceed the 5% limit set by the Environment Agency.

5.27 The modelling has also shown the potential that the AQS objective could be exceeded at the façade of the new hospital with a maximum PEC of 4,387 µg/m^3 predicted at a receptor location representing the second floor of the hospital closest to the generator stacks. Once more a statistical analysis of the potential that the

AQS objective will be exceeded at the façade of the hospital has been undertaken and this has shown that PECs could exceed 200 µg/m^3 up to 813 times (813 hours out of the total 8,760 hours of emission modelled which represents 9.3% of the modelled hours), however, the statistical analysis has shown that the generators would have to operate for more than 124 hours each year before the risk that the AQS objective would be exceeded would be 5% or more.

5.28 On the basis of this analysis the proposed emergency generators are not anticipated to result in an exceedance of the short-term AQS objective for NO_2 at existing receptors nor at the façade of the proposed hospital building.

Daily Mean PM_{10}

5.29 The modelled results, presented in Table 8-10 of Appendix F, show that even if the emergency generators are assumed to operate for 8,760 hours per year they would not cause an exceedances of the 24-hour mean AQS objective for PM_{10} (50 µg/m^3 not to be exceeded more than 35 times per year) with the maximum PC of 0.9 µg/m^3 (representing 2% of the AQS objective and, as such, can be considered insignificant in accordance with the Environment Agency screening criteria) predicted at Receptor R61, while the maximum PEC, 31.1 µg/m^3, is predicted at R41.

5.30 Likewise, the maximum PC predicted on the second floor façade of the proposed hospital closest to the generators is 10.4 µg/m^3 (representing 21% of the AQS objective) and the PEC is 40.3 µg/m^3. As such even based on a worst-case assumption that the generators run constantly throughout the year the 24-hour AQS objective will not be exceeded, especially given that the generators will only operate for 14 hours per year for testing (a maximum of three hours in any one 24 hour period), significantly less than the 35 days over which an exceedance of the AQS objective is calculated.

Fifteen Minute Mean SO_2

5.31 The modelled results, presented in Table 8-10 of Appendix F, show that even if the emergency generators are assumed to operate for 8,760 hours per year they would not cause an exceedances of the 15-minute mean AQS objective for SO_2 (266 µg/m^3 not to be exceeded more than 35 times per year) with the maximum PC of 43 µg/m^3 (representing less than 20% of the AQS objective, minus twice background pollutant concentrations, and, as such, can be considered insignificant in accordance with the Environment Agency screening criteria) and maximum PEC of 52.2 µg/m^3, both predicted to occur at Receptor R62.

5.32 The maximum PC, 805 µg/m^3, is predicted on the top floor façade of the proposed hospital building closest to the generators, with the resultant PEC predicted to be 814 µg/m^3, indicating that the 15 minute AQS objective for SO_2 could be exceeded at the facade of the hospital building closest to the generator stacks. Undertaking a hypergeometric distribution analysis of the modelled hours using the 2016 meteorological data (the year that gave the highest concentration) has shown that assuming the generators operate all the time the PEC could exceed 266 µg/m^3 on 77 occasions (77 hours out of the modelled 8,784, equivalent to 308 15-minute periods in a year). Based on the generators operating for 14 hours (56 15-minute periods) the statistical likelihood that the AQS objective would be exceeded is <0.1%. In order to exceed the 5% risk of exceedance level set by the Environment Agency, the generators would have to operate for over 180 hours (720 15-minute periods) per year.

5.33 On the basis of this analysis the proposed emergency generators are not anticipated to result in an exceedance of the 15-minute AQS objective for SO_2 at existing receptors nor at the façade of the proposed hospital building.

Hourly Mean SO_2

5.34 The modelled results, presented in Table 8-10 of Appendix F, show that even if the emergency generators are assumed to operate for 8,760 hours per year they would not cause an exceedances of the 1-hour mean AQS objective for SO_2 (350 µg/m^3 not to be exceeded more than 24 times per year) with the maximum PC of 27.2 µg/m^3 (representing less than 10% of the AQS objective, and, as such, can be considered insignificant in accordance with the Environment Agency screening criteria) and maximum PEC of 36.4 µg/m^3, both predicted to occur at Receptor R62.

5.35 The maximum PC, 461 µg/m^3, is predicted on the third floor façade of the proposed hospital building closest to the generators, with the resultant PEC predicted to be 470 µg/m^3, indicating that the 1-hour mean AQS objective for SO_2 could be exceeded at the facade of the hospital building closest to the generator stacks if the generators were to operate for an extended period. However, it should be noted that the generators will be tested for a maximum of 14 hours per year and so even if tested under the worst-conditions the AQS objective would not be exceeded given that the standard allows up to 24 hours above 350 µg/m^3.

5.36 Undertaking a hypergeometric distribution analysis of the modelled hours using the 2015 meteorological data (the year that gave the highest concentration) has shown that assuming the generators operate all the time the PEC could exceed 350 µg/m^3 on 248 occasions (248 hours out of the total 8,760 hours of emissions modelled which represents 2.8% of the modelled hours). Based on the generators operating for 14 hours the statistical likelihood that the AQS objective would be exceeded is <0.1%. In order to exceed the 5% risk of exceedance level set by the Environment Agency, the generators would have to operate for over 572 hours per year.

5.37 On the basis of this analysis the proposed emergency generators are not anticipated to result in an exceedance of the 1-hour AQS objective for SO_2 at existing receptors nor at the façade of the proposed hospital building.

Daily Mean SO_2

5.38 The modelled results, presented in Table 8-10 of Appendix F, show that even if the emergency generators are assumed to operate for 8,760 hours per year they would not cause an exceedances of the 24-hour mean AQS objective for SO_2 (125 µg/m^3 not to be exceeded more than 3 times per year) with the maximum PC of 12.7 µg/m^3 (representing less than 20% of the AQS objective, minus twice background pollutant concentrations, and, as such, can be considered insignificant in accordance with the Environment Agency screening criteria) and maximum PEC of 21.9 µg/m^3, both predicted to occur at Receptor R61.

5.39 The maximum PC, 173 µg/m^3, is predicted on the third floor façade of the proposed hospital building closest to the generators, with the resultant PEC predicted to be 182 µg/m^3, indicating that the 24-hour mean AQS objective for SO_2 could be exceeded at the facade of the hospital building closest to the generator stacks if the generators were to operate for an extended period. However, it should be noted that the generators will be tested for a maximum of 3 hours in any 24-hour period, therefore, it is extremely unlikely that the AQS objective would be exceeded. To demonstrate this the maximum hourly SO_2 PC predicted at the façade of the hospital is 470 µg/m^3 if this were multiplied by 3 and the resultant number divided by 24, to represent the three hours of operation in any one 24-hour period, the resultant PC would be 61.5 µg/m^3 and so well below the 24-hour AQS objective of 125 µg/m^3. Even when double the annual background SO_2 concentration is take into account, the maximum daily PEC, 93.9 µg/m^3, would still be below the AQS objective.

5.40 On the basis of this analysis the proposed emergency generators are not anticipated to result in an exceedance of the 24-hour AQS objective for SO_2 at existing receptors nor at the façade of the proposed hospital building during routine testing.

Running Eight Hour Mean CO

5.41 The modelled results, presented in Table 8-10 of Appendix F, show that even if the emergency generators are assumed to operate for 8,760 hours per year they would not cause an exceedances of the running 8-hour mean AQS objective for CO (10,000 µg/m^3) with the maximum PC of 53.4 µg/m^3 (representing less than 10% of the AQS objective and, as such, can be considered insignificant in accordance with the Environment Agency screening criteria) and maximum PEC of 917 µg/m^3, both predicted to occur at Receptor R61.

5.42 Likewise, the maximum PC, 1,039 µg/m^3 (representing less than 20% of the AQS objective, minus twice background pollutant concentrations, and, as such, can be considered insignificant in accordance with the Environment Agencies screening criteria) is predicted on the sixth floor façade of the proposed hospital building closest to the generators and the PEC is 1,048 µg/m^3. As such even based on a worst-case assumption that the generators run constantly throughout the year the running 8-hour AQS objective for CO will not be exceeded, especially given that the generators will only be tested for a maximum of three hours in any one day, significantly less than the 8-hours averaging period used to determine compliance with the AQS objective.

Air Quality Neutral Results

5.43 In order to address the GLA's policy for new developments to be 'air quality neutral' emissions for the Proposed Development were estimated, and used to evaluate its performance against site-specific benchmark values from the GLAs consultation draft Air Quality Neutral guidance [2]. The Proposed Development consists of a new seven story building, plus roof top plant room and basement, and a new multi storey car park offering 950 parking spaces.

5.44 The Air Quality Guidance cites TRAVL database derived trip generation rates for care homes and hospitals. The Proposed Development is located within Outer London. Consequently, the most appropriate trip generation rate for Care homes and hospitals in outer London (19.5 trips/m^2/annum) was multiplied by the Gross Internal Area (GIA) of the Proposed Development (17,000 m^2) to calculate the annual Transport Benchmark of 331,500 trips per annum'

5.45 The total number of trips generated by the Proposed Development, 9,072 trips per annum as provided by the projects transport consultants based on Scenario 2 traffic generation numbers, is less than the benchmark value (331,500) as described within the Air Quality Neutral guidance, and as such the Proposed Development can be considered to be air quality neutral for transport-related emissions.

5.46 The Proposed Development does not contain an energy centre. Heating and hot water for the Proposed Development will be derived from ground source heat pumps and/or air source heat pumps[3] which do not have emissions to air.

5.47 The Proposed Development includes four diesel fired standby generators located to the south of the hospital building. With the exception of testing the generators are only for emergency use and will not be used for commercial power generation. Barring an emergency, the generators are anticipated to operate for up to 14 hours per year for testing consisting of, 1 hour per month for 11 months and 3 hours for one month. The Air Quality Neutral guidance states that, "*Backup plant installed for emergency and life safety power supply, such as diesel generators, may be excluded from the calculation of predicted building emissions. Normally, it would be expected that the use of these generators for anything other than an emergency and operational testing (less than 50 hours per year) would be prevented by planning condition.*"

5.48 The Proposed Development is, therefore considered air quality neutral for both transport and building related emissions.

Damage Cost Assessment

5.49 LBH requires that an environmental damage cost calculation be carried out to estimate the equivalent monetary 'damage cost' value of development-related emissions.

5.50 Both vehicle and generator emissions have been calculated for the Proposed Development and have been used in conjunction with the latest damage cost guidance and tools [49] to consider NO_x and $PM_{2.5}$ emissions associated with the first five years of operation of the Proposed Development (2027 to 2031). The key emissions-related input parameters used for the calculation are presented in Table 5-4 and Table 5-6, while the results of the assessment are presented in Table 5-5 for the generators and Table 5-7 for the roads emissions.

Table 5-4. Input Data for Calculation of Generator Related Emissions

Testing	Duration of Operation (hours)	Frequency per Year	NOx Emission Rate (kg/hour)	PM2.5 Emission Rate (kg/hour)
Monthly Testing	1	11	19.67	0.03
Annual Testing	3	1	19.67	0.03

[3] Information regarding the heating and hot water has been taken from the Hillingdon Hospital Redevelopment: RIBA Stage 2 MEP Report (Document Number: THHR_01-ACM-ZZ-XX-RP-BS-0001 - Stage 2 Report – Hospital)

Table 5-5. Damage Cost Estimate of Emergency Generator Related Emissions (routine testing only)

Parameter	Result	Notes
5-Year NO_x Emissions	5.507 tonnes	5-year emissions total for 4 generator sets
5-Year $PM_{2.5}$ Emissions	0.009 tonnes	5-year emissions total for 4 generator sets
5-Year Damage Cost NO_x	£45,843	5-year damage cost (central present value) for 4 generator sets
5-Year Damage Cost $PM_{2.5}$	£845	5-year damage cost (central present value) for 4 generator sets
Total 5-Year Damage Cost	£46,688	-

Table 5-6. Input Data for Calculation of Transport Related Emissions

Parameter	Value	Notes
EFT Spreadsheet Tool	Defra EFT v11.0	
Daily Vehicle Trips Generated	9,072 AADT	Proposed Development 2027
Average Vehicle Speed	50 km/h	Average speed value recommended in Defra guidance
Road Link Length	10 km	NTS UK average value recommended in Defra guidance.
Price Base Year	2022	
Appraisal Start Year	2027	Development Opening Year
Appraisal End Year	2031	End of 5 year assessment period
NO_x and $PM_{2.5}$ Damage Costs Used	Road Transport	2022 base year costs were rebased to 2027 (start of evaluation period) and additionally uplifted to the assessment years according to Defra guidance

Table 5-7. Damage Cost Estimate of the Proposed Development-Related Traffic Emissions

Parameter	Result	Notes
5-Year NO_x Emissions	21.7 tonnes	5-year emissions total for Hospital related road traffic only
5-Year $PM_{2.5}$ Emissions	2.8 tonnes	5-year emissions total for Hospital related road traffic only
5-Year Damage Cost NO_x	£178,783	5-year damage cost (central present value)
5-Year Damage Cost $PM_{2.5}$	£271,831	5-year damage cost (central present value)
Total 5-Year Damage Cost	£450,615	-

5.51 The total 5-year damage cost associated with routing generator testing is estimated at £46,688, whilst the total 5-year environmental damage cost associated with traffic related emissions is £450,615.

5.52 It should be noted however that the existing hospital trips (10,209 AADT) in a 'Do Minimum' Scenario exceed the combined trip generation of the Proposed Development and outline development of 9,822 AADT movements. As such, the Proposed Development actually results in a reduction in vehicle movements in the vicinity of the site. If this were to be put into damage cost terms the existing land use has an estimated total damage cost of £507,091 while the Proposed Development and outline development estimated total damage cost is predicted to be £487,868. As such, the redevelopment of the existing hospital site actually results in a £19,223 reduction in damage costs in terms of transport emission to air or a total increase of just £27,465 once emissions from the emergency generator testing are accounted for.

5.53 The selection of measures to be adopted to mitigate air quality impacts of the development shall be subject to further discussion and agreement between the Applicant and LBH. LBH advises that damage cost figures should be used to guide the Applicant's investment/expenditure on commensurate measures to mitigate the likely impacts on local air quality, as far as reasonably practicable.

6. Mitigation Measures

Construction Phase Mitigation Measures

6.1 Based on the results of the dust risk assessment, the following mitigation measures are recommended by the Mayors SPG [1] for High Risk Sites. It is recognised that not all of the recommended measures maybe be appropriate or feasible for all high-risk sites. It is provided to recommend the desirable mitigation and is intentionally designed not to limit mitigation that is finally selected by the demolition/construction company to avoid issues once the planning is agreed. The dust controls are generally agreed after planning as a condition with the requirement that the demolition/construction company issue a dust management plan (DMP) or Construction Environmental Management Plan (CEMP) prior to works commencing on site.

Table 6-1. Construction Phase Dust and PM_{10} Mitigation Measures

Mitigation Measure	Highly Recommended (H) / Desirable (D)
Site Management	
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
Develop a Dust Management Plan.	H
Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary.	H
Display the head or regional office contact information.	H
Record and respond to all dust and air quality pollutant emissions complaints.	H
Make a complaint log available to the local authority when asked.	H
Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority when asked.	H
Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry or windy conditions.	H
Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.	H
Hold regular liaison meetings with other high-risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.	H
Preparing and Maintaining the Site	
Plan site layout: machinery and dust causing activities should be located away from receptors.	H
Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site.	H
Fully enclosure site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	H
Install green walls, screens or other green infrastructure to minimise the impact of dust and pollution.	D
Avoid site runoff of water or mud.	H
Keep site fencing, hoarding, barriers and scaffolding clean using wet methods.	H
Remove materials from site as soon as possible.	H
Cover, seed or fence stockpiles to prevent wind whipping.	H
Avoid double handling of material wherever reasonably practicable.	H
Carry out regular dust soiling checks of buildings within 100m of site boundary and cleaning to be provided if necessary.	H
Provide showers and ensure a change of shoes and clothes are required before going off-site to reduce transport of dust.	D

Mitigation Measure	Highly Recommended (H) / Desirable (D)
Agree monitoring locations with the Local Authority.	H
Where possible, commence baseline monitoring at least three months before phase begins.	H
Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly.	H
Operating Vehicle/Machinery and Sustainable Travel	
Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone.	H
Ensure all non-road mobile machinery (NRMM) comply with the standards set within this guidance.	H
Ensure all vehicles switch off engines when stationary – no idling vehicles.	H
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where possible.	H
Impose and signpost a maximum-speed-limit of 10mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	H
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	H [4]
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	H
Loading of material into lorries within designated bay.	H
Plant working on site to have exhausts positioned such that the risk of re-suspension of ground dust is minimised (exhausts should preferably point upwards), where reasonably practicable.	H
Ensure all vehicles carrying loose or potentially dusty material to or from the site are fully sheeted.	H
Use ultra-low sulphur fuels in plant and vehicles.	H
Operations	
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H
Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible).	H
Use enclosed chutes, conveyors and covered skips.	H
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H
Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
Waste Management	
Reuse and recycle waste to reduce dust from waste materials	H
Avoid bonfires and burning of waste materials.	H
Measures Specific to Demolition	
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)	H
Ensure water suppression is used during demolition operations.	H
Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H
Bag and remove any biological debris or damp down such material before demolition.	H
Measures Specific to Earthworks	
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces.	H
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil.	H

[4] An Outline Construction Logistics Plan for The Hillingdon Hospital Development (THHR_01-MMD-XX-XX-RP-U-6000 Revision P02 dated 22/02/2022) has been produced by Mott MacDonald.

Mitigation Measure	Highly Recommended (H) / Desirable (D)
Only remove secure covers in small areas during work and not all at once.	H
Measures Specific to Construction	
Avoid scabbling (roughening of concrete surfaces) if possible	H
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place	H
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	H
For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	D
Measures Specific to Trackout	
Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.	H
Avoid dry sweeping of large areas.	H
Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.	H
Record all inspections of haul routes and any subsequent action in a site log book.	H
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned.	H
Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable	H
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
Access gates to be located at least 10m from receptors where possible.	H
Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site	H

Source: GLA Construction and Demolition Dust SPG

Operational Phase Mitigation Measures

6.2 The Proposed Development is predicted to have a negligible impact on local air quality and the site is considered suitable for its intended use. As such, no mitigation measures are required, in terms of air quality, during the operational phase of the Proposed Development.

7. Conclusions

7.1 A summary of the overall findings of the dust assessment, air quality neutral and air quality assessment are presented below with recommendations on mitigation measures if required.

Construction Phase

7.2 The results of the construction phase assessment indicate that, in the absence of mitigation, construction phase impacts associated with the Proposed Development, such as removal/demolition of existing structures, earthworks, construction and track-out can be described as high risk to dust soiling and human health. There are a range of mitigation measures which can be followed to reduce the nuisance and human-health impacts of the dust and PM_{10}, which, if effectively implemented, can reduce to an insignificant level. Appropriate mitigation measures are set out in Appendix D and should be implemented through a DMP or CEMP.

7.3 Local air quality is considered unlikely to be significantly affected during the construction phase of the Proposed Development as a result of vehicle emissions. Any impacts would be considered short term and temporary in nature and therefore not significant.

Operational Phase

7.4 The operational impact of the Proposed Development on local air quality was assessed at 65 receptor locations. Predicted annual mean NO_2 and PM_{10} concentrations are predicted to be below the applicable AQS objective of 40 µg/m^3 at all the receptors included within the dispersion modelling in both the 'Without' and 'With' development scenarios. Annual mean $PM_{2.5}$ concentrations are predicted to be below 20 µg/m^3 at all modelled receptors in both the 'Without' and 'With' scenarios.

7.5 The impact of the Proposed Development at all existing receptor locations is negligible, in accordance with the IAQM/EPUK significance criteria applied in this assessment. Overall, the Proposed Development operational traffic impacts on local air quality are considered to be not significant.

7.6 The Proposed Development is predicted to have a negligible impact on local air quality and the site is considered suitable for its intended use. As such, no mitigation measures are required, in terms of air quality, during the operational phase of the Proposed Development.

7.7 The modelled results show that all predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are well below their respective AQS objectives at all receptors modelled. As all modelled annual mean NO_2 concentrations are additionally predicted to be below 60 µg/m^3, the hourly AQS objective for NO_2 is also anticipated to be achieved on the site. Likewise, daily PM_{10} concentrations are predicted to be below 32 µg/m^3 and, as such, the 24-hour PM_{10} AQS objective is also anticipated to be achieved at all modelled receptor locations. The Proposed Development is, therefore, considered to be appropriate, in terms of air quality, for its proposed use.

7.8 Short-term impacts of the emergency generators have also been assessed. While the modelling has shown the potential for the generators to result in an exceedance of the short-term NO_2 AQS objective at eight existing receptors and at the facade of the hospital building itself, this is based on a worst-case assumption that the generators will operate for 8,760 hours per year, which is unrealistic given that, except for emergency use, the generators will only operate for up to 14 hours per year for testing purposes. A statistical analysis of the modelled results, undertaken in line with the methodology recommended by the Environment Agency, has shown that the statistical likelihood that testing the generators for 14 hours per year will causing an exceedance of the AQS objective in the next twenty years is <0.1% and, therefore, highly unlikely statistically.

7.9 The modelling has also shown the potential for the short-term AQS objectives for SO_2 and CO to be exceeded at the façade of the hospital building if the generators are operational for 8,760 hours per year. However, once more a statistical analysis of the modelled results has shown that in reality, as the generators are only operational for 14 hours per year for testing, the likelihood that the AQS objectives will be exceeded in the next twenty years is <0.1% and, therefore, highly unlikely statistically.

Air Quality Neutral

7.10 The Proposed Development does not contain an energy centre or boilers. For the provision of heating and hot water, the Proposed Development will use ground and air source heat pumps and reverse cycle heat pumps which do not have emissions to air. The Proposed Development does include four diesel-fired emergency generators; however, these are only for emergency use to provide power to life critical systems in the event of a power cut or other emergency. The generators will be tested once a month for one hour and once a year for up to three hours. The air quality neutral guidance explicitly excludes the assessment of emissions from plant installed for emergency and life safety power supply and, as such, these have not been considered further. The Proposed Development can, therefore, be considered air quality neutral for building-related emissions.

7.11 The total number of trips generated by the Proposed Development, 9,072 trips per annum as provided by the projects transport consultants based on Scenario 2 traffic generation numbers, is less than the benchmark value (331,500 trips per year). The Proposed Development can, therefore, be considered air quality neutral for transport-related emissions.

Damage Cost Calculation

7.12 Vehicle and generator emissions have been calculated for the Proposed Development and have been used in conjunction with the latest damage cost guidance and tools [49] to consider NO_x and $PM_{2.5}$ emissions associated with the first five years of operation of the Proposed Development (2027 to 2031).

7.13 The total 5-year damage cost associated with routing generator testing is estimated at £46,688, whilst the total 5-year environmental damage cost associated with traffic related emissions is £450,615. However, it should be noted that this is based on the hospital being a new development and ignoring the traffic flows already associated with the existing hospital. As the traffic flows associated with the Proposed Development (Proposed Development and outline development) are actually lower than those assonated with the current land use the transport related damage cost of the Proposed Development is actually £19,223 less than if the existing hospital were to continue with no redevelopment while, once the generator testing emission are taken not account, the total change would be an increase in damage costs of just £27,465 in comparison to the existing land use.

7.14 Any measures to be adopted to mitigate air quality impacts of the development shall be subject to further discussion and agreement between the Applicant and LBH.

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Appendix A Figures

AECOM

PROJECT
NHS SBS Hillingdon Hospital

CLIENT
NHS

CONSULTANT
AECOM Limited
Sunley House, 4 Bedford Park,
Croydon, CR0 2AP
United Kingdom
T +44 (0)20 8639 3500
www.aecom.com

LEGEND
- Hillingdon Diffusion Tube Network
- AECOM Monitoring
- Phase 1 Site Boundary
- Phase 2 Site Boundary
- Modelled Road Network

NOTES
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ISSUE PURPOSE
FINAL

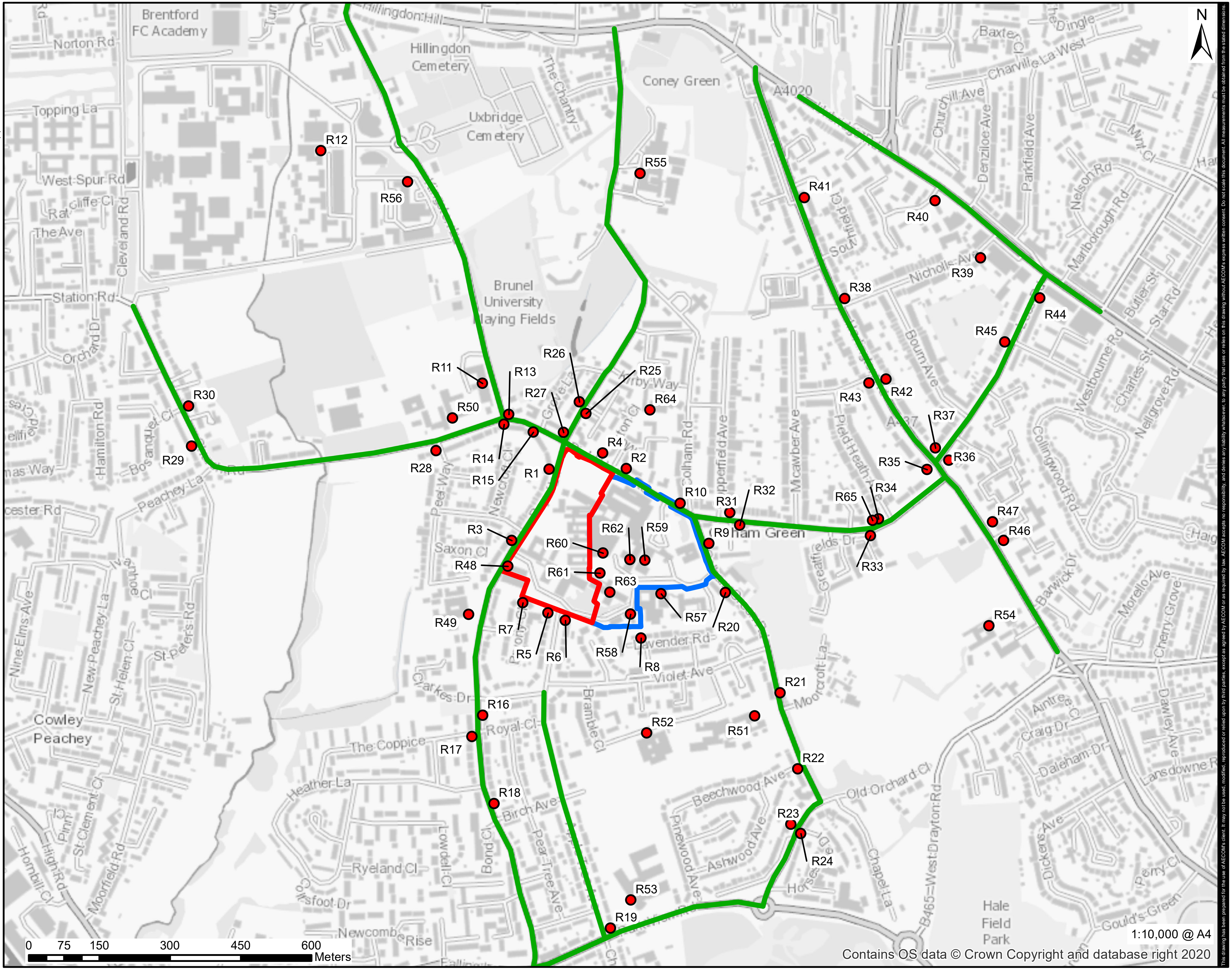
PROJECT NUMBER
60642181

SHEET TITLE
Monitoring Locations and Proposed Development

SHEET NUMBER
Figure 1

Revision: Rev No.1 Drawn: HN Checked:ZA Approved: PF Date: 10/02/2022

Revision: Rev No.1 Drawn: HN Checked:ZA Approved: PF Date: 10/02/2022



AECOM

PROJECT

NHS SBS Hillingdon Hospital

CLIENT

NHS

CONSULTANT

AECOM Limited
Sunley House, 4 Bedford Park,
Croydon, CR0 2AP
United Kingdom
T +44 (0)20 8639 3500
www.aecom.com

LEGEND

- Receptors
- Modelled Road Network
- Phase 1 Site Boundary
- Phase 2 Site Boundary

NOTES

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60642181

SHEET TITLE

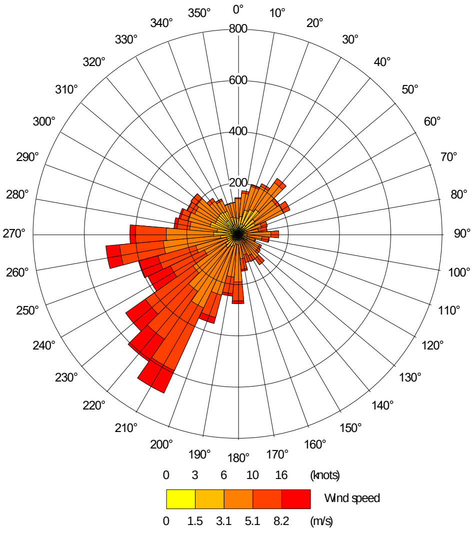
Modelled Receptors

SHEET NUMBER

Figure 2

Figure 3. Wind Roses from Heathrow Meteorological Station, 2015 - 2019

2015



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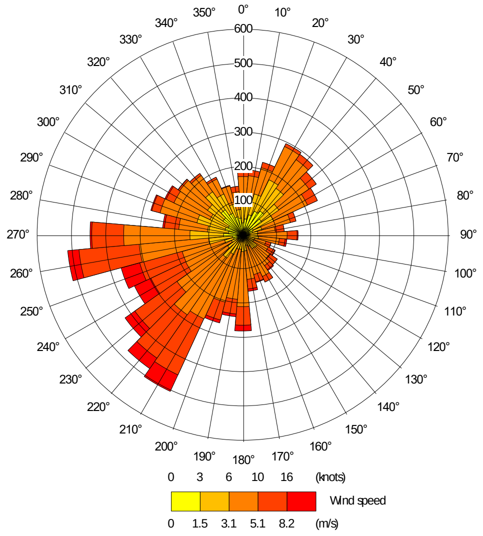

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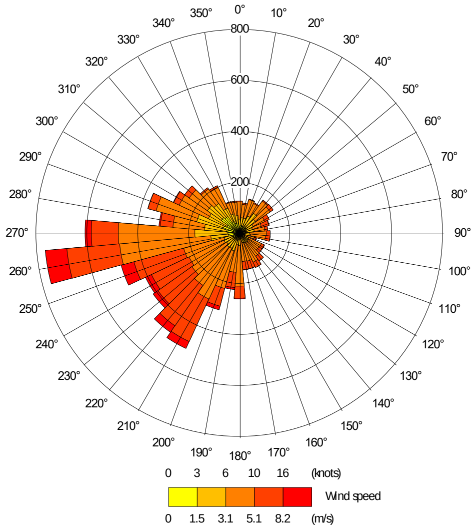
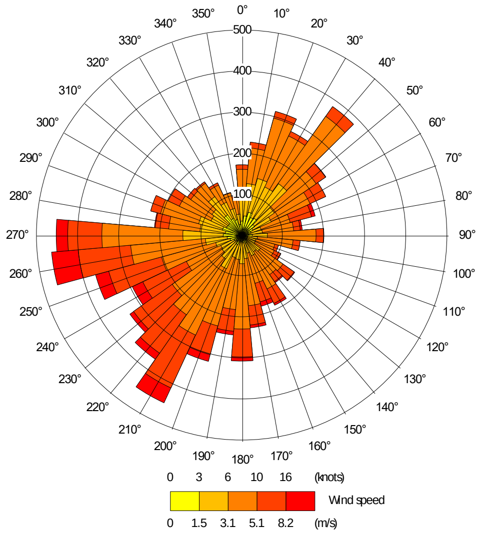
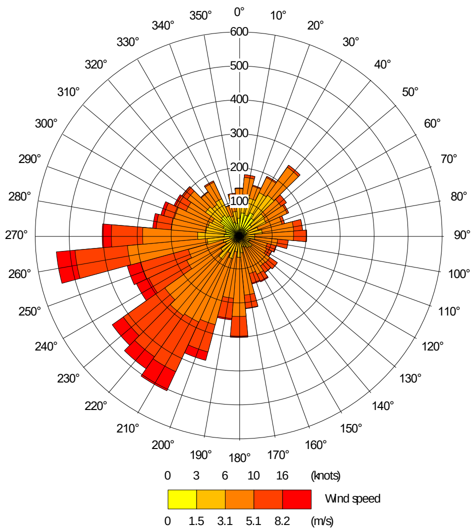


2018



2019



Revision: Rev No.1 Drawn: HN Checked: ZA Approved: PF Date: 14/02/2022

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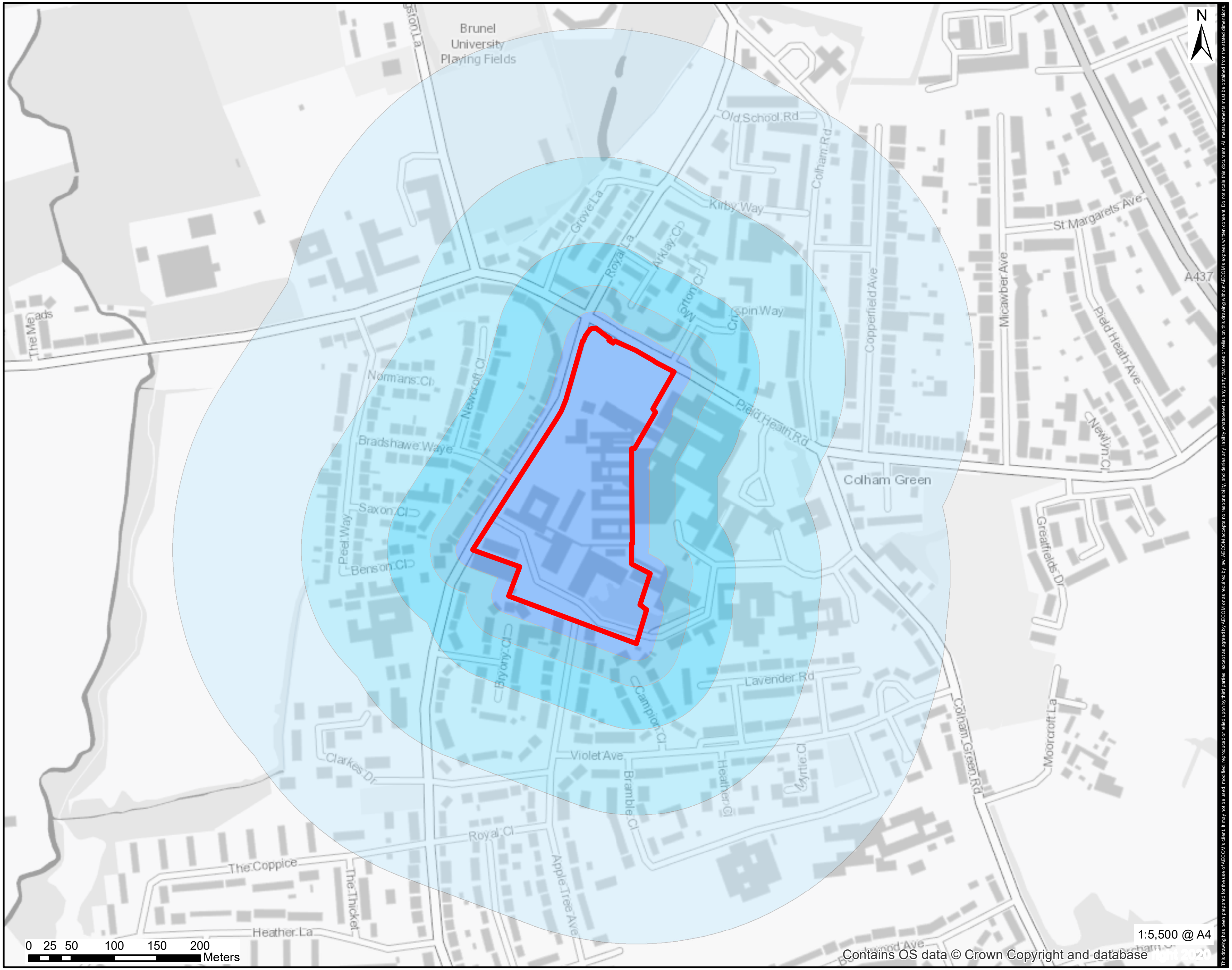

AECOM

PROJECT

NHS SBS Hillingdon Hospital

CLIENT

NHS

CONSULTANT

AECOM Limited
Sunley House, 4 Bedford Park,
Croydon, CR0 2AP
United Kingdom
T +44 (0)20 8639 3500
www.aecom.com

LEGEND

Phase 1 Site Boundary

Construction Dust Assessment Buffer Zones (m)

- 0 to 20
- 20 to 50
- 50 to 100
- 100 to 200
- 200 to 350

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ISSUE PURPOSE

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PROJECT NUMBER

60642181

SHEET TITLE

Construction Dust Assessment Zones

SHEET NUMBER

Figure 4

Appendix B Full results of AECOM Monitoring

Table 8-1. Summary of Annualisation for 2021 Monitoring Results

Site	Raw Result (µg/m³)			Periods mean (3-month Average, (µg/m³)	2021 Unbiased Annualised means (µg/m³)	2021 Bias Adjusted Annualised means (µg/m³)
	Feb	Mar	Apr			
DT1	32.8	36.4	32.4	33.9	29.0	24.3
DT2	35.8	32.2	31.2	33.1	28.3	23.7
DT3	41.3	40.4	34.1	38.6	33.0	27.7
DT4	30.5	26.5	23.6	26.9	23.0	19.3
DT5	37.1	35.5	32.9	35.2	30.1	25.3
DT6	47.5	44.9	40.2	44.2	37.8	31.7
DT7	34.7	32.1	28.8	31.9	27.3	22.9
DT8	35.0	26.9	23.7	28.5	24.4	20.5
DT9	29.7	23.9	22.2	25.3	21.6	18.1
DT10	37.6	36.7	35.5	36.6	31.3	26.3

The three-month monitoring survey was carried out between start of February to start of May during 2021. Results of the survey are provided in Table 8-1, along with the annualisation factors in Table 8-2 used to convert the data into annual mean NO2 concentrations for 2021. A bias adjustment factor of 0.84 was applied. Note this is the 2020 national bias adjustment factor for Gradko tubes prepared using method 50% in Acetone, as the 2021 national bias adjustment factor is not yet available.

Table 8-2. Annualisation summary

	Hillingdon Sipson	London Haringey Prior Park South AURN	Reading New Town AURN	
Period Mean (3-months, µg/m³)	20.9	19.4	24.5	
Annual Mean (2021, µg/m³)	18.2	17.3	19.7	
Ratio (Annual mean/ Period Mean)	0.870	0.892	0.803	**Average Ratio = 0.855**

Appendix C Receptors

Table 8-3. Modelled Receptor Locations

ID	Receptor	X	Y	Height (m)	Receptor Type
R1	107 Royal Lane	506700	181998	1.5	Residential
R2	30 Crispin Way	506864	182000	1.5	Residential
R3	65 Royal Lane	506621	181847	1.5	Residential
R4	14 Morton Close	506814	182033	1.5	Residential
R5	121 Apple Tree	506697	181694	1.5	Residential
R6	134 Apple Tree	506734	181678	1.5	Residential
R7	10 Bryony Close	506644	181715	1.5	Residential
R8	11 Lavender Road	506895	181640	1.5	Residential
R9	1 Colham Green	507039	181841	1.5	Residential
R10	John Rich House, 50 Crispin Way	506978	181926	1.5	Residential
R11	Marian House Nursing Home	506559	182181	1.5	Residential
R12	Brunel University Halls - Bishop Hall	506216	182674	1.5	Residential
R13	124 Pield Heath Road	506615	182115	1.5	Residential
R14	177 Pield Heath Road	506604	182094	1.5	Residential
R15	157 Pield Heath Road	506666	182077	1.5	Residential
R16	96 Royal Lane	506559	181477	1.5	Residential
R17	31 Royal Lane	506536	181432	1.5	Residential
R18	42 Royal Lane	506583	181290	1.5	Residential
R19	145 Park View Road	506830	181025	1.5	Residential
R20	4 Colham Green	507074	181737	1.5	Residential
R21	8 Colham Green	507190	181524	1.5	Residential
R22	5 Beechwood Avenue	507227	181363	1.5	Residential
R23	16 Park View Road	507213	181245	1.5	Residential
R24	35 Park View Road	507234	181226	1.5	Residential
R25	62 Arklay Close	506778	182116	1.5	Residential
R26	123 Royal Lane	506764	182141	1.5	Residential
R27	102 Pield Heath Road	506730	182076	1.5	Residential
R28	211 Pield Heath Road	506460	182038	1.5	Residential
R29	26 Church Road	505941	182047	1.5	Residential
R30	25 Church Road	505935	182133	1.5	Residential
R31	78 Pield Heath Road	507084	181907	1.5	Residential
R32	Prince Albert Court, Flat 1 & 2	507104	181880	1.5	Residential
R33	1-4 Greatfields Drive	507382	181857	1.5	Residential
R34	1 Pield Heath Avenue	507399	181893	1.5	Residential
R35	204 Harlington Road	507502	181998	1.5	Residential
R36	58 Lees Road	507548	182018	1.5	Residential
R37	Residential Home on corner of Harlington Road (A437) and Lees Road	507519	182043	1.5	Residential
R38	99 Nicholls Avenue	507327	182361	1.5	Residential

ID	Receptor	X	Y	Height (m)	Receptor Type
R39	42 Nicholls Avenue	507616	182447	1.5	Residential
R40	3 Brambles Farm Drive	507519	182568	1.5	Residential
R41	49 Harlington Road	507241	182574	1.5	Residential
R42	139 Harlington Road	507415	182190	1.5	Residential
R43	162 Harlington Road	507378	182181	1.5	Residential
R44	1 Lees Road	507741	182361	1.5	Residential
R45	73 Lees Road	507667	182268	1.5	Residential
R46	55 Barncroft Close	507664	181848	1.5	Residential
R47	10 Hooper Drive	507641	181887	1.5	Residential
R48	Proposed Ambulance Station (formerly Busy Bees at Hillingdon Nursery once construction begins)	506613	181793	1.5	Educational
R49	Meadow Special School	506529	181691	1.5	Educational
R50	Pield Heath House School	506495	182107	1.5	Educational
R51	Colham Manor Primary School	507136	181476	1.5	Educational
R52	Moorcroft School	506907	181439	1.5	Educational
R53	Park Academy West London	506873	181085	1.5	Educational
R54	Hillingdon Manor School	507633	181666	1.5	Educational
R55	Bishopshalt School	506893	182626	1.5	Educational
R56	Brunel University	506400	182608	1.5	Educational
R57	Woodlands Centre	506937	181735	1.5	Medical
R58	Tudor Centre	506873	181691	1.5	Medical
R59	Maternity Building	506903	181805	1.5	Medical
R60	Nightingale Centre (AMU)	506814	181821	1.5	Medical
R61	Modular Ward North	506808	181778	1.5	Medical
R62	Bevan Ward	506871	181806	1.5	Medical
R63	Modular Ward South	506829	181738	1.5	Medical
R64	Hillingdon Hospitals, Estates & Facilities Dept	506914	182124	1.5	Medical
R65	West London Medical Centre	507386	181890	1.5	Medical

Appendix D Model Verification

The performance of the dispersion model was assessed by comparing the modelled concentrations using the Defra EFT v11.0 emission factors for 2019 with measured concentrations at roadside monitoring locations close to the study area in 2019. A mix of meteorological data, monitored concentrations, vehicle emission rates and traffic data from 2019 and 2021 was available, however it was decided that 2019 data would be used for the model verification as 2019 was not impacted by COVID-19, and therefore produced a more conservative and realistic factor. It should be noted that council data was not available for 2021.

Table 8-4 presents a summary of the model performance prior to the bias adjustment. These comparisons show that the mode had a tendency to under predict annual mean concentrations of NO_2, with ‘HILL04’ under predicting by 13.6% and ‘HILL05’ under predicting by 26.9%.

Table 8-4. Model Performance Prior to Bias Adjustment

Roadside Monitoring Location	Background NO_2	Measured NO_2 (µg/m^3)	Modelled NO_2 (µg/m^3)	% Difference (Modelled – Measured / Measured)
HILL04	19.6	27.8	24.0	-13.6
HILL05	20.9	34.1	24.9	-26.9

An adjustment factor of 3.39 was applied to the modelled road NO_x concentrations to adjust for model bias. The comparison of modelled with measured values was then repeated. The results are shown in Table 8-5.

Table 8-5. Model Performance After Bias Adjustment

Roadside Monitoring Location	Background NO_2	Measured NO_2 (µg/m^3)	Modelled NO_2 (µg/m^3)	% Difference (Modelled – Measured / Measured)
HILL04	19.6	27.8	28.5	2.6
HILL05	20.9	34.1	33.7	-1.3

The accuracy of the adjusted model was also considered via the calculation of the Root Mean Square Error (RMSE) and fractional bias. With the unadjusted model results, the RMSE was 7.6 µg/m^3, while with the adjusted model results this was reduced to 0.6 µg/m^3. The adjustment has reduced the average error or uncertainty in the model results. The fractional bias was 0.3 with the unadjusted model which shows a tendency to under predict. The adjusted model shows a fractional bias of zero which shows that the under prediction has been removed.

The adjustment factor described above was applied at all receptors within the study area. In the absence of sufficient PM_{10} and $PM_{2.5}$ monitoring data, the same factor has been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions, as recommended in LAQM.TG(16).

Appendix E Road Traffic Data

Table 8-6. Traffic Data

Road Name	ATC Site	2019 Base Without Development Traffic Flows		2027 Future Base (with Existing Hospital CTDM Baseline)		2027 Future Baseline Background Only & New Hospital		2027 With Development Traffic Flows	
		AADT	HDV %	AADT	HDV %	AADT	HDV %	AADT	HDV %
Pield Heath Road	1	9046.4	5.7	9912.9	5.7	9766.3	5.1	9852.7	5.7
Kingston Lane	2	7661.8	7.1	8487.7	7.1	8214.9	5.3	8413.3	7.1
Pield Heath Road	3	14326.3	5.2	15814.4	5.2	15394.9	4.2	15679.8	5.2
Royal Lane	4	2901.8	1.7	3198.8	1.7	3141.1	1.5	3193.8	1.7
Royal Lane	5	6826.6	1.8	7582.6	1.8	6041.4	1.6	6057.7	1.8
Royal Lane	6	5265.1	2.3	5770.6	2.3	5702.1	2.1	5718.4	2.3
Royal Lane	7	2672.4	2.1	2930.9	2.1	2883.5	1.9	2894.9	2.1
Pield Heath Road	8	12372.8	6.5	13680.0	6.5	14760.9	4.6	15114.7	6.5
Pield Heath Road	9	11853.9	5.2	13064.3	5.2	12646.2	3.9	12930.0	5.2
Colham Green Road	10	7129.0	7.9	7878.4	7.9	7385.1	6.7	7672.7	7.9
Colham Green Road	11	6754.5	8.5	7426.0	8.5	7266.6	7.1	7379.3	8.5
Colham Green Road	12	6043.2	5.4	6650.8	5.4	6496.0	4.5	6604.0	5.4
A437 Harlington Road	13	13015.6	5.4	14172.6	5.4	14134.6	5.3	14159.6	5.4
Lees Road	14	15740.5	4.0	17102.3	4.0	17061.3	3.9	17091.3	4.0
A437 Harlington Road	15	28362.0	4.8	30831.7	4.8	30754.7	4.7	30808.7	4.8
A408 Park View Road	16	15256.4	4.7	16584.0	4.7	16554.5	4.7	16561.5	4.7
Apple Tree Avenue	17	4575.9	8.1	5006.7	8.1	4947.7	7.3	4961.7	8.1
Church Road	18	7955.6	5.8	8695.5	5.8	8568.5	5.2	8644.5	5.8
Uxbridge Road	DFT site	24087.0	3.2	-	-	-	-	-	-

Appendix F Modelling Results

Table 8-7. Modelled Annual NO_2 Concentrations (µg/m^3)

Receptor	2019 Base	2027 Without	2027 With Proposed Development Only					2027 With Cumulative (Proposed Development and Outline Development)				
			Roads	Generators	Total	Change	Significance	Roads	Generators	Total	Change	Significance
R1	25.3	18.5	-0.3	0.0	18.2	-0.2	Negligible	-0.2	0.0	18.3	-0.2	Negligible
R2	28.2	19.8	0.1	0.0	19.9	0.1	Negligible	0.3	0.0	20.1	0.3	Negligible
R3	24.7	18.2	-0.3	0.0	17.9	-0.3	Negligible	-0.3	0.0	17.9	-0.3	Negligible
R4	27.2	19.5	0.0	0.0	19.6	0.1	Negligible	0.2	0.0	19.7	0.2	Negligible
R5	21.9	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R6	21.8	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R7	22.2	16.9	-0.1	0.0	16.8	0.0	Negligible	-0.1	0.0	16.8	0.0	Negligible
R8	21.8	16.7	0.0	0.0	16.6	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R9	27.9	19.4	-0.2	0.0	19.2	-0.2	Negligible	0.0	0.0	19.4	0.0	Negligible
R10	30.1	20.7	0.1	0.0	20.8	0.1	Negligible	0.4	0.0	21.1	0.4	Negligible
R11	24.1	18.0	-0.1	0.0	17.9	-0.1	Negligible	0.0	0.0	18.0	0.0	Negligible
R12	21.4	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R13	31.5	21.7	-0.2	0.0	21.5	-0.2	Negligible	0.0	0.0	21.7	0.0	Negligible
R14	29.1	20.5	-0.2	0.0	20.4	-0.1	Negligible	0.0	0.0	20.5	0.0	Negligible
R15	29.4	20.7	-0.2	0.0	20.5	-0.2	Negligible	-0.1	0.0	20.6	0.0	Negligible
R16	23.2	17.4	0.0	0.0	17.4	0.0	Negligible	0.0	0.0	17.4	0.0	Negligible
R17	22.5	17.0	0.0	0.0	17.0	0.0	Negligible	0.0	0.0	17.0	0.0	Negligible
R18	23.2	17.4	0.0	0.0	17.3	0.0	Negligible	0.0	0.0	17.4	0.0	Negligible
R19	28.1	19.7	0.0	0.0	19.7	0.0	Negligible	0.0	0.0	19.7	0.0	Negligible
R20	25.6	18.2	-0.1	0.0	18.2	-0.1	Negligible	0.0	0.0	18.2	0.0	Negligible

R21	27.7	19.4	-0.1	0.0	19.2	-0.1	Negligible	0.0	0.0	19.3	0.0	Negligible
R22	24.4	17.7	0.0	0.0	17.7	0.0	Negligible	0.0	0.0	17.7	0.0	Negligible
R23	24.0	17.5	-0.1	0.0	17.5	0.0	Negligible	0.0	0.0	17.5	0.0	Negligible
R24	25.7	18.4	-0.1	0.0	18.3	-0.1	Negligible	0.0	0.0	18.4	0.0	Negligible
R25	24.8	18.4	-0.1	0.0	18.3	0.0	Negligible	0.0	0.0	18.4	0.0	Negligible
R26	24.0	18.0	-0.1	0.0	18.0	0.0	Negligible	0.0	0.0	18.0	0.0	Negligible
R27	29.3	20.7	-0.2	0.0	20.5	-0.2	Negligible	0.0	0.0	20.7	0.0	Negligible
R28	24.3	18.1	-0.1	0.0	18.0	0.0	Negligible	0.0	0.0	18.1	0.0	Negligible
R29	22.8	16.3	0.0	0.0	16.3	0.0	Negligible	0.0	0.0	16.3	0.0	Negligible
R30	23.7	16.8	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R31	27.1	19.1	-0.1	0.0	18.9	-0.1	Negligible	0.0	0.0	19.1	0.0	Negligible
R32	30.0	20.5	-0.2	0.0	20.3	-0.2	Negligible	0.0	0.0	20.5	0.0	Negligible
R33	27.2	19.1	-0.1	0.0	19.0	-0.1	Negligible	0.0	0.0	19.1	0.0	Negligible
R34	27.9	19.5	-0.2	0.0	19.3	-0.1	Negligible	0.0	0.0	19.4	0.0	Negligible
R35	29.2	20.1	-0.1	0.0	20.0	-0.1	Negligible	0.0	0.0	20.1	0.0	Negligible
R36	31.0	20.7	-0.1	0.0	20.7	0.0	Negligible	0.0	0.0	20.7	0.0	Negligible
R37	29.3	19.8	0.0	0.0	19.8	0.0	Negligible	0.0	0.0	19.8	0.0	Negligible
R38	25.9	18.0	0.0	0.0	18.0	0.0	Negligible	0.0	0.0	18.0	0.0	Negligible
R39	22.6	15.5	0.0	0.0	15.5	0.0	Negligible	0.0	0.0	15.5	0.0	Negligible
R40	24.5	15.4	0.0	0.0	15.4	0.0	Negligible	0.0	0.0	15.4	0.0	Negligible
R41	26.3	18.1	0.0	0.0	18.1	0.0	Negligible	0.0	0.0	18.1	0.0	Negligible
R42	25.8	18.0	0.0	0.0	18.0	0.0	Negligible	0.0	0.0	18.0	0.0	Negligible
R43	24.2	17.2	0.0	0.0	17.2	0.0	Negligible	0.0	0.0	17.2	0.0	Negligible
R44	29.9	19.1	0.0	0.0	19.1	0.0	Negligible	0.0	0.0	19.1	0.0	Negligible
R45	26.5	18.2	0.0	0.0	18.2	0.0	Negligible	0.0	0.0	18.2	0.0	Negligible
R46	30.1	20.6	0.0	0.0	20.6	0.0	Negligible	0.0	0.0	20.6	0.0	Negligible
R47	29.9	20.5	0.0	0.0	20.5	0.0	Negligible	0.0	0.0	20.5	0.0	Negligible

R48	25.7	18.7	-0.4	0.0	18.3	-0.4	Negligible	-0.4	0.0	18.3	-0.4	Negligible
R49	22.5	17.1	-0.1	0.0	17.0	-0.1	Negligible	-0.1	0.0	17.0	-0.1	Negligible
R50	23.4	17.7	-0.1	0.0	17.6	0.0	Negligible	0.0	0.0	17.7	0.0	Negligible
R51	22.5	16.8	0.0	0.0	16.8	0.0	Negligible	0.0	0.0	16.8	0.0	Negligible
R52	21.7	16.6	0.0	0.0	16.6	0.0	Negligible	0.0	0.0	16.6	0.0	Negligible
R53	23.2	17.3	0.0	0.0	17.3	0.0	Negligible	0.0	0.0	17.3	0.0	Negligible
R54	23.1	17.1	0.0	0.0	17.1	0.0	Negligible	0.0	0.0	17.1	0.0	Negligible
R55	22.0	17.0	0.0	0.0	16.9	0.0	Negligible	0.0	0.0	17.0	0.0	Negligible
R56	22.6	17.3	0.0	0.0	17.2	0.0	Negligible	0.0	0.0	17.3	0.0	Negligible
R57	22.1	16.8	0.0	0.0	16.8	0.0	Negligible	0.0	0.0	16.8	0.0	Negligible
R58	21.9	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R59	22.3	16.9	0.0	0.0	16.9	0.0	Negligible	0.0	0.0	16.9	0.0	Negligible
R60	22.2	16.8	0.0	0.1	16.9	0.0	Negligible	0.0	0.1	16.9	0.0	Negligible
R61	22.0	16.8	0.0	0.1	16.8	0.1	Negligible	0.0	0.1	16.8	0.1	Negligible
R62	22.2	16.9	0.0	0.0	16.9	0.0	Negligible	0.0	0.0	16.9	0.0	Negligible
R63	21.9	16.7	0.0	0.1	16.7	0.0	Negligible	0.0	0.1	16.8	0.0	Negligible
R64	22.5	17.2	0.0	0.0	17.2	0.0	Negligible	0.0	0.0	17.2	0.0	Negligible
R65	27.5	19.2	-0.1	0.0	19.1	-0.1	Negligible	0.0	0.0	19.2	0.0	Negligible

Table 8-8. Modelled Annual PM_{10} Concentrations (μg/m^3)

Receptor	2019 Base	2027 Without	2027 With Proposed Development Only					2027 With Cumulative (Proposed Development and Outline Development)				
			Roads	Generators	Total	Change	Significance	Roads	Generators	Total	Change	Significance
R1	16.2	15.7	-0.1	0.0	15.6	-0.1	Negligible	-0.1	0.0	15.6	-0.1	Negligible
R2	16.2	16.2	0.0	0.0	16.3	0.0	Negligible	0.0	0.0	16.3	0.0	Negligible
R3	16.2	15.6	-0.1	0.0	15.5	-0.1	Negligible	-0.1	0.0	15.5	-0.1	Negligible

R4	16.2	16.0	0.0	0.0	16.0	0.0	Negligible	0.0	0.0	16.0	0.0	Negligible
R5	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R6	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R7	16.2	15.2	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R8	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R9	16.6	16.5	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible
R10	16.2	16.6	0.0	0.0	16.6	0.0	Negligible	0.0	0.0	16.6	0.0	Negligible
R11	16.2	15.5	0.0	0.0	15.4	0.0	Negligible	0.0	0.0	15.4	0.0	Negligible
R12	16.2	14.9	0.0	0.0	14.9	0.0	Negligible	0.0	0.0	14.9	0.0	Negligible
R13	16.2	16.9	-0.1	0.0	16.8	-0.1	Negligible	-0.1	0.0	16.8	-0.1	Negligible
R14	16.2	16.4	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible
R15	16.2	16.4	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible
R16	16.2	15.3	0.0	0.0	15.3	0.0	Negligible	0.0	0.0	15.3	0.0	Negligible
R17	16.2	15.2	0.0	0.0	15.2	0.0	Negligible	0.0	0.0	15.2	0.0	Negligible
R18	16.2	15.3	0.0	0.0	15.3	0.0	Negligible	0.0	0.0	15.3	0.0	Negligible
R19	16.2	16.4	0.0	0.0	16.4	0.0	Negligible	0.0	0.0	16.4	0.0	Negligible
R20	16.6	16.1	0.0	0.0	16.0	0.0	Negligible	0.0	0.0	16.0	0.0	Negligible
R21	16.6	16.5	-0.1	0.0	16.5	-0.1	Negligible	-0.1	0.0	16.5	-0.1	Negligible
R22	16.6	15.9	0.0	0.0	15.8	0.0	Negligible	0.0	0.0	15.8	0.0	Negligible
R23	16.6	15.8	0.0	0.0	15.8	0.0	Negligible	0.0	0.0	15.8	0.0	Negligible
R24	16.6	16.1	0.0	0.0	16.1	0.0	Negligible	0.0	0.0	16.1	0.0	Negligible
R25	16.2	15.6	0.0	0.0	15.5	0.0	Negligible	0.0	0.0	15.5	0.0	Negligible
R26	16.2	15.4	0.0	0.0	15.4	0.0	Negligible	0.0	0.0	15.4	0.0	Negligible
R27	16.2	16.4	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible
R28	16.2	15.5	0.0	0.0	15.5	0.0	Negligible	0.0	0.0	15.5	0.0	Negligible
R29	16.7	15.9	0.0	0.0	15.9	0.0	Negligible	0.0	0.0	15.9	0.0	Negligible
R30	16.7	16.1	0.0	0.0	16.1	0.0	Negligible	0.0	0.0	16.1	0.0	Negligible

R31	16.6	16.4	-0.1	0.0	16.3	-0.1	Negligible	-0.1	0.0	16.3	-0.1	Negligible
R32	16.6	17.0	-0.1	0.0	16.9	-0.1	Negligible	-0.1	0.0	16.9	-0.1	Negligible
R33	16.6	16.4	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible
R34	16.6	16.6	-0.1	0.0	16.5	-0.1	Negligible	-0.1	0.0	16.5	-0.1	Negligible
R35	16.6	16.9	0.0	0.0	16.9	0.0	Negligible	0.0	0.0	16.9	0.0	Negligible
R36	16.8	17.9	0.0	0.0	17.9	0.0	Negligible	0.0	0.0	17.9	0.0	Negligible
R37	16.8	17.5	0.0	0.0	17.5	0.0	Negligible	0.0	0.0	17.5	0.0	Negligible
R38	16.8	16.8	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R39	16.8	15.7	0.0	0.0	15.7	0.0	Negligible	0.0	0.0	15.7	0.0	Negligible
R40	16.8	15.6	0.0	0.0	15.6	0.0	Negligible	0.0	0.0	15.6	0.0	Negligible
R41	16.8	16.8	0.0	0.0	16.8	0.0	Negligible	0.0	0.0	16.8	0.0	Negligible
R42	16.8	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R43	16.8	16.4	0.0	0.0	16.4	0.0	Negligible	0.0	0.0	16.4	0.0	Negligible
R44	16.8	17.1	0.0	0.0	17.1	0.0	Negligible	0.0	0.0	17.1	0.0	Negligible
R45	16.8	16.7	0.0	0.0	16.7	0.0	Negligible	0.0	0.0	16.7	0.0	Negligible
R46	16.6	17.2	0.0	0.0	17.2	0.0	Negligible	0.0	0.0	17.2	0.0	Negligible
R47	16.6	17.2	0.0	0.0	17.2	0.0	Negligible	0.0	0.0	17.2	0.0	Negligible
R48	16.2	15.8	-0.2	0.0	15.7	-0.2	Negligible	-0.2	0.0	15.7	-0.2	Negligible
R49	16.2	15.2	0.0	0.0	15.2	0.0	Negligible	0.0	0.0	15.2	0.0	Negligible
R50	16.2	15.3	0.0	0.0	15.3	0.0	Negligible	0.0	0.0	15.3	0.0	Negligible
R51	16.6	15.5	0.0	0.0	15.5	0.0	Negligible	0.0	0.0	15.5	0.0	Negligible
R52	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R53	16.2	15.4	0.0	0.0	15.4	0.0	Negligible	0.0	0.0	15.4	0.0	Negligible
R54	16.6	15.7	0.0	0.0	15.7	0.0	Negligible	0.0	0.0	15.7	0.0	Negligible
R55	16.2	15.0	0.0	0.0	15.0	0.0	Negligible	0.0	0.0	15.0	0.0	Negligible
R56	16.2	15.2	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R57	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible

R58	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R59	16.2	15.2	0.0	0.0	15.2	0.0	Negligible	0.0	0.0	15.2	0.0	Negligible
R60	16.2	15.2	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R61	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R62	16.2	15.2	0.0	0.0	15.2	0.0	Negligible	0.0	0.0	15.2	0.0	Negligible
R63	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R64	16.2	15.1	0.0	0.0	15.1	0.0	Negligible	0.0	0.0	15.1	0.0	Negligible
R65	16.6	16.5	-0.1	0.0	16.4	-0.1	Negligible	-0.1	0.0	16.4	-0.1	Negligible

Table 8-9. Modelled Annual $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	2019 Base	2027 Without	2027 With Proposed Development Only					2027 With Cumulative (Proposed Development and Outline Development)				
			Roads	Generators	Total	Change	Significance	Roads	Generators	Total	Change	Significance
R1	11.1	10.5	-0.1	0.0	10.5	-0.1	Negligible	-0.1	0.0	10.5	-0.1	Negligible
R2	11.1	10.8	0.0	0.0	10.8	0.0	Negligible	0.0	0.0	10.8	0.0	Negligible
R3	11.1	10.5	-0.1	0.0	10.4	-0.1	Negligible	-0.1	0.0	10.4	-0.1	Negligible
R4	10.9	10.6	0.0	0.0	10.6	0.0	Negligible	0.0	0.0	10.6	0.0	Negligible
R5	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R6	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R7	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R8	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R9	11.3	11.0	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R10	11.1	11.0	0.0	0.0	11.0	0.0	Negligible	0.0	0.0	11.0	0.0	Negligible
R11	10.9	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R12	10.9	10.0	0.0	0.0	10.0	0.0	Negligible	0.0	0.0	10.0	0.0	Negligible
R13	10.9	11.1	-0.1	0.0	11.0	-0.1	Negligible	-0.1	0.0	11.0	-0.1	Negligible
R14	10.9	10.8	0.0	0.0	10.8	0.0	Negligible	0.0	0.0	10.8	0.0	Negligible

R15	10.9	10.8	0.0	0.0	10.8	0.0	Negligible	0.0	0.0	10.8	0.0	Negligible
R16	11.1	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R17	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R18	11.1	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R19	11.1	10.9	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R20	11.3	10.7	0.0	0.0	10.7	0.0	Negligible	0.0	0.0	10.7	0.0	Negligible
R21	11.3	11.0	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R22	11.3	10.6	0.0	0.0	10.6	0.0	Negligible	0.0	0.0	10.6	0.0	Negligible
R23	11.3	10.6	0.0	0.0	10.6	0.0	Negligible	0.0	0.0	10.6	0.0	Negligible
R24	11.3	10.8	0.0	0.0	10.7	0.0	Negligible	0.0	0.0	10.7	0.0	Negligible
R25	10.9	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R26	10.9	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R27	10.9	10.8	0.0	0.0	10.8	0.0	Negligible	0.0	0.0	10.8	0.0	Negligible
R28	10.9	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R29	11.3	10.6	0.0	0.0	10.6	0.0	Negligible	0.0	0.0	10.6	0.0	Negligible
R30	11.3	10.7	0.0	0.0	10.7	0.0	Negligible	0.0	0.0	10.7	0.0	Negligible
R31	11.3	10.9	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R32	11.3	11.2	-0.1	0.0	11.2	-0.1	Negligible	-0.1	0.0	11.2	-0.1	Negligible
R33	11.3	10.9	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R34	11.3	11.0	0.0	0.0	11.0	0.0	Negligible	0.0	0.0	11.0	0.0	Negligible
R35	11.3	11.2	0.0	0.0	11.2	0.0	Negligible	0.0	0.0	11.2	0.0	Negligible
R36	11.4	11.8	0.0	0.0	11.8	0.0	Negligible	0.0	0.0	11.8	0.0	Negligible
R37	11.4	11.6	0.0	0.0	11.5	0.0	Negligible	0.0	0.0	11.5	0.0	Negligible
R38	11.4	11.1	0.0	0.0	11.1	0.0	Negligible	0.0	0.0	11.1	0.0	Negligible
R39	11.4	10.5	0.0	0.0	10.5	0.0	Negligible	0.0	0.0	10.5	0.0	Negligible
R40	11.4	10.5	0.0	0.0	10.5	0.0	Negligible	0.0	0.0	10.5	0.0	Negligible
R41	11.4	11.2	0.0	0.0	11.2	0.0	Negligible	0.0	0.0	11.2	0.0	Negligible

R42	11.4	11.1	0.0	0.0	11.1	0.0	Negligible	0.0	0.0	11.1	0.0	Negligible
R43	11.4	10.9	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible
R44	11.4	11.3	0.0	0.0	11.3	0.0	Negligible	0.0	0.0	11.3	0.0	Negligible
R45	11.4	11.1	0.0	0.0	11.1	0.0	Negligible	0.0	0.0	11.1	0.0	Negligible
R46	11.3	11.4	0.0	0.0	11.4	0.0	Negligible	0.0	0.0	11.4	0.0	Negligible
R47	11.3	11.3	0.0	0.0	11.3	0.0	Negligible	0.0	0.0	11.3	0.0	Negligible
R48	11.1	10.6	-0.1	0.0	10.5	-0.1	Negligible	-0.1	0.0	10.5	-0.1	Negligible
R49	11.1	10.3	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R50	10.9	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R51	11.3	10.4	0.0	0.0	10.4	0.0	Negligible	0.0	0.0	10.4	0.0	Negligible
R52	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R53	11.1	10.3	0.0	0.0	10.3	0.0	Negligible	0.0	0.0	10.3	0.0	Negligible
R54	11.3	10.5	0.0	0.0	10.5	0.0	Negligible	0.0	0.0	10.5	0.0	Negligible
R55	10.9	10.0	0.0	0.0	10.0	0.0	Negligible	0.0	0.0	10.0	0.0	Negligible
R56	10.9	10.1	0.0	0.0	10.1	0.0	Negligible	0.0	0.0	10.1	0.0	Negligible
R57	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R58	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R59	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R60	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R61	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R62	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R63	11.1	10.2	0.0	0.0	10.2	0.0	Negligible	0.0	0.0	10.2	0.0	Negligible
R64	10.9	10.1	0.0	0.0	10.1	0.0	Negligible	0.0	0.0	10.1	0.0	Negligible
R65	11.3	11.0	0.0	0.0	10.9	0.0	Negligible	0.0	0.0	10.9	0.0	Negligible

Table 8-10. Maximum Modelled Short-term Pollutant Concentrations (µg/m^3) due to Generator Emissions

Receptor	NO_2 1-hour		PM_{10} Daily		SO_2 15-Minute		SO_2 1-hour		SO2 Daily		CO Running 8-Hour	
	PC	PEC	PC	PEC	PC	PEC	PC	PEC	PC	PEC	PC	PEC
R1	177.9	**210.3**	0.3	30.2	29.1	38.3	18.0	27.2	6.8	16.0	35.6	899.6
R2	162.1	194.5	0.4	30.3	26.6	35.8	16.6	25.8	6.3	15.5	31.9	895.9
R3	159.0	191.4	0.3	30.1	23.3	32.5	16.6	25.8	6.8	16.0	26.7	890.7
R4	154.7	187.7	0.4	30.1	26.5	37.4	15.5	26.5	6.3	17.3	31.6	885.6
R5	147.1	179.5	0.4	30.2	27.5	36.7	15.3	24.5	6.9	16.1	40.3	904.3
R6	132.2	164.6	0.3	30.1	21.8	31.0	11.9	21.1	4.2	13.4	32.2	896.2
R7	194.3	**226.7**	0.3	30.2	29.8	39.0	19.9	29.1	11.7	20.9	34.8	898.8
R8	99.1	131.5	0.2	30.0	16.2	25.4	10.4	19.6	4.2	13.4	19.8	883.8
R9	112.7	145.0	0.3	30.8	22.4	32.1	11.6	21.3	3.9	13.6	31.5	883.5
R10	140.3	172.7	0.3	30.1	23.2	32.4	14.6	23.8	4.5	13.7	30.8	894.8
R11	110.6	143.5	0.2	29.9	20.8	31.8	10.8	21.8	3.1	14.1	29.3	883.3
R12	74.8	107.8	0.1	29.8	13.7	24.7	7.2	18.2	1.4	12.3	22.2	876.2
R13	133.3	166.2	0.2	29.9	22.7	33.6	13.3	24.3	4.0	15.0	32.5	886.5
R14	128.3	161.2	0.2	29.9	23.8	34.7	13.1	24.0	4.0	14.9	31.3	885.3
R15	149.8	182.7	0.2	30.0	26.5	37.5	14.8	25.7	5.1	16.1	32.8	886.8
R16	49.0	81.4	0.1	29.9	7.5	16.7	5.1	14.3	2.2	11.4	9.9	873.9
R17	45.7	78.2	0.1	29.9	7.0	16.2	4.7	13.9	2.1	11.3	9.3	873.3
R18	33.4	65.9	0.1	29.9	5.6	14.8	3.3	12.5	1.5	10.7	8.3	872.3
R19	46.6	79.0	0.0	29.9	8.3	17.5	4.7	13.9	1.3	10.5	13.1	877.1
R20	49.9	82.3	0.2	30.7	7.4	17.1	5.3	15.0	2.7	12.4	9.6	861.6
R21	45.8	78.1	0.1	30.6	9.3	19.0	4.6	14.3	1.7	11.4	14.9	866.9
R22	72.2	104.6	0.1	30.6	12.3	22.0	6.6	16.3	1.7	11.4	15.6	867.6
R23	73.4	105.7	0.1	30.6	12.0	21.7	7.1	16.8	1.5	11.2	16.2	868.2
R24	71.7	104.0	0.1	30.6	11.8	21.5	6.9	16.6	1.5	11.2	15.7	867.7

R25	144.9	177.9	0.3	30.0	25.2	36.1	14.7	25.6	4.6	15.6	33.6	887.6
R26	149.3	182.2	0.2	29.9	25.2	36.1	15.0	25.9	4.2	15.1	33.0	887.0
R27	152.7	185.7	0.3	30.0	27.3	38.2	15.5	26.5	5.1	16.1	33.9	887.9
R28	134.3	167.3	0.2	29.9	23.2	34.2	13.4	24.3	4.3	15.2	29.8	883.8
R29	35.2	65.2	0.0	30.8	6.4	16.7	3.6	13.9	1.0	11.2	14.3	866.3
R30	68.4	98.4	0.0	30.8	12.6	22.8	6.3	16.5	1.4	11.6	20.9	872.9
R31	120.4	152.7	0.2	30.7	21.2	30.9	12.0	21.7	3.3	13.0	26.0	878.0
R32	104.3	136.6	0.2	30.7	19.2	28.9	9.7	19.4	3.0	12.7	25.0	877.0
R33	25.6	58.0	0.1	30.6	3.8	13.5	2.7	12.4	1.1	10.8	5.5	857.5
R34	24.8	57.1	0.1	30.6	3.7	13.4	2.6	12.3	1.1	10.8	6.3	858.3
R35	19.8	52.1	0.1	30.6	3.1	12.8	2.1	11.8	0.8	10.5	4.9	856.9
R36	17.8	47.9	0.0	31.0	2.9	11.6	1.8	10.6	0.7	9.5	4.5	850.5
R37	21.9	52.0	0.0	31.0	3.7	12.4	2.1	10.9	0.8	9.6	6.9	852.9
R38	81.4	111.5	0.1	31.07	14.4	23.1	8.3	17.1	1.7	10.5	19.9	865.9
R39	39.8	70.0	0.0	31.02	9.5	18.2	3.8	12.5	0.9	9.6	13.3	859.3
R40	56.8	86.9	0.1	31.03	9.7	18.4	5.3	14.0	1.1	9.8	14.9	860.9
R41	74.5	104.6	0.1	31.07	13.9	22.6	7.6	16.3	1.7	10.4	20.4	866.4
R42	53.2	83.4	0.1	31.05	9.2	17.9	5.1	13.8	1.3	10.0	16.9	862.9
R43	57.6	87.8	0.1	31.06	9.9	18.7	5.8	14.6	1.4	10.1	18.4	864.4
R44	28.0	58.2	0.0	31.0	5.4	14.2	2.6	11.4	0.6	9.4	7.6	853.6
R45	32.5	62.6	0.0	31.0	5.7	14.4	3.0	11.7	0.7	9.5	7.7	853.7
R46	14.4	46.7	0.0	30.5	2.2	11.9	1.5	11.2	0.7	10.4	2.5	854.5
R47	15.3	47.6	0.0	30.5	2.3	12.0	1.6	11.3	0.7	10.4	2.5	854.5
R48	188.9	**221.3**	0.3	30.1	30.4	39.6	19.0	28.2	8.1	17.3	47.4	911.4
R49	85.2	117.6	0.2	30.0	12.6	21.8	8.9	18.1	6.0	15.2	16.5	880.5
R50	142.2	175.2	0.2	29.9	22.6	33.6	13.3	24.3	3.6	14.6	30.7	884.7
R51	75.2	107.5	0.1	30.6	12.9	22.6	7.3	17.0	2.1	11.8	17.9	869.9

R52	99.1	131.5	0.1	29.9	15.9	25.1	10.1	19.3	2.1	11.3	19.1	883.1
R53	59.7	92.1	0.0	29.9	10.2	19.4	5.6	14.8	1.3	10.5	14.2	878.2
R54	15.1	47.4	0.0	30.5	2.2	11.9	1.6	11.3	0.7	10.4	2.5	854.5
R55	82.8	115.8	0.1	29.8	16.6	27.5	7.3	18.2	1.7	12.7	24.2	878.2
R56	65.2	98.2	0.1	29.8	13.4	24.3	6.8	17.8	1.4	12.4	22.9	876.9
R57	81.7	114.1	0.3	30.2	12.1	21.3	8.7	17.9	5.0	14.2	18.4	882.4
R58	96.3	128.8	0.3	30.1	14.0	23.2	10.2	19.4	5.9	15.1	16.2	880.2
R59	**220.2**	**252.7**	0.5	30.4	39.9	49.1	20.7	29.9	7.6	16.8	46.2	910.2
R60	**219.9**	**252.3**	0.7	30.6	34.6	43.8	22.2	31.4	9.9	19.1	41.4	905.4
R61	**257.8**	**290.2**	0.9	30.8	39.8	49.0	26.4	35.6	12.7	21.9	53.4	917.4
R62	**261.9**	**294.4**	0.6	30.5	43.0	52.2	27.2	36.4	9.4	18.6	51.6	915.6
R63	184.8	**217.2**	0.8	30.6	29.9	39.1	19.6	28.8	11.0	20.2	44.5	908.5
R64	133.1	166.1	0.3	30.0	23.2	34.2	13.6	24.5	4.6	15.5	28.7	882.7
R65	25.5	57.8	0.1	30.6	3.8	13.5	2.7	12.4	1.1	10.8	6.7	858.7

Numbers in bold show the concentrations exceeding the AQS objective value however it should be noted this is based on an unrealistic worst-case assumption that the generators operate for all hours of the year rather than the 14 hours of testing per year that they are intended to run for.