New Oxford Street, London

Air Quality Assessment

On behalf of **River Levett Buckhall**

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1 Introduction

1.1 Proposed Development

1.1.1 River Levett Buckhall has commissioned Peter Brett Associates LLP (PBA) to undertake an air quality assessment to support a planning application for the proposed residential and commercial redevelopment of a site located in New Oxford Street, London. The proposed development site is located within the boundary of the London Borough of Camden.

1.1.2 It is proposed to redevelop and refurbish the site for a mixed-use consisting of residential, retail, leisure and offices. A number of existing façades and architectural details within the development are intended to be restored.

1.2 Scope

1.2.1 This report describes existing air quality within the study area, considers the suitability of the site for residential and commercial development, and assesses the impact of construction activities on air quality in the surrounding area. The development will not have any parking associated with it and therefore the effect of development related traffic on local air quality has been scoped out of the assessment. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic are nitrogen dioxide (NO_2) and PM_{10}.

1.2.2 An energy centre is proposed to be installed within the premises of the proposed development site. An assessment of the emissions has been undertaken to confirm whether or not will be a likely significant effect on air quality.

1.2.3 The assessment has been prepared taking into account relevant local and national guidance and regulations.

1.3 Consultation

1.3.1 Consultation has been carried out with the Environmental Health Officer (EHO) at the London Borough of Camden Adam Webber (e-mail 3rd November 2015) to obtain the latest air quality monitoring for the Council.

2 Legislation and Policy

2.1 The Air Quality Strategy

2.1.1 The Air Quality Strategy (2007) (DERT, 2007) establishes the policy framework for ambient air quality management and assessment in the UK. The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

2.1.2 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000 (Statutory Instrument, 2000) and the Air Quality (Amendment) (England) Regulations 2002 (Statutory Instrument, 2002).

2.1.3 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.

2.1.4 The Local Air Quality Management Technical Guidance 2009 (LAQM.TG(09); Defra, 2009), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

2.2.1 The Air Quality Standards Regulations 2010 (Statutory Instrument, 2010) implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO_2. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

2.2.2 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

2.2.3 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

2.3 Planning Policy

National Policy

2.3.1 The National Planning Policy Framework (NPPF) was published in March 2012 (Department for Communities and Local Government, 2012). This sets out the Government's planning policies for England and how they are expected to be applied. In relation to conserving and enhancing the natural environment, paragraph 109 states that:

"*The planning system should contribute to and enhance the natural and local environment by…. preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.*"

2.3.2 Paragraph 124, also states that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.3.3 Paragraph 203 goes on to say:

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

Planning Practice Guidance

2.3.4 The Planning Practice Guidance (PPG) (Planning Practice Guidance, 2014) was published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-001-20 of the PPG provides a summary as to why air quality is a consideration for planning:

"…Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit….The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date….If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan…..Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive…..Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

2.3.5 Paragraph 002, Reference 32-002-20140306, of the PPG concerns the role of Local Plans with regard to air quality:

"….Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider:

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*

- *the impact of point sources of air pollution..; and*

- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

2.3.6 Paragraph 005, Reference 32-005-20140306, of the PPG identifies when air quality could be relevant for a planning decision:

"….When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*

- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.3.7 Paragraph 007, Reference 32-007-20140306, of the PPG provides guidance on how detailed an assessment needs to be:

"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific."

2.3.8 Paragraph 008, Reference 32-008-20140306, of the PPG provides guidance on how an impact on air quality can be mitigated:

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact….Examples of mitigation include:

- *the design and layout of development to increase separation distances from sources of air pollution;*

- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*
- *means of ventilation;*
- *promoting infrastructure to promote modes of transport with low impact on air quality;*
- *controlling dust and emissions from construction, operation and demolition; and*
- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."*

2.3.9 Paragraph 009, Reference 32-009-20140306, of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment:

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."

The London Plan

2.3.10 The London Plan 2015 (adopted 10th March 2015) (Greater London Authority, 2015) provides strategic planning guidance for Greater London. Each Borough's development plans must be in 'general conformity' with it.

2.3.11 The Plan includes Policy 7.14 (Improving Air Quality) which states that development proposals should:

- Promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the Greater London Authority and London Councils;
- Where biomass boilers are included, set out a detailed air quality assessment that should forecast pollutant concentrations. Permission should only be granted if no adverse impacts from biomass are identified; and
- Aim to be 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as AQMAs).

2.3.12 Boroughs and others with relevant responsibilities should also have policies that:

- Seek reductions in levels of pollutants referred to in the Government's National Air Quality Strategy having regard to the Mayor's Air Quality Strategy; and
- Take account of the findings of the Air Quality Review and Assessments and Action Plans, in particular where AQMAs have been designated.

2.3.13 The Mayor will work with strategic partners to ensure the spatial, transport and design policies of the London Plan support his Air Quality Strategy.

2.3.14 The Plan also includes Policy 8.2 (Planning Obligations) which states that the Mayor will provide guidance for boroughs and other partners on the preparation of frameworks for

negotiations on planning obligations reflecting strategic priorities including the improvement of Air Quality.

2.3.15 Supplementary Planning Guidance (SPG) (Greater London Authority, 2014) on 'Sustainable Design and Construction' adopted in April 2014 forms part of the Implementation Framework for the London Plan. For air pollution, the Mayor's Priorities are stated as:

- Developers are to design their schemes so that they are at least 'air quality neutral';
- Developments should be designed to minimise the generation of air pollution;
- Developments should be designed to minimise and mitigate against increased exposure to poor air quality;
- Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7 (of the document); and
- Developers and contractors should follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development.

2.3.16 The Sustainable Design and Construction SPG requires that air quality assessments are prepared for major developments where the development:

- is located within an AQMA;
- is likely to result in a new air pollution exceedance;
- is located within 150 metres of a sensitive receptor (schools, hospitals, care homes, nurseries, residential development);
- will bring sensitive receptors into an area of poor air quality;
- includes biomass boilers and/or combined heat and power; and
- involves waste management/treatment activities, mineral extraction or any other general industrial combustion process.

2.3.17 For major developments that meet the above criteria, an air quality assessment is required to be submitted with the planning application and include:

- a review of air quality around the development site using existing air quality monitoring and/or modelling data;
- air quality dispersion modelling data carried out in accordance with the London Councils Air Quality and Planning Guidance;
- an indication of the number of people (receptors) which will be exposed to poor air quality as a result of the development, and show their location on a map;
- an assessment of the impact on air quality during the construction phase and detailed mitigation methods for controlling dust and pollution emissions in line with the adopted SPG on The control of dust and emissions from construction and demolition;
- an outline and justification of mitigation measures associated with the design, location and operation of the development in order to reduce air pollution and exposure to poor air quality; and

- a maintenance regime for any combustion equipment or mitigation measures.

2.3.18 The Sustainable Design and Construction SPG provides guidance on:

- Minimising air quality emissions from location, transport, construction and demolition, and design and occupation;
- Protecting internal air quality;
- What is meant by 'air quality neutral';
- Emissions standards for combustion plant; and
- Offsetting provisions.

2.3.19 'Air quality neutral' applies across London as a whole and emission benchmarks have been proposed in terms of buildings' operation and transport emissions in order to meet this criteria. It is understood that the benchmark should be capable of being met without the need for significant additional mitigation. The emission benchmarks are summarised in **Appendix C.**

2.3.20 Where individual and/or communal gas fired boilers are installed in commercial and domestic buildings they should achieve a NO_x rating of less than 40mgNO_x/kWh. If the particular combustion equipment is not known at the time of the planning application, developers are required to provide a written statement of their commitment and ability to meet the emissions standards within their Air Quality Assessments. Emissions standards are provided for solid biomass boilers and CHP plants (see **Appendix D**).

2.3.21 Where developments do not meet the air quality neutral benchmarks, it is suggested that appropriate on-site mitigation measures will be required to off-set any excess in emissions. Measures could include:

- Green planting/walls and screens;
- Upgrade or abatement work to combustion plant;
- Retro-fitting abatement technology for vehicles and flues; and
- Exposure reduction.

2.3.22 In addition, as part of the Implementation Framework for the London Plan, a SPG on 'The Control of Dust and Emissions during Construction and Demolition' was published in July 2014 (Greater London Authority, 2014).

2.3.23 The SPG requires an Air Quality and Dust Risk Assessment to be submitted at the time of a planning application; with an Air Quality and Dust Management Plan submitted prior to the commencement of works.

2.3.24 The SPG provides guidance for:

- The preparation of an Air Quality and Dust Risk Assessment for construction and demolition activities, including air quality (dust) risk assessments;
- The stages of development the Air Quality and Dust Risk Assessment is to cover, that is for demolition, earthwork, construction stages and trackout (vehicles leaving the site) stages of the works;

- The identification of the potential scale (large, medium, small) of dust emissions for each stage of work;
- The identification of the level of risk due to the scale of dust emissions on soiling (dirt), health and the natural environment, depending on the duration of the activities, their intensity, the prevailing meteorological conditions, the existing levels of background pollution and the sensitivity of receptors to dust;
- Best practice methods for controlling dust and pollution control on-site and to prevent trackout;
- Recommendations for monitoring low, medium and high risk sites; and
- Early notification of new 2015 and 2020 standards for non-road mobile machinery.

Mayor's Air Quality Strategy

2.3.25 The Mayor's Air Quality Strategy (2010) (Greater London Authority, 2010) sets out policies to improve air quality in London and includes the following measures:

- Ensuring that public transport becomes cleaner;
- Reducing traffic growth by improving public transport and encouraging developers to make easy access to public transport in new developments; and
- Introduction of Phase 3 of the Low Emission Zone (LEZ) in 2012 to cover PM_{10} emissions from minibuses and heavier Light Goods Vehicles (LGVs), and a LEZ nitrogen oxides (NO_x) standard from 2015.

2.3.26 Policy 7 on 'Using the planning process to improve air quality' aims to ensure that no new development has a negative impact on air quality in London. It states that the Mayor will use his planning powers to:

- Develop a check list to guide boroughs and developers in the assessment of potential emissions from new developments;
- Minimise increased exposure to existing poor air quality, particularly in AQMAs and where developments are to be used by large numbers of vulnerable people;
- Ensure air quality benefits are realised through planning conditions and Section 106 agreements; and
- A package of non-transport policy measures is also proposed to reduce localised pollution sources.

Local Policy

2.3.27 The London Borough of Camden Core Strategy (2010 – 2025) (Camden Core Strategy, 2010) sets out the key elements of the planning framework in the Borough. A draft Local Plan is being produced which will replace the Core Strategy.

2.3.28 Policy CS13 of the Core Strategy, describes the measures new developments and/or redevelopments have to adopt during construction and occupation in order to achieve higher environmental standards. It states that:

"The Council will require all development to take measures to minimise the effects of, and

to adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) …minimising carbon emissions from the redevelopment, construction and occupation of buildings…"

2.3.29 Policy CS16 consider the air quality within the borough. It states that:

"The Council will seek to improve health and well-being in Camden. We will:

e) … recognise the impact of poor air quality on health and implement Camden's Air Quality Action Plan which aims to reduce air pollution levels."

2.3.30 The draft Local Plan (Camden Draft Local Plan, 2015) considers air quality on draft Policy CC4, which states:

"The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of a development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that I development would cause harm to air quality, the Council will not grant planning permission unless mitigation measures are adopted to reduce the impact to acceptable levels. Similarly, development in locations of poor air quality will not be acceptable unless designed to mitigate the impact to within acceptable limits.

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

The Council will only grant permission for development in Camden's Clear Zone region that significantly increases travel demand where it considers that appropriate measures to minimise the transport impact of development are incorporated."

2.3.31 The Camden Development Policies adopted in 2010 (Camden Development Polices, 2010), forms part of the Council's Local Development Framework. It contributes towards delivering the Core Strategy by setting out detailed planning policies that the council will use when determining applications for planning permission in the borough. Policy DP32 on Air Quality and Camden's Clear Zone, states that:

"The Council will require air quality assessments where development could potentially cause significant harm to air quality. Mitigation measures will be expected in developments that are located in areas of poor air quality.

The Council will also only grant planning permission for development in the Clear Zone region that significantly increases travel demand where it considers that appropriate measures to minimise the transport impact of development are incorporated. We will use planning conditions and legal agreements to secure Clear Zone measures to avoid, remedy or mitigate

the impacts of development schemes in the Central London Area."

London Borough of Camden Air Quality Action Plan

2.3.32 The Camden's Clean Air Action Plan (2013 – 2015) (Camden Air Quality Action Plan, 2013) adopted in 2013, presents the actions the Borough will take in order to help reduce key pollutants in Camden - Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) - which mainly arise from traffic and boilers. Since 2000, the whole London Borough of Camden has been designated and Air Quality Management Area (AQMA) for exceedances of NO_2 and PM_{10} concentrations.

2.3.33 Some of actions presented in the Air Action plan are the following:

- *"Require developers to undertake and Air Quality Assessment (AQA) where a new development could have a negative impact on air quality, and provide and air quality mitigation plan where necessary.*
- *Require developers to submit Construction Management Plans in accordance with the London Best Practice Guidance to Control Dust and Emissions form Construction and Demolition.*
- *Promote the adoption of fuel saving measures to residents.*
- *Continue to monitor air pollution levels across the borough and review air quality monitoring network every year.*
- *Require development sites to meet the Mayor of London's energy hierarchy, with high standards of sustainable building design and construction, and consideration of CHP and renewables. Developers must ensure that best practice requirements for controlling NO_x and PM_{10} emissions from biomass boilers and CHP are met."*

2.3.34 As part of the Clean Air Act, a 'Gas CHP Information Request Form' has to be supplied to the local authority prior to, or as part of, the planning application in order for the local authority to approve the CHP.

Air Quality Planning Checklist

2.3.35 Camden has issued an Air Quality Planning Checklist which is required to be completed for all developments that have an Air Quality Assessment. The checklist covers the following aspects as is completed in **Appendix E**.

3 Methodology

3.1 Existing Conditions

3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by the London Borough of Camden (LBC). Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2015).

3.2 Construction Impacts

3.2.1 During demolition and construction the main potential effects are dust annoyance and locally elevated concentrations of PM_{10}. The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

3.2.2 Separation distance is also an important factor. Large dust particles (greater than 30µm), responsible for most dust annoyance, will largely deposit within 100m of sources. Intermediate particles (10-30µm) can travel 200-500m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10µm) are deposited slowly and may travel up to 1km; however, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

3.2.3 The Sustainable Design and Construction SPG (the SPG) (Greater London Authority, 2014) outlines the risk evaluation to consider based on the site evaluation process set out in the Institute of Air Quality Management (IAQM) 2014 guidance on the assessment of dust from demolition and construction (Holman et al, 2014).

3.2.4 In accordance with the SPG, the dust emission magnitude is defined as either large, medium or small (**Table 3.1**) taking into account the general activity descriptors on site and professional judgement.

3.2.5 The sensitivity of the study area to construction dust impacts is defined as high, medium and low (**Table 3.2**), taking into account professional judgement.

Table 3.1: Criteria for Dust Emission Magnitude

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000m^3 building volume, on site concrete batching, sandblasting

Dust Emission Magnitude	Activity
	Trackout >50 HDVs out / day, dusty soil type (e.g. clay), >100m unpaved roads
Medium	**Demolition** 20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks 2,500 - 10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4m - 8m high bunds, 20,000 - 100,000 tonnes material moved
	Construction 25,000 - 100,000m^3 building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 -100m unpaved roads
Small	**Demolition** <20,000m^3 building demolished, non-dusty material, <10m above ground level, work in winter
	Earthworks <2,500m^2 site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved
	Construction <25,000m^3, non-dusty material
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

Table 3.2: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50m 10 – 100 dwellings within 20m Museums, car parks, car showrooms within 50m PM_{10} concentrations approach or are above the daily mean objective.	National or Internationally designated site within 20m with dust sensitive features / species present
Medium	>100 dwellings, hospitals, schools, care homes within 100m 10 – 100 dwellings within 50m Less than 10 dwellings within 20m	National or Internationally designated site within 50m with dust sensitive features / species present Nationally designated site

Area Sensitivity	People and Property Receptors	Ecological Receptors
	Offices/shops/parks within 20m PM_{10} concentrations below the daily mean objective.	or particularly important plant species within 20m
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350m Less than 10 dwellings within 20 - 350m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 - 50m Locally designated site with dust sensitive features within 50m

3.2.6 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 3.3**), taking into account professional judgement.

Table 3.3: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

3.2.7 Based on the risk of dust impacts, appropriate mitigation is selected using professional judgement.

Significance Criteria

3.2.8 The construction impact significance criteria are based on the SPG. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

3.2.9 With appropriate mitigation in place, the residual effect of construction impacts on air quality is assessed as not significant.

3.3 Road Traffic

Sensitive Locations

3.3.1 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, the proposed locations are considered to be sensitive receptors.

3.3.2 Four locations on the façade of the proposed building have been chosen as proposed receptors (see **Figure 1**); such receptors are described in **Table 3.4** below.

Table 3.4 Proposed Receptors Description

Proposed Receptor	Floor Level	Model Height (m)	Type
PR1	Ground Floor	1.5	Commercial
	First Floor	5.2	Existing Office
	Second Floor	8.55	Existing Office
	Third Floor	11.55	Residential
	Fourth Floor	14.55	Residential
PR2	Ground Floor	1.5	Commercial
	First Floor	5.2	Residential
	Second Floor	8.55	Residential
	Third Floor	11.55	Residential
	Fourth Floor	14.55	Residential
PR3	Ground Floor	1.5	Residential
	First Floor	5	Residential
	Second Floor	8.45	Residential
	Third Floor	11.45	Residential
PR4	Ground Floor	1.5	Residential
	First Floor	5	Residential
	Second Floor	8.45	Residential
	Third Floor	11.45	Residential

3.3.3 Concentrations have also been predicted at CA21 diffusion tube monitor located at Bloomsbury Street in order to verify the modelled results (see **Appendix F** for further details on the verification method).

Impact Predictions

3.3.4 Predictions have been carried out using the ADMS-Roads dispersion model (v3.2.4.0). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2014 meteorological data from the London City Airport monitoring station, which is considered suitable for this area.

3.3.5 AADT flows and the proportions of HDVs, for roads within 250m of the proposed development site and monitoring site CA21 have been taken from the London Atmospheric Emissions Inventory (LAEI). Traffic data used in this assessment is summarised in **Appendix G**.

3.3.6 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v6.0.2, which utilises NO_x emission factors taken from the European Environment Agency COPERT 4 (v10) emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model. In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been

carried out utilising 2014 emission factors and background concentrations, thus assuming no improvement in vehicle emissions or concentrations.

Assessment Criteria

3.3.7 The NAQOs for NO_2 and PM_{10} set out in the Air Quality Regulations (England) 2000) and the Air Quality (England) (Amendment) Regulations 2002,are shown in **Table 3.5**.

Table 3.5: NO_2 and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen dioxide (NO_2)	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40µg/m^3
Particulate matter (PM_{10})	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40µg/m^3

3.3.8 The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and 2004, respectively, and continue to apply in all future years thereafter. Analysis of long term monitoring data suggests that if the annual mean NO_2 concentration is less than 60µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. This concentration has been used to screen whether the one-hour mean objective is likely to be achieved (Defra, 2009).

Significance

3.3.9 There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by Environment Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) (Moorcroft and Barrowcliffe et al, 2015) considers the change in air quality as a result of a proposed development on existing receptors. However, as the proposed development will be car free, the significance criteria are therefore not considered relevant to this assessment.

3.3.10 The assessment has been limited to predicting air quality at the site and the significance of this is based on whether the National Air Quality Objectives for each pollutant are exceeded or not.

3.4 Energy Centre Emissions

3.4.1 It is proposed to install one SAV XRGI 9 gas fired CHP engine to provide base load heat and electricity for the development. The proposed engine will be have a thermal input less than 50MW_{th} and therefore is below the size threshold for compliance with the London Mayor's SPG limits on emissions. Nevertheless, NO_x emissions are 52 mg/Nm^3 and therefore would meet the Band B requirements of the SPG on Sustainable Design and Construction. The CHP system would operate for approximately 5,400 hours per year.

3.4.2 In addition, a Wessex Modumax 750c condensing boiler will be installed to provide additional heat. The boilers have a NO_x emission rate of 37.9 mg/kWh and are therefore compliant with the SPG on Sustainable Design and Construction. The boilers are anticipated to operate for 600 hours per year.

3.4.3 An initial screening exercise has been undertaken using the dispersion parameters in the Environment Agency guidance H1 Annex F: Air Emissions. The guidance provides worst case dispersion parameters to predict the maximum ground level concentration for varying effective

stack heights. An effective stack height of zero metres has been used to estimate the maximum concentration that would result from a given pollutant release rate using the following formulae:

- For annual average concentrations, the maximum concentration = 148 µg/m^3/(g/s)
- For hourly average concentrations, the maximum concentration = 3900 µg/m^3/(g/s)

3.4.4 An effective stack height of zero metres is worst case for the estimation of maximum concentrations as it assumes that the release occurs at the same height of the roof of the building on which it is located. In reality, the stacks will be taller than this above the roof of the building and therefore the calculation is conservative.

3.4.5 The emissions from the combustion equipment will be released as NO_x; on a conservative basis it is assumed that 100% of the release is NO_2 for annual average concentrations and 50% for hourly average concentrations. A release is potentially significant if the long term process contribution is greater than 1% of the annual average NAQO or 10% of the hourly average NAQO.

4 Baseline Conditions

4.1 LAQM

4.1.1 LBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. A whole borough Air Quality Management Area (AQMA) has been declared due to exceedances of the annual and hourly mean NO_2 objectives.

4.2 Monitoring

Nitrogen Dioxide

4.2.1 LBC carried out monitoring of NO_2 concentrations at a number of locations across the borough. The closest and most representative locations are described below and shown in **Figure 2**. Data for these sites are presented in **Table 4.1** and **Table 4.2**.

Table 4.1: Measured NO_2 Concentrations, 2010-2014

ID	Site Type	Within AQMA	Annual Mean (µg/m^3)				
			2010	2011	2012	2013	2014
Automatic Site							
CD3	R	Y	**89**	**76**	**71**	**74**	**69****
Diffusion Tubes							
CA21*	R	Y	**41**	**76.73**	**71.66**	**76.08**	**80.82**
Objective		**40**					

Exceedances of the objective highlighted in bold.
R= Roadside
2010 – 2014 data taken from the Updating and Screening Assessment 2015 LBC (provided by EHO)
*Used for model verification
**Low data capture

Table 4.2: Measured Exceedances of the Hourly Mean NO_2 Objective, 2010- 2014

Site	Number of Hours >200µg/m^3				
	2010	2011	2012	2013	2014
Automatic Site					
CD3	**21**	-*	12	-*	-*
Objective		**18 (200)**			

Exceedances of the objective highlighted in bold.
2010 – 2014 data taken from London Air Quality Network website (London Air Quality Network, 2015)
*Data not available on the London Air Quality Network website

4.2.2 Measured concentrations have been above the objective at both monitoring locations over the 2010 – 2014 time period. There is not clear trend in concentrations over time. As CD3 had low data capture in 2014 it has not been used for model verification.

Particulates (PM_{10})

4.2.3 The results of the PM_{10} monitoring at CD3 monitoring site are shown in **Table 4.3** below.

Table 4.3: Measured PM_{10} Concentrations, 2010 – 2014

Site	Site Type	2010	2011	2012	2013	2014
Annual Mean (µg/m^3)[(a)]						
CD3	R	29	32	29	29	25
Objective		**40**				
Number of days > 50µg/m^3[(b)]						
CD3	R	-*	27	18	-*	-*
Objective		**35**				

R= Roadside
[(a)] Annual mean data 2010 – 2014 taken from Updating and Screening Assessment 2015 LBC (provided by EHO)
[(b)] Number of Days with more than 50µg/m^3 PM_{10} for the period 2010 – 2014 taken from London Air Quality Network website (London Air Quality Network, 2015)
*Data not available on the London Air Quality Network website

4.2.4 PM_{10} measured concentrations have been below the relevant objectives since 2010.

4.3 Background Concentrations

4.3.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (**Table 4.4**; Defra, 2015).

4.3.2 The NO_2 background concentrations at the site are above the relevant objective.

Table 4.4: Estimated Annual Mean Background Concentrations

Year	Annual Mean (µg/m^3)		
	NO_x	NO_2	PM_{10}
2014	90.9	**50.5**	25.5
Objectives	**-**	**40**	**40**

Exceedances of the objectives in bold

5 Impact Assessment

5.1 Construction Impacts

5.1.1 The main potential effects during construction are dust deposition and elevated PM_{10} concentrations. The following activities have the potential to cause emissions of dust:

- Site preparation including delivery of construction material, erection of fences and barriers;
- Demolition of existing buildings on site;
- Earthworks including digging foundations and landscaping;
- Materials handling such as storage of material in stockpiles and spillage;
- Construction and fabrication of units; and
- Disposal of waste materials off-site.

5.1.2 Typically the main cause of unmitigated dust generation on construction sites is from demolition and vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

5.1.3 Based on the SPG criteria (**Table 3.1**), the risk of dust emissions is considered to be small. The study area is considered to be of high sensitivity (**Table 3.2**). Appropriate mitigation corresponding to a low risk site is therefore required during the construction phase (**Table 3.3**) (see **paragraph 6.1.1**). With appropriate mitigation in place the construction impacts as described are not significant.

5.2 Road Traffic Impacts

5.2.1 Predicted concentrations at PR1 – PR4 modelled receptor locations are presented in **Appendix H**. Details of the proposed receptors are shown in **Table 3.4** (see **Figure 1**).

5.2.2 There are predicted exceedances of the long-term annual mean NO_2 concentrations at PR1 (at third and fourth floor), PR2 (from first to fourth floor), PR3 (from first to third floor) and PR4 (from first to third floor). The predicted annual mean NO_2 concentration is above 60µg/m^3 at PR1, PR2, PR3 (ground floor) and PR4 (ground floor) and therefore the short term objective may also be exceeded at these locations.

5.2.3 There are no predicted exceedances of the annual mean PM_{10} concentrations at any of the proposed receptors locations (PR1 – PR4) at all floor levels.

Uncertainty

5.2.4 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

5.2.5 A disparity between the national road transport emission projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean nitrogen oxides and nitrogen dioxide concentrations from road traffic emissions should have fallen by around 15-25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase.

5.2.6 In order to take account of uncertainties in future year vehicle emission factors, the assessment has been carried out for 2014, utilising 2014 emission factors and background concentrations. This is considered to provide a conservative assessment of concentrations on site.

5.3 Energy Centre Emissions

5.3.1 Based on the Environment Agency worst case dispersion parameters for a zero effective stack height, the maximum annual average NO_2 concentration from the CHP is 0.09 µg/m^3 and from the boiler is 0.07 µg/m^3 assuming 100% conversion of NO_x to NO_2. The total maximum concentration is therefore 0.16 µg/m^3 which will occur in the immediate vicinity of the stacks. The maximum annual average NO_2 concentration is only 0.4% of the NAQO. The maximum predicted annual average concentration is therefore insignificant, even assuming 100% conversion of NO_x to NO_2.

5.3.2 The maximum predicted hourly average NO_2 concentration from the CHP is 2.0 µg/m^3 and from the boiler is 13.7 µg/m^3 assuming 50% conversion of NO_x to NO_2. The total impact is only 7.9% of the NAQO and therefore insignificant in accordance with the Environment Agency guidance.

5.4 Air Quality Neutral Calculations

5.4.1 The estimated annual NO_x emission from the boilers and CHP is 34 kg/annum. The NO_x Building Emissions Benchmarks (BEBs) are shown in **Appendix C**. Based on Gross Floor Areas of 402 m^2 for office accommodation, 383 m^2 for leisure, 815 m^2 for retail and 2,449 m^2 for residential, the estimated building emission benchmark is 107 kg/annum. The building will therefore comply with the air quality neutral requirement of the SPG.

5.4.2 As there is no significant traffic generation from the development, the transport emissions benchmark has not been calculated.

6 Mitigation

6.1 Construction

6.1.1 The following standard low risk mitigation measures from the SPG guidance are recommended. An Air Quality and Dust Management Plan should be submitted to the Local Authority prior to works commencing on site.

Site Management

- Display the name and contact details of persons accountable on the site boundary;
- Display the head or regional office information on the site boundary;
- Record and respond to all dust and air quality pollutant emissions complaints;
- Make a complaint log available to the local authority when asked;
- 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;
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken; and
- 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.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible;
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site;
- Fully enclose the site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Avoid site run off of water or mud; and
- Remove potentially dusty materials from site as soon as possible.

Operating Vehicle/Machinery

- Ensure all on road vehicles comply with the London Low Emission Zone;
- Ensure all non-road mobile machinery comply with the standards; where applicable;
- Ensure all vehicles switch off engines when stationary;
- Avoid the use of diesel or petrol powered generators where possible;

- Impose and signpost a maximum speed limit of 10mph on surface haul and work areas; and
- Implement a Travel Plan that supports and encourages sustainable travel (public transports, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding and sawing equipment with dust suppression equipment;
- Ensure an adequate supply of water on site for dust suppressant;
- Use enclosed chutes and conveyors and covered skips; and
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- Avoid bonfires and burning of waste materials on site.

Demolition

- Use of soft strip inside buildings before demolition;
- Ensure effective water suppression is used during demolition operations;
- Avoid explosive blasting; and
- Bag and remove any biological debris or damp down such material before demolition.

Construction

- Avoid scabbling (roughening of concrete surfaces) if possible; and
- Ensure sand and other aggregates are stored in bunded areas and are not allow to dry out.

Trackout

- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary to remove any material track on the site;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transportation; and
- Implement a wheel washing system.

6.2 Operation

6.2.1 Mitigation in the form of mechanical ventilation is required for the entire building at all levels, as the relevant objectives are predicted to be exceeded at all levels. As background pollutant

concentrations are above the objective, then mitigation in the form of NO_x filtration would be more effective than drawing air from high elevations in the building.

6.2.2 In addition, it is recommended that residents should be provided advice regarding when air is most likely to be poor and when it would be advisable to close windows.

7 Conclusions

7.1.1 The air quality impacts associated with the proposed redevelopment of the site at New Oxford Street located within the boundary of the London Borough of Camden have been assessed.

7.1.2 A whole borough Air Quality Management Area (AQMA) has been declared in Camden due to exceedences of the annual and hourly mean NO_2 objectives.

7.1.3 The construction works have the potential to create dust. During construction it is recommended that a package of mitigation measures is put in place to minimise the risk of elevated PM_{10} concentrations and dust nuisance in the surrounding area. With mitigation in place the construction impacts are judged as not significant.

7.1.4 The long-term and short-term NO_2 objectives are predicted to be exceeded at all the proposed receptor locations modelled at all floor levels and therefore mitigation will be required for all of the building. There are no predicted exceedances of the PM_{10} objective at any of the proposed receptor locations at all floor levels.

7.1.5 Emissions from the CHP plant are predicted to have an insignificant effect on local air quality and the building emissions comply with the air quality neutral requirements.

Appendix A Glossary

AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQA	Air Quality Assessment
AQMA	Air Quality Management Area
CAZ	Central Activity Zone
CHP	Combustion Heat and Power
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EFT	Emission Factor Toolkit
EHO	Environmental Health Officer
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes Includes Heavy Gross Vehicles and buses
IAQM	Institute for Air Quality Management
LAQM	Local Air Quality Management
LBC	London Borough of Camden
LEZ	Low Emission Zone
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides, generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
NPPF	National Planning Policy Framework
PM_{10}	Small airborne particles less than 10μm in diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
SPG	Supplementary Planning Guidance

Appendix B References

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Appendix C Benchmarks

C.1 Air Quality Neutral Emissions Benchmarks for Buildings

C.1.1 The following table provides the Building Emissions Benchmarks based on the gross floor area for each type of development class.

Table C.1: 'Air Quality Neutral' Emissions Benchmarks for Buildings (BEBs)

Land Use Class	NO_x (g/m^2/annum)	PM_{10} (g/m^2/annum)
Class A1	22.6	1.29
Class A3 – A5	75.2	4.32
Class A2 and Class B1	30.8	1.77
Class B2 – B7	36.6	2.95
Class B8	23.6	1.90
Class C1	70.9	4.07
Class C2	68.5	5.97
Class C3	26.2	2.28
D1 (a)	43.0	2.47
D1 (b)	75.0	4.30
Class D1 (c - h)	31.0	1.78
Class D2 (a - d)	90.3	5.18
Class D2 (e)	284	16.3

The gross floor area (GFA) is used to define the area.

C.2 Air Quality Neutral Emissions Benchmarks for Transport

C.2.1 The following table provides the Transport Emissions Benchmarks based on the gross floor area and the location of the development.

Table C.2: 'Air Quality Neutral' Emissions Benchmarks for Transport (TEBs)

Land Use	CAZ	Inner	Outer
NO_x (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5

Land Use	CAZ	Inner	Outer
NO_x (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

Appendix D Emissions Standards

D.1.1 Developments are to meet these emission standards along with the 'air quality neutral' benchmark values. Where meeting these emission standards still does not allow the air quality neutral benchmarks to be met, further reduction or offsetting measures would be required.

D.1.2 The emission standards are 'end-of-pipe' concentrations expressed at specific reference conditions for temperature, pressure, oxygen and moisture content. Compliance with these standards should be demonstrated based on monitoring undertaken on the actual installed plant or, where this does not exist at planning application stage, based on manufacturer guaranteed performance levels supported by type approval monitoring undertaken by the equipment supplier. At the very least, a statement of intent to only include combustion plant within the development that meets these standards must be made at application stage. Providing further details on actual installed combustion plant and emissions performance prior to full operation of the development should be made compulsory by way of planning condition. It is not permissible for emission factors (e.g. g/kWh, g/GJ etc) to be converted into an equivalent concentration for compliance purposes.

D.1.3 To deliver both reductions in carbon dioxide emissions and improve air quality a tiered approach has been developed for applicable emission standards. This approach is based upon differentiation according to the baseline air quality in the area of development and will be dependent upon whether or not the development falls into the two tiers defined below.

Table D.1: Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input range 50kWth – 20 MWth

Band	Applicable Range	
	Baseline Annual Mean NO_2 and PM_{10}	Baseline 24-Hour Mean PM_{10}
Band A	>5% below national objective	>1-day less than national objective
Band B	Between 5% below or above national objective	1 day below or above national objective

D.1.4 The emission standards below are target minimum standards. If an assessment indicates that significant air quality effects may occur even when meeting the emission standards, additional measures (such as stack height increase, enforcement of more stringent standards etc.) should be considered in order to produce an acceptable level of impact.

Table D.2: Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input Range 50kWth to less than 20MWth for development in Band A

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Spark ignition engine (natural gas/biogas)[B]	NO_x	250	329	Advanced lean burn operation (lean burn engines) NSCR (rich burn engines)

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Compression ignition engine (diesel / bio-diesel)[B]	NO_x	400	526	SCR
Gas turbine[C]	NO_x	50	177	None above standard technology for modern turbines
Solid biomass boiler (including those involved in CHP applications)[D]	NO_x	275	386	Modern boiler with staged combustion and automatic control
	PM	25	35	Modern boiler with staged combustion and automatic control including cyclone / multicyclone
All (stack heat release less than 1MW)[E]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[E]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

[A] Combustion appliances operating less than 500 hours per annum are exempt from these standards
[B] Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O_2, dry gas
[C] Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O_2, dry gas
[D] Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O_2, dry gas
[E] The stack heat release can be calculated as per equation (3) in the D1 guidance note:

$$Q = \frac{V\left(1-\frac{283}{T}\right)}{2.9}$$

Where:
Q= Stack heat release (MW)
V = Volume flow of stack gases at discharge conditions (Am^3s^{-1})
T = Discharge temperature (K)
N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Table D.3: Emission Standards for Solid Biomass Boilers and CHP Plant in Thermal Input Range 50kWth to less than 20MWth for development in Band B

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Spark ignition engine (natural gas/biogas)[B]	NO_x	95	125	SCR (lean burn engines) NSCR (rich burn engines)
Compression ignition engine (diesel / bio-diesel)[B]	NO_x	400	526	SCR
Gas turbine[C]	NO_x	20	71	Latest generation DLN burners and / or SCR
Solid biomass boiler < $1MW_{th}$ input (including those involved in CHP applications)[D]	NO_x	180	252	Modern boiler with staged combustion and / or SNCR
	PM	5	7	Fabric / ceramic filter
Solid biomass boiler ≥ $1MW_{th}$ input (including those involved in CHP applications)[D]	NO_x	125	175	Modern boiler with staged combustion, automatic control and / or SNCR
	PM	5	7	Fabric / ceramic filter
All (stack heat release less than 1MW)[E]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[E]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

[A] Combustion appliances operating less than 500 hours per annum are exempt from these standards
[B] Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O_2, dry gas
[C] Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O_2, dry gas
[D] Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O_2, dry gas
[E] The stack heat release can be calculated as per equation (3) in the D1 guidance note:

$$Q = \frac{V\left(1-\frac{283}{T}\right)}{2.9}$$

Where:
Q= Stack heat release (MW)
V = Volume flow of stack gases at discharge conditions (Am^3s^{-1})
T = Discharge temperature (K)

N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Appendix E Camden Air Quality Planning Checklist

Travel and Transport

1) If there will be parking in the development, will electric vehicle charging points be included?

   No
   There are no parking spaces associated with the development and therefore no electric vehicle charging points have been included.

2) Will secure cycle storage be provided for users of the building?

   Yes
   44

Energy

3) If a CHP is to be included, did you ensure that this technology is suitable for the energy requirements of the building? Please see Camden's Boiler Guidance Manual B for more information.

   Yes
   Please refer to the Energy Strategy for justification of the inclusion of CHP.

4) If CHP is to be included, was this included within the air quality modelling in the AQA?

   No
   Modelling has not been undertaken as the emissions of the CHP have been screened out as being insignificant using the Environment Agency's H1 Annex F procedure.

5) If CHP will be included and the final technology agreed, have you ensured that it is the best in class in terms of NO_x emissions?

   Yes
   Emissions from the CHP unit meet Band B emission limit requirements as stated in this report. Emissions from the boilers meet the NO_x emission limit of less than 40 mg/kWh. The screening assessment has demonstrated that emissions from the CHP and boiler plant will have an insignificant impact on air quality.

Exposure

6) If located in an area of poor air quality and/or next to a busy road or diesel railway line, does the AQA include details of the way in which the building has been designed to reduce the exposure of occupants (e.g. through orientation, greening, placement of residential properties, or, only for developments in areas of very poor air quality, mechanical ventilation?)

   Yes
   The building will be fitted with mechanical ventilation and NO_2 filtration as per the recommendations of the air quality assessment.

Construction Dust

7) Does the project have a Construction Management Plan written in accordance with the recommendations in the Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, including an assessment of the risk? And, if the risk is High, a real time monitoring proposal?

   No
   The AQA has included an air quality risk assessment as required by the SPG on the Control of Dust and Emissions during Construction and Demolition which has recommended appropriate mitigation. In accordance with the guidance, and on the appointment of a construction contractor, a Construction Management Plan will be able to be prepared.

Appendix F Model Verification

Nitrogen Dioxide

Most nitrogen dioxide is produce in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NO_x = NO + NO_2). The model has been run to predict the 2014 annual mean road-NO_x contribution at the CA21 roadside diffusion tube (identified in **Table 4.1**), which is the most representative of the proposed development.

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was determined from the measured NO_2 concentration using the NO_x from NO_2 calculator and the adjusted background NO_2 concentrations from the Defra background map.

An adjustment factor was determined as follows:

- Measured NO_2: 80.82µg/m^3
- Measured road-NO_x: 98.97µg/m^3
- Modelled road-NO_x : 54.8422µg/m^3
- Road-NO_x adjustment factor: 98.97/54.8422 = 1.8046

This factor implies that the model is under-predicting the road-NO_x contribution. This is a common experience with this and most other models.

PM_{10}

No monitoring of PM_{10} is carried out in proximity to the development site. The primary adjustment factor calculated for NO_2 concentrations has therefore been applied to the modelled road-PM_{10} concentrations.

Appendix G Traffic Data

Location	2014	
	AADT	%HDV
Tottenham Court Road	17,825	9.5%
Bedford Avenue (Between A400 Charing Cross and Adeline Place)	8,045	6.2%
Bedford Avenue (Between Adeline Place and Bloomsbury Street)	1,398	6.9%
Bloomsbury Street A400 (Between Store Street and New Oxford Street)	11,345	14.0%
Montague Place B506	10,474	4.3%
Russell Square A4200	3,489	5.0%
Montague Street	4,887	8.0%
Great Russell Street (Between Bloomsbury Road and Coptic Street)	6,114	7.9%
Great Russell Street (Between Coptic Street and Gilbert Place)	3,325	8.5%
Great Russell Street (Between Gilbert Street and Montague Street)	5,052	8.8%
Great Russell Street (Between Montague Street and Southampton Row)	4,557	5.2%
Coptic Street	2,825	6.7%
Museum Street (Between Great Russell Street and Bloomsbury Way)	1,739	9.4%
New Oxford Street (Between A400 Charing Cross and Bloomsbury Street)	12,295	26.4%
New Oxford Street (Between Bloomsbury Street and High Holborn)	21,088	11.7%
High Holborn (Between A40 and Shaftesbury Avenue)	15,585	4.0%
Southampton Place	3,193	3.5%
Museum Street (Between New Oxford Street and High Holborn Street)	3,489	5.0%
Drury Lane	14,007	4.2%
High Holborn (Between Shaftesbury Avenue and A400 Charing Cross)	8,160	10.3%
Shaftesbury Avenue (Between New Oxford Street and High Holborn)	5,639	4.6%
Shaftesbury Avenue (Between High Holborn and A400 Charing Cross)	21,410	4.5%
Monmouth Street	14,854	4.5%
Charing Cross (Between New Oxford Street and High Holborn)	8,160	10.3%

Location	2014	
	AADT	%HDV
Charing Cross (Between Denmark Street and Old Compton Street)	8,207	25.2%
Endell Street B401	10,541	4.9%
Bloomsbury Street (Between New Oxford Street and High Holborn)	12,909	4.4%

Appendix H Predicted Concentrations

Table G.1 – (Part 1): Predicted Annual Mean NO_2 Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3)				
	Ground Floor (1.5m)	First Floor (5.5m)	Second Floor (8.55m)	Third Floor (11.55m)	Fourth Floor (14.55m)
PR1	**90.4**	**88.3**	**86.4**	**85.3**	**84.5**
PR2	**70.1**	**62.8**	**57.7**	**55.5**	**54.3**
Objective	**40**				

Exceedances of the objectives in bold

Table G.1 – (Part 2): Predicted Annual Mean NO_2 Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3)			
	Ground Floor (1.5m)	First Floor (5m)	Second Floor (8.45m)	Third Floor (11.45m)
PR3	**61.7**	**59.5**	**57.0**	**55.4**
PR4	**60.2**	**58.5**	**56.6**	**55.3**
Objective	**40**			

Exceedances of the objectives in bold

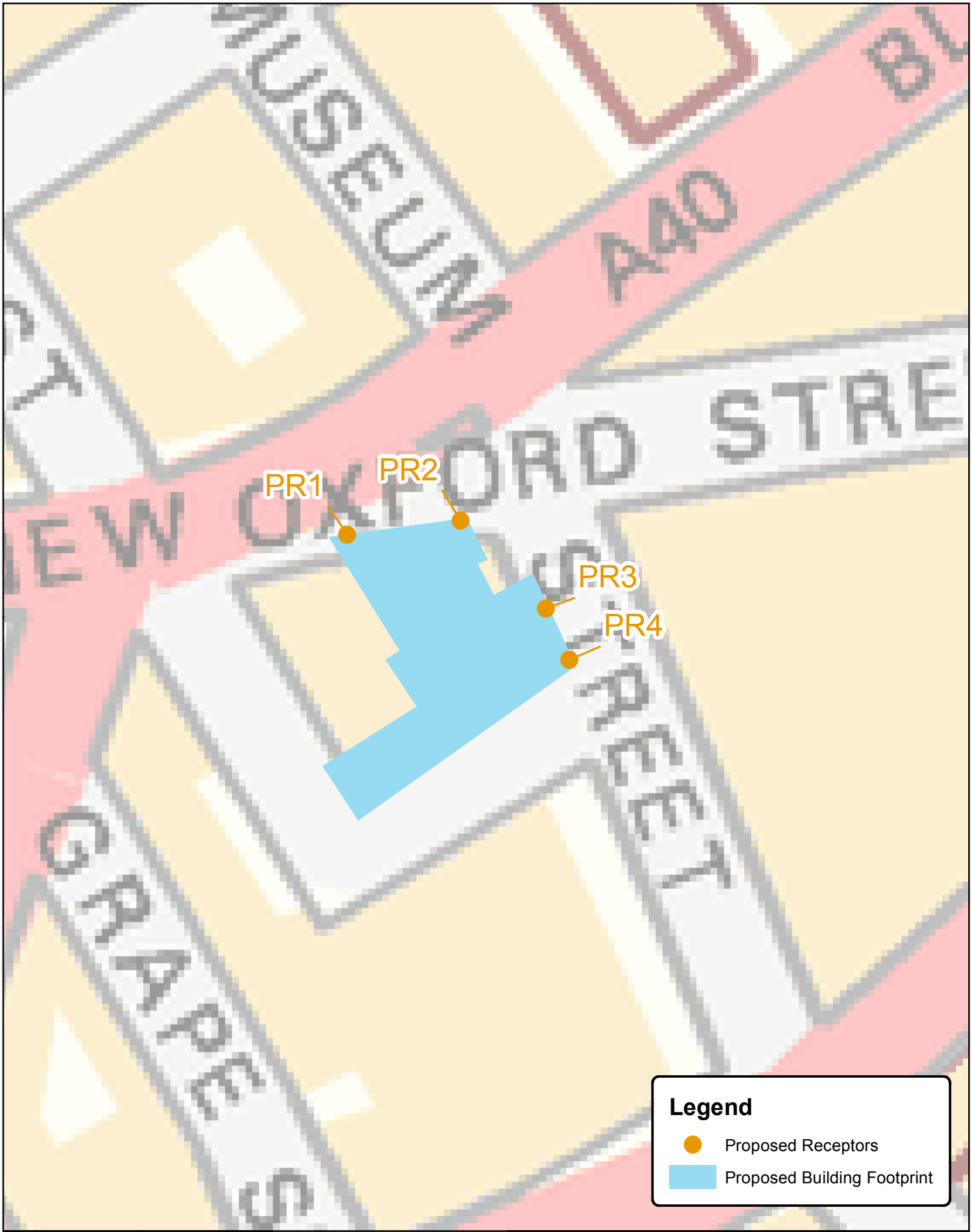
Table G.2 – (Part 1): Predicted Annual Mean PM_{10} Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3)				
	Ground Floor (1.5m)	First Floor (5.5m)	Second Floor (8.55m)	Third Floor (11.55m)	Fourth Floor (14.55m)
PR1	30.0	29.6	29.2	29.0	28.9
PR2	27.7	26.9	26.3	26.0	25.9
Objective	**40**				

Table G.2 – (Part 2): Predicted Annual Mean PM_{10} Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3)			
	Ground Floor (1.5m)	First Floor (5m)	Second Floor (8.45m)	Third Floor (11.45m)
PR3	26.8	26.5	26.2	26.0
PR4	26.6	26.4	26.2	26.0
Objective	**40**			

Appendix I Figures



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Client

River Levett Buckhall

0 10 20 Metres

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New Oxford Street

Air Quality Receptors

Date	11/11/2015
Scale	1:700 @ A4
Drawn By	YO
Checked By	GH
Revision Number	01
Figure Number	**Figure 1**

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Air Quality Monitoring Locations

Date	11/11/2015
Scale	1:1,600 @ A4
Drawn By	YO
Checked By	GH
Revision Number	01
Figure Number	**Figure 2**