Kairus Ltd

Air Quality Assessment

81 Bayham Street

Camden

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1 Introduction

1.1 Introduction

Kairus Ltd was commissioned by SPRUNT to carry out an air quality assessment in connection with a residential development at 81 Bayham Street, Camden.

The Site is located in Camden Town within the London Borough of Camden. Camden Council (CC) has declared the whole borough an Air Quality Management Area (AQMA) due to exceedences of the nitrogen dioxide (NO_2) and particulate matter (PM_{10}) objectives. There is therefore a risk that the air quality objectives are being exceeded at the Site and conditions at the Site need to be assessed in relation to the exposure of future occupants.

This report assessed the proposed development in terms of local air quality. Potential sources of emissions are identified and assessed in the context of existing air quality and emission sources and the nature and location of receptors. The assessment has been undertaken in accordance with the Camden Air Quality Assessment Guidance[1] and the scope agreed with the Air Quality Officer at CC, Amy Farthing.

A glossary of common air quality terminology is provided in Appendix A.

1.2 Scope of Assessment

The application is for detailed planning permission to develop the Site to provide retail units at ground floor level and residential units on floors 1 to 4. The development would not provide any on-site parking and therefore would not generate any additional traffic movements on the adjacent road network. Operational impacts associated with the proposals have therefore been scoped out of the assessment. However, due to the risk of the NO_2 and PM_{10} objectives being exceeded at the Site air quality has been predicted at the facades of the proposed new building to assess the exposure of future occupants to the relevant pollutants.

The assessment has concentrated on NO_2, particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10}), and particulate matter with an aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$), the pollutants most associated with traffic emissions and which can be harmful and cause discomfort to humans.

CC has indicated that a ‘basic air quality assessment’ is required for the Site as set out in the CC assessment guidance. The assessment has therefore focused on predicting air quality at the Site to consider exposure of future occupants to local air quality and on assessing air quality impacts associated with the construction phase of the development. CC has not requested that an Air Quality Neutral Assessment be undertaken for the Site. However, due to the car free nature of the development and the proposed sustainable measures being incorporated to reduce carbon emissions from the Site, including the provision of photovoltaics, the development is considered to be AQN in accordance with the Major of London’s Air Quality Strategy[2] and the London Plan[3].

1 http://www.camden.gov.uk/ccm/content/environment/planning-and-built-environment/two/planning-applications/making-an-application/supporting-documentation/air-quality-assessment.en;jsessionid=FFFB387EC89E46A75EA36D755924A5C0

2 The Major of London (2010) Clearing the Air – The Majors London Air Quality Strategy, Greater London Authority

3 Greater London Authority (March 2015) The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011

2 Site Description

2.1 The Existing Site

The Site is located in Camden Town at 81 Bayham Street. The Site is in a built up area and is currently occupied by a two storey building with a restaurant at ground floor level and residential accommodation above. Directly adjacent to the Site to the north is a four storey building with a retail unit at ground floor and residential units above. Further to the north along Bayham Street are buildings with a mix of retail/commercial and residential uses. To the east along Bayham Street the buildings are mainly residential, while the building directly to the south on the corner of Pratt Street is also residential. To the west the buildings make up the rear of properties along Pratt Street, which are also a mix of retail, commercial and residential. The location of the Site is shown below in Figure 2.1.

Figure 2.1: Location of Development Site

2.2 The Proposed Development

It is proposed to develop the Site to provide a four storey building with retail use at ground floor and 8 residential units spread over floors 1 to 4. Each floor would be provided with an outside terrace area and an area of brown roofing would be provided at 3rd and 4th floor levels. Photovoltaics would also be located at roof height to provide a proportion of the buildings energy demand. An indicative layout of the Site at 4th floor level is provided in Figure 2.2.

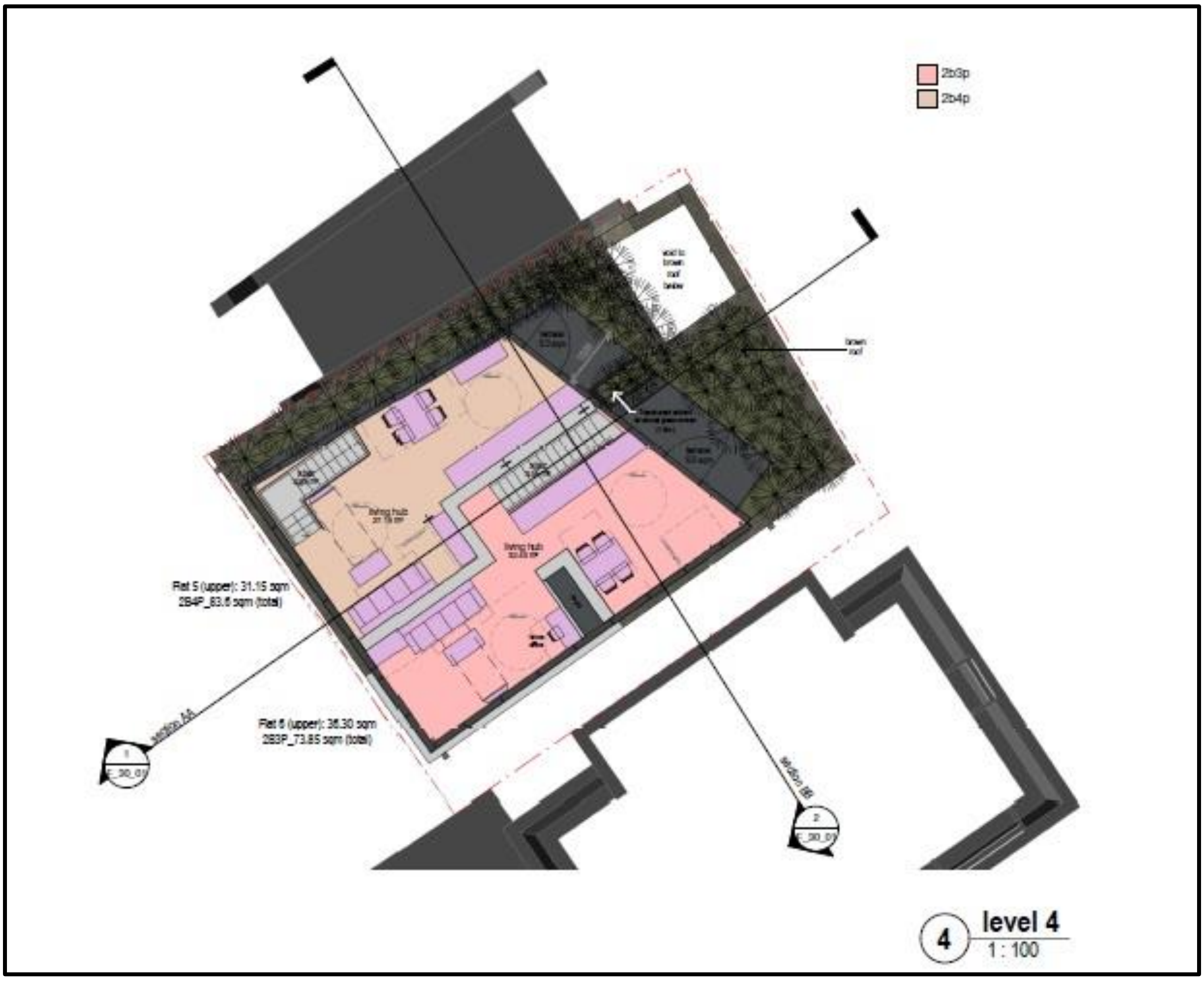

Figure 2.2: Layout of Proposed Development at 4th Floor Level

3 Policy Context

3.1 International Legislation and Policy

The EU Directive 2008/50/EC[4] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for a number of pollutants and the dates by which these objectives should be met. The Air Quality Standards Regulations 2010[5] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

3.2 National Legislation and Policy

3.2.1 Air Quality Strategy for England, Scotland, Wales & Northern Ireland

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[6], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

Of the pollutants included in the AQS, $NO_{2,}$ PM_{10} and $PM_{2.5}$ would be particularly relevant to this project as these are the primary pollutants associated with road traffic.

4 Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

5 Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001

6 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

The current statutory standards and objectives for the three pollutants are set out below in Table 3.1.

Table 3.1: Relevant Objectives set out in the Air Quality Strategy			
Pollutant	**Concentrations**	**Measured As**	**Date to be Achieved By**
Nitrogen Dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times per year	1 hour mean	31 December 2005
	40 μgm^{-3}	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 μgm^{-3}	Annual mean	31 December 2004
Particulate Matter ($PM_{2.5}$)	25 μgm^{-3}	Annual mean	2020

The statutory standards and objectives apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2009 (LAQM.TG(09))[7] issued by DEFRA for Local Authorities on where the objectives apply, as detailed in Table 3.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

Table 3.2: Locations Where Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at:**	**Objectives should generally not apply at:**
Annual Mean	All locations where members of the public might be regularly exposed.	Building facades of residential properties, schools, hospitals, libraries etc. Building facades of offices or other places of work where members of the public do not have regular access. Gardens of residential properties. Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
24 Hour Mean	All locations where the annual mean objective would apply. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.

7 DEFRA (2009) Local Air Quality Management. Technical Guidance LAQM.TG(09)

Table 3.2: Locations Where Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at:**	**Objectives should generally not apply at:**
1 Hour Mean	All locations where the annual mean and 24 hour mean objectives apply. Kerbside Sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2.2 National Planning Policy Framework

Published on 27th March 2012, the National Planning Policy Framework (NPPF)[8] sets out the Government's planning policies for England and how these are expected to be applied. It replaces Planning Policy Statement 23: Planning and Pollution Control[9] which provided planning guidance for local authorities with regards to air quality.

At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development.

Current planning law requires that application for planning permissions must be determined in accordance with the relevant development plan (i.e. Local Plan or Neighbourhood Plan). The NPPF should be taken into account in the preparation of development plans and therefore the policies set out within the Framework are a material consideration in planning decisions.

The NPPF identifies 12 core planning principles that should underpin both plan-making and decision-taking, including a requirement for planning to *'contribute to conserving and enhancing the natural environment and reducing pollution'*.

Under Policy 11: Conserving and Enhancing the Natural Environment the Framework requires the planning system to *'prevent both new and existing developments from contributing to or being put at unacceptable risk or being adversely affected by unacceptable levels of air pollution'*.

In dealing specifically with air quality the Framework 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'.*

8 Communities and Local Government (2012) National Planning Policy Framework

9 Office of the Deputy Prime Minister (2004) Planning Policy Statement 23: Planning and Pollution Control. HMSO

3.2.3 Control of Dust and particulates Associated with Construction

Section 79 of the Environmental Protection Act (1990)[10] states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

- *'any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and*
- *'any accumulation or deposit which is prejudicial to health or a nuisance'.*

Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

In the context of the proposed development, the main potential for nuisance of this nature would arise during the construction phase - potential sources being the clearance, earthworks, construction and landscaping processes.

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist - 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates. However, impacts remain subjective and statutory limits have yet to be derived.

3.3 Regional Legislation and Policy

3.3.1 The Major of London's Air Quality Strategy

The Mayor of London's AQS sets out a series of policies and proposals for the implementation of the UK AQS and for the achievement of the air quality standards and objectives in Greater London. With regards new developments the following policies are of relevance:

Policy '1 - Encouraging smarter choices and sustainable travel': The Mayor will support a shift to public transport, by only supporting developments that generate high levels of trips in locations with good public transport accessibility, by supporting car free developments and encouraging the inclusion of infrastructure to support sustainable travel, such as cycling, electric vehicle recharging points and car clubs;

Policy '6 - Reducing emissions from construction and demolition sites': The London Council's Best Practice guidance will be reviewed and updated, and more vigorously implemented;

Policy '7 - Using the planning process to improve air quality - new developments in London as a minimum shall be 'air quality neutral': The Mayor will encourage boroughs to require emissions assessments to be carried out alongside conventional air quality assessments. Where air quality impacts are predicted to arise from developments these will have to be offset by developer contributions and mitigation measures secured through planning conditions, section 106 agreements or the Community Infrastructure Levy;

Policy '8 - Maximising the air quality benefits of low to zero carbon energy supply': The Mayor will apply emission limits for both PM and NOx for new biomass boilers and NOx emission limits for Combined Heat and Power Plant (CHPP). Air quality assessments will be required for all developments proposing biomass boilers or CHPPs and operators will be required to provide evidence yearly to demonstrate compliance with the emission limits;

10 Secretary of State, The Environment Act 1990 HMSO

Policy '9 - Energy efficient buildings': The Mayor will set CO_2 reduction targets for new developments which will be achieved using the Mayor's Energy Hierarchy. These measures will result in reductions of NO_x emissions; and

Policy '10 - Improved air quality in the public realm': The Mayor will encourage the improvement of air quality in the public realm by planting vegetation to trap particulate matter. Through the planning system the Mayor will increase the number of green roofs and living walls across London. Additionally, he will encourage the planting of trees in areas of poor air quality.

3.3.2 The London Plan

The London Plan 2015[11] was published in March and consolidated the London Plan 2011 with the Revised Early Minor Alterations to the London Plan13 and the Further Alterations to the London Plan also published in March 2015. The Plan is the overall strategic plan for London setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. It specifically addresses how development can help support the implementation of the Mayor's Air Quality Strategy and achieve a reduction in pollutant emissions and public exposure to pollution.

Policy 7.14 – Improving Air Quality requires all development proposals to:

- Minimise increased exposure to existing poor air quality, make provision to address local problems of air quality (particularly within AQMAs) and promote greater use of sustainable transport modes through travel plans;
- Promote sustainable design and construction to reduce emissions from demolition and construction of buildings including following current best practice guidance;
- Be at least 'air quality neutral' and therefore not leading to further deterioration of existing poor air quality;
- Look, in the first instance, to implement measures on-site to reduce emissions from a development. If inappropriate or impractical, other measures should be considered and where found to provide equivalent air quality benefits, planning obligations or planning conditions should be used to ensure their implementation;
- Permission will only be granted where a detailed assessment of biomass boilers shows no adverse impact from emissions

3.3.3 Major of London Sustainable Design and Construction SPG

The Mayor's Sustainable Design and Construction Supplementary Planning Guidance (SPG)[3] sets out guidance on meeting the London Plan Policy on sustainable design and construction.

In relation to air quality the SPG sets out guidance on the following key areas:

- assessment requirements;
- construction and demolition;
- design and occupation;
- air quality neutral policy for buildings and transport; and
- emissions standards for combustion plant.

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11 Greater London Authority (March 2015) The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011

Reference has been made to the guidance set out within the SPG when undertaking this assessment.

3.4 Local Legislation and Policy

3.4.1 Camden Core Strategy

The Camden Core Strategy[12] sets out the vision for the borough up until 2026. Under policy CS9 it states that the Council will '*continue to designate Central London as a Clear Zone Region to reduce congestion, promote walking and cycling and improve air quality'*. Furthermore, under policy CS16 it will '*recognise the impact of poor air quality on health and implement Camden's Air Quality Action Plan which aims to reduce air pollution levels'*.

3.4.2 Camden Development Policies

The Camden Development Policies[13] set out policies governing development within the borough until 2025.

In dealing with air quality the document sets out policy 32 – Air Quality and Camden's Clear Zone with requires all developments which could potentially cause a significant harm to air to undertake air quality assessments, setting out mitigation measures where required. The policy also states that planning permission will only be granted for developments in the Clear Zone where appropriate measures are in place to reduce the impact of transport.

3.4.3 Draft Local Plan

The Local Plan will replace the core strategy and development policies once adopted. In dealing with air quality the plan the draft local plan[14] sets out the following under policy CC4:

'*The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both 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 Councils Air Quality Action Plan;*

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

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12 Camden Council (2010) Local Development Framework –Camden Core Strategy 2010-2025

13 Camden Council (2010) Camden Development Policies 2010-2025

14 Camden Council (2014) Draft Camden Local Plan 2015

4 Methodology

4.1 Construction Phase

4.1.1 Introduction

It is inevitable that with any development, demolition and construction activities would cause some disturbance to those nearby. Dust arising from most construction activities tends to be of a coarse nature, which through dispersion by the wind, can lead to soiling of property including windows, cars, external paintwork and laundry.

The ability of dust particles to remain suspended in the air depends on its shape, size and density. Coarse particles (>30µm) tend to be deposited within 100 m of source[15]. Finer particles, between 10-30µm, are generally deposited within 200 to 500 m of source, while very fine particles (<10 µm), which remain suspended for longer, can travel up to 1 km from source. The greatest proportion of construction dust is made up of coarse particles, thus the majority of dust emissions are deposited within 100 m of source.

However, as well as giving rise to annoyance due to soiling of surfaces from dust emissions, there is evidence of major construction activities causing increases in long term PM_{10} and $PM_{2.5}$ concentrations and in the number of days exceeding the short term PM_{10} objective of 50 μgm^{-3}. The potential for impacts to occur during the construction of a proposed development must therefore be considered, to ensure appropriate mitigation measures are applied to reduce potential impacts at adjacent receptors. However, it should be noted that disruption due to demolition and construction is a localised phenomenon and is temporary in nature.

During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO_2, PM_{10} and $PM_{2.5}$.

It is anticipated that during the construction phase there would be no more than 15-20 heavy duty vehicles (HDV) accessing the Site in any given day. The recently released Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) air quality guidance[16] sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are likely to occur where a development results in greater than 25 HGV movements per day within an AQMA. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 PM_{10} and $PM_{2.5}$ concentrations and has not been considered any further in this assessment.

4.1.2 Prediction Method and Approach

To assess the potential impacts associated with dust and PM_{10} releases during the construction phase and to determine any necessary mitigation measures, an assessment has been undertaken based on the latest guidance from the Major of London[17].

The guidance divides activities on construction sites into the following four categories:

- demolition (removal of existing structures);

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15 Office of the Deputy Prime Minister, 2000. MPG11: Controlling Environment Effects of Minerals, Annex 1 – The Control and Mitigation of dust at Minerals and Related Workings.

16 EPUK and IAQM (2015) Land-Use Planning and Development Control: Planning for Air Quality

17 Mayor of London (2014) The Control of Dust and Emissions from Construction and Demolition

- earthworks (soil-stripping, ground-leveling, excavation and landscaping);
- construction (activities involved in the provision of a new structure); and
- trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

The assessment methodology requires consideration of dust effects arising from three potential impacts:

- annoyance due to dust soiling;
- harm to ecological receptors; and
- the risk of health effects due to a significant increase in exposure to PM_{10} and $PM_{2.5}$.

The three impacts are assessed taking into account the sensitivity of the area likely to experience these effects, with the results of the assessment being used to define appropriate mitigation measures to prevent any significant effects at nearby receptors.

The SPG sets out the assessment into a number of steps. The first is an initial screening assessment to determine if there are sensitive receptors (both human and ecological) within 50 m of the site boundary or within 50 m of the proposed construction haulage routes up to 500 m from the site entrance, thus determining the requirement for a more detailed evaluation.

Step 2 of the methodology assesses the risk of dust impacts for each construction activity and takes account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (step 2a); and
- the sensitivity of the area (step 2b).

The above two steps are then combined (step 2c) to identify the risk of dust impacts which are described in terms of there being a low, medium or high risk of dust effects for each of the four activity groups and assuming no mitigation measures are in place.

Based on the identified risk, appropriate mitigation measures are identified as set out in the SPG guidance.

All construction sites are different and the potential for dust impacts are dependent on a number of local factors. The methodology set out in the SPG guidance is therefore considered as a framework for assessing dust impacts and a certain level of professional judgment is required in determining the effects from each site.

The significance of identified effects is evaluated post-mitigation using professional judgment and assuming that the mitigation measures identified and set out within the assessment are implemented by way of an Air Quality and Dust Management Plan (AQDMP).

4.2 Operational Phase

4.2.1 Introduction

Potential impacts on air quality due to local traffic emissions have been predicted using the ADMS dispersion model (version 3.2.4, released in November 2013 and updated in September 2014). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in Table 3.1 for NO_2, PM_{10} and $PM_{2.5}$.

4.2.2 Emissions Data

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from London City Airport Meteorological Station for 2013 has been used for the assessment.

The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$ at the facades of the proposed new building. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the DEFRA air quality website (http://uk-air.defra.gov.uk).

The most recent emission factors released by DEFRA in July 2014 and provided in the emissions factor toolkit EFT2014_6.0.1, have been used within the ADMS model to predict existing traffic emissions.

The ADMS model cannot accurately predict short-term pollutant concentrations. The number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration has therefore been calculated from the annual mean, following the approach set out by DEFRA in LAQM TG(09):

$$A = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

where A is the number of exceedences of 50 µgm^{-3} as a 24-hour mean PM_{10} concentration.

LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[18] has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. NO_2 concentrations at the Site have also been considered in terms of the 1-hour objective based on the predicted annual mean concentrations.

4.2.3 Background Concentrations

The ADMS model estimates concentrations arising as a result of vehicle emissions. It is necessary to add an estimate of local background concentrations to obtain the total concentration for comparison against the air quality objectives.

Background concentrations of NO_x and NO_2 for use in the modelling assessment have been taken from the nearby automatic monitoring site located at Bloomsbury. The data is presented in Table 5.2.

Although the site monitors PM_{10} concentrations it was found that the estimated background concentrations set out within the DEFRA 2011 background maps were higher during 2013. Background PM_{10} data has therefore ben taken from the DEFRA maps. The Bloomsbury site does not monitor concentrations of $PM_{2.5}$ therefore background concentrations of this pollutant have also been taken from the DEFRA 2011 background maps. Concentrations have been extracted from the maps for the grid squares representing the development site and surrounding area. Background concentrations for 2013 have been used to be consistent with the meteorological data and allow verification of the model results which is discussed in further detail in section 4.2.5 below.

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18 D Laxen and B Marner: *Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites* (July 2003).

Details of the background PM data used within the modeling assessment are provided in Table 5.6.

4.2.4 Traffic Data

There are a number of sources of traffic data which provide traffic flows along the main roads within London, these include the London Atmospheric Emissions Inventory 2011 (LAEI2011), the Department of Transport (DfT) traffic count data sets[19] and the '*How Polluted Is My Road*' (HPIMR) website[20]. Base traffic flows along the roads surrounding the Site and for the roads used in the model verification process have been taken from all three traffic data sources. The highest Annual Average Daily Traffic (AADT) flow for each road link has then been used within the modelling assessment to ensure a worst-case prediction of local air quality.

The traffic data used within this assessment are provided below in Table 4.1.

Table 4.1: AADT traffic Flows used in ADMS Modelling Assessment				
Road link	**Data Source**	**Speed (kph)**	**%HGV**	**AADT**
Camden Road (A503)	LAEI2011	40	8.1	29355
Euston Road (A501)	HPIMS	35	11.9	53942
Bayham Street (A503)	HPIMS	48	15.6	18220
Pratt Street (A503)	HPIMS	40	15.6	18220
Bayham Street (south of Pratt Street)	LAEI2011	48	10.8	10387
Camden High Street (A400)	DfT	35	10.3	23698

4.2.5 Verification of Model Results

It is recommended that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(09) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

Verification of the model has been undertaken by predicting NO_2 concentrations at three local monitoring sites, the Euston Road automatic monitoring site and the Camden Road (CA23) and Euston Road (CA4) diffusion tube sites. There is another monitoring site in close proximity to Bayham Road, CA20 Brill Place, however no traffic data could be obtained for Brill Place therefore this site was excluded from the verification process.

The results of the comparison are presented below in Table 4.2.

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19 http://www.dft.gov.uk/traffic-counts/

20 http://www.howpollutedismyroad.org.uk/

Table 4.2: Comparison of Modelled and Monitored NO_2 Concentrations (µg/m^3)			
Monitoring Site	**Monitored Concentrations**	**Predicted Concentrations**	**% Difference**
Euston Road Automatic Site	106.0	79.6	-24.9
CA4	107.8	69.8	-35.3
CA23	77.8	68.3	-12.2

The comparison of monitored and modelled concentrations indicates that the model is under-predicting annual mean NO_2 concentrations by an average of 24% compared to monitored concentrations. The results of the modelling assessment have therefore been adjusted using the methodology given in LAQM.TG(09) to better reflect local concentrations. Full details of the verification and calculation of the adjustment factors for NO_2 are provided in Appendix B.

Following adjustment of the model results the assessment is showing no overall tendency to over or under predict concentrations and predicted concentrations are within 25% of monitoring data at all three sites.

There is no suitable monitoring of PM_{10} or $PM_{2.5}$ data to allow verification of the PM model results. However, LAQM.TG(09) suggests applying the NO_x adjustment factor to modelled road-PM_{10} where no appropriate verification against PM_{10} data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

Receptors

As discussed in Section 3.2.1 and set out in Table 3.2, LAQM.TG(09) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations *'where members of the public are regularly present'* should be considered. At such locations, members of the public would be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

For instance, on a footpath, where exposure would be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term standards (such as 24 hour mean or annual mean) may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

For the completion of this assessment, air quality has been predicted at the facades of the proposed new building which represent the residential units at each floor. Each receptor has been assumed to be 1.5 m above floor height with each floor assumed to be 3m in height.

The details of each receptor are presented below in Table 4.3 and their locations shown in Figure 4.1.

Table 4.3: Location of Receptors used in ADMS Modelling Assessment		
Receptor Number	**Receptor Location**	**OS Grid References**
1	Façade of building fronting onto Bayham Street – Ground floor up to 3rd floor	529081, 183723
2	Façade of building fronting onto Bayham Street – Ground floor up to 3rd floor	529077, 183731
3	Rear Façade of building – ground up to 4th floor plus roof height	529070, 183716
4	Rear Façade of building – ground up to 4th floor	529065, 183723
5	Front façade of Penthouse – 4th floor and roof height	529078, 183722
6	Front façade of Penthouse – 4th floor and roof height	529078, 183723

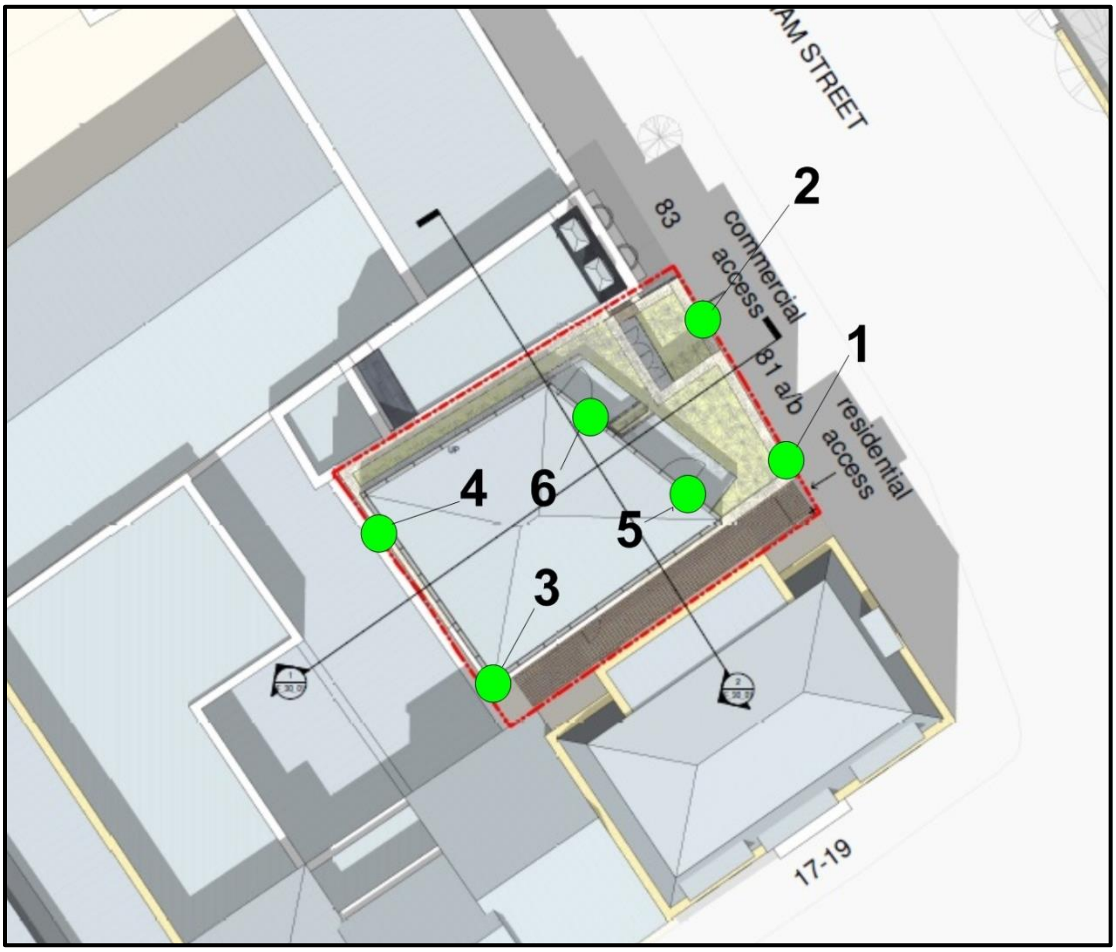

Figure 4.1: Receptor Locations

5 Baseline Assessment

5.1 Air Quality Monitoring

5.1.1 Automatic Monitoring

CC operates 4 automatic monitoring sites within the borough, the closest sites to Bayham Street being the roadside site located on Euston Road and the background site at London Bloomsbury. Although the Bloomsbury site measures both NO_2 and PM_{10} concentrations only NO_2 is monitored on Euston Road. However, NO_2 is also monitored at a number of diffusion tube sites across the borough which have also been used to inform the baseline assessment. As there are no other sites in close proximity measuring PM_{10}, data recorded at the other two automatic sites have been included to assessment baseline concentrations of this pollutant.

Details of all four monitoring sites are set out in Table 5.1.NO_2 concentrations recorded over the last 5 years are provided in Tables 5.2 and 5.3 and PM_{10} concentrations are provided in Tables 5.4 and 5.5.

Table 5.1: Details of the CC Automatic Monitoring Sites

Site	Classification	OS Grid Ref	Pollutants Monitored	Distance to Kerb of nearest Road
London Bloomsbury	Urban Background	530120, 182034	NO_2, PM_{10}	27 m
Swiss Cottage	Kerbside	526633, 184392	NO_2, PM_{10}	3 m
Shaftesbury Avenue	Roadside	530060, 181290	NO_2, PM_{10}	<1 m
Euston Road	Roadside	529878, 182648	NO_2	0.5 m

Table 5.2: Annual Mean NO_2 Concentrations Recorded at the Automatic Monitoring Sites ($\mu g/m^3$)

Site	Year				
	2010	2011	2012	2013	2014
Bloomsbury	55	50	55	51	45
Euston Road	-	122	106	106	104

The data presented in Table 5.2 shows NO_2 concentrations exceeding the annual mean objective of 40 $\mu g/m^3$ at both roadside and background locations. The data shows NO_2 concentrations are much higher along Euston Road than at background locations.

The data indicates an overall decline in concentrations at both sites over the last five years although there has been little change in concentrations along Euston Road over the last three years.

Table 5.3: Number of Exceedences of the 1-hour NO_2 Objective of 200 µg/m^3					
Site	**Year**				
	2010	**2011**	**2012**	**2013**	**2014**
Bloomsbury	1	3	1	1	1
Euston Road	-	726	295	296	220

Both monitoring sites have recorded exceedences of the 1 hour objective of 200 µg/m^3 over the last five years (Table 5.3). However, at the Bloomsbury site the highest number of exceedences was 3. The objective allows for up to 18 exceedences of the objective in any given year therefore at background locations it is considered unlikely that the 1-hour objective is being breached. However, along Euston Road the objective has been breached during all four monitoring years presented.

Table 5.4: Annual Average PM_{10} Concentrations recorded at the Automatic Sites (µgm^{-3})					
Site	**Year**				
	2010	**2011**	**2012**	**2013**	**2014**
Bloomsbury	18	22	19	18	19
Swiss Cottage	26	27	23	21	22
Shaftesbury Avenue	29	32	29	29	25

Table 5.5: Number of Exceedences of the 24-hour 50 µgm^{-3} PM_{10} objective					
Site	**Year**				
	2010	**2011**	**2012**	**2013**	**2014**
Bloomsbury	2	17	10	4	10
Swiss Cottage	26	31	21	8	11
Shaftesbury Avenue	29	27	18	15	16

The data presented in Table 5.4 shows annual mean PM_{10} concentrations consistently below the 40 µg/m^3 objective at both roadside and background monitoring locations over the last five years.

All three monitoring sites have recorded exceedences of the 24 hour 50 µg/m^3 objective limit over the last five years. However, the objective allows for up to 35 exceedences of the objective in any given year therefore the objective has not been breached at either background or roadside locations within the borough.

5.1.2 Non-automatic Monitoring

CC also operates an extensive network of passive diffusion tubes which monitor NO_2 concentrations across the borough. The closest sites to Bayham Street are set out in Table 5.5 along with data recorded over the last five years.

Diffusion tubes are a passive form of monitoring, which, due to their relative in-expense, allow for a much greater spatial coverage than with automatic monitoring sites. Diffusion tubes are acknowledged as a less accurate method of monitoring ambient air pollutants than automatic monitors, with diffusion tubes over or under estimating concentrations by as much as 30 %.

To allow the results to be reliably compared with the AQ Objectives, the data should be bias corrected using data collected from tubes co-located with continuous monitoring sites. The CC data has been bias adjusted using the national factors available from the National Diffusion Tube Bias Spreadsheet available on the DEFRA website[21].

Table 5.5: Diffusion Tube annual average nitrogen dioxide concentrations (μgm^{-3})

Site	Classific-ation	OS Grid Ref	Year				
			2010	2011	2012	2013	2014
CA4 Euston Road	Roadside	530110, 182795	82.0	93.1	82.1	107.8	89.7
CA20 – Brill Place	Roadside	529914, 183147	54	50.8	50.0	49.4	52.3
CA23 – Camden Road	Roadside	529173, 184129	84	72.2	67.4	77.9	72.2

Annual mean NO_2 concentrations have been consistently above the objective of 40 µg/m^3 at all three monitoring sites over the last five years. Concentrations recorded at the site on Brill Place and Camden Road show an overall decline in concentrations over the last five years, although concentrations increased slightly in 2014 at Brill Place. However, the data recorded at Euston Road shows no consistent trend in concentrations although there seems to be an overall increase in concentrations since 2010.

Short-term NO_2 concentrations cannot be recorded by diffusion tubes, therefore no short term data is available. However, research indicates that where the annual mean is below 60 μgm^{-3} it can be assumed that exceedences of the 1 hour objective for NO_2 are unlikely to occur. Based on the information provided in Table 5.5, it is expected that the short-term objective is being exceeded at roadside locations along both Camden Road and Euston Road.

5.2 DEFRA Background Maps

Additional information on estimated background pollutant concentrations has been obtained from the DEFRA 2011 background maps provided on UK-AIR, the Air Quality Information Resource (http://uk-air.defra.gov.uk). Estimated air pollution concentrations for NO_2, PM_{10} and $PM_{2.5}$ have

21 http://laqm.defra.gov.uk/diffusion-tubes/diffusion-tubes.html

been extracted from the 2013 background pollution maps for the UK. These maps are available in 1 km x 1 km grid squares.

The average background concentrations for the following grid squares are presented in Table 5.6, which represent concentrations in the vicinity of the development site and the road network considered within the modelling assessment;

- 529500, 182500;
- 530500, 182500;
- 529500, 184500. .

The data indicates that background concentrations of NO_2 are exceeding the annual mean objective while background concentrations of both PM_{10} and $PM_{2.5}$ are below the relevant objective limits.

Table 5.6: DEFRA Annual Mean Background Air Pollution Concentrations	
Pollutant	**2013**
Nitrogen dioxide	43.1
PM_{10}	25.2
$PM_{2.5}$	16.8

5.3 Air Quality at the Development Site

As detailed in section 2, the Site is located in Camden Town along Bayham Street. Bayham Street connects to Camden Road to the north and joins Pratt Street to the south. It is expected that NO_2 concentrations in the vicinity of the Site would be similar to or slightly lower than concentrations recorded at the Camden Road (CA23) monitoring site. Annual mean NO_2 concentrations are therefore expected to be exceeding the annual mean and 1-hour objective at the Site.

Based on the PM_{10} data presented in Table 5.4 and 5.5 , PM_{10} concentrations are expected to meet both the annual mean and 24-hour objective limits at the Site.

Although $PM_{2.5}$ concentrations are not recorded at roadside locations in the borough, background concentrations are comfortably below the annual mean objective of 25 $\mu g/m^3$. Based on professional judgment and experience of assessing air quality at similar sites it is expected that $PM_{2.5}$ concentrations are unlikely to be significantly higher than background concentrations in the vicinity of Bayham Street therefore it is unlikely that this objective will be breached at the Site.

6 Construction Impacts

6.1 Site and Surroundings

A summary of the proposed development is provided in Section 2 of this report.

The Site is currently occupied by a two story building which will be demolished as part of the proposals. An assessment of impacts associated with demolition activities has therefore been included in this assessment.

There are residential properties located within 50 m of the Site, the closest being those directly to the north and south, followed by the properties to the east on Bayham Street. An assessment of construction related impacts in relation to human receptors is therefore considered necessary.

There are no statutory designation sites (i.e. Special Areas of Conservation, Sites of Special Scientific Interest, Nature reserves or Special Protection Areas) within 50 m of the Site therefore the sensitivity of the surrounding area in relation to ecological receptors is considered to be low and impacts as a result of dust emissions, negligible. Impacts on ecologically sensitive receptors have not been considered any further within the assessment.

As discussed in Section 5, PM_{10} concentrations in the vicinity of the Site are expected to be below the relevant objective limits. Based on concentrations recorded at other roadside sites in the borough annual mean PM_{10} concentrations in the vicinity of the Site are expected to be in the region of 25-30 µg/m^3.

The precise behavior of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

A windrose from the London City Airport Meteorological Station is provided below in Figure 6.1, which shows that the prevailing wind is from the south-west although there were also strong winds from the east. Receptors located to the north-east and west are therefore most at risk of experiencing impacts.

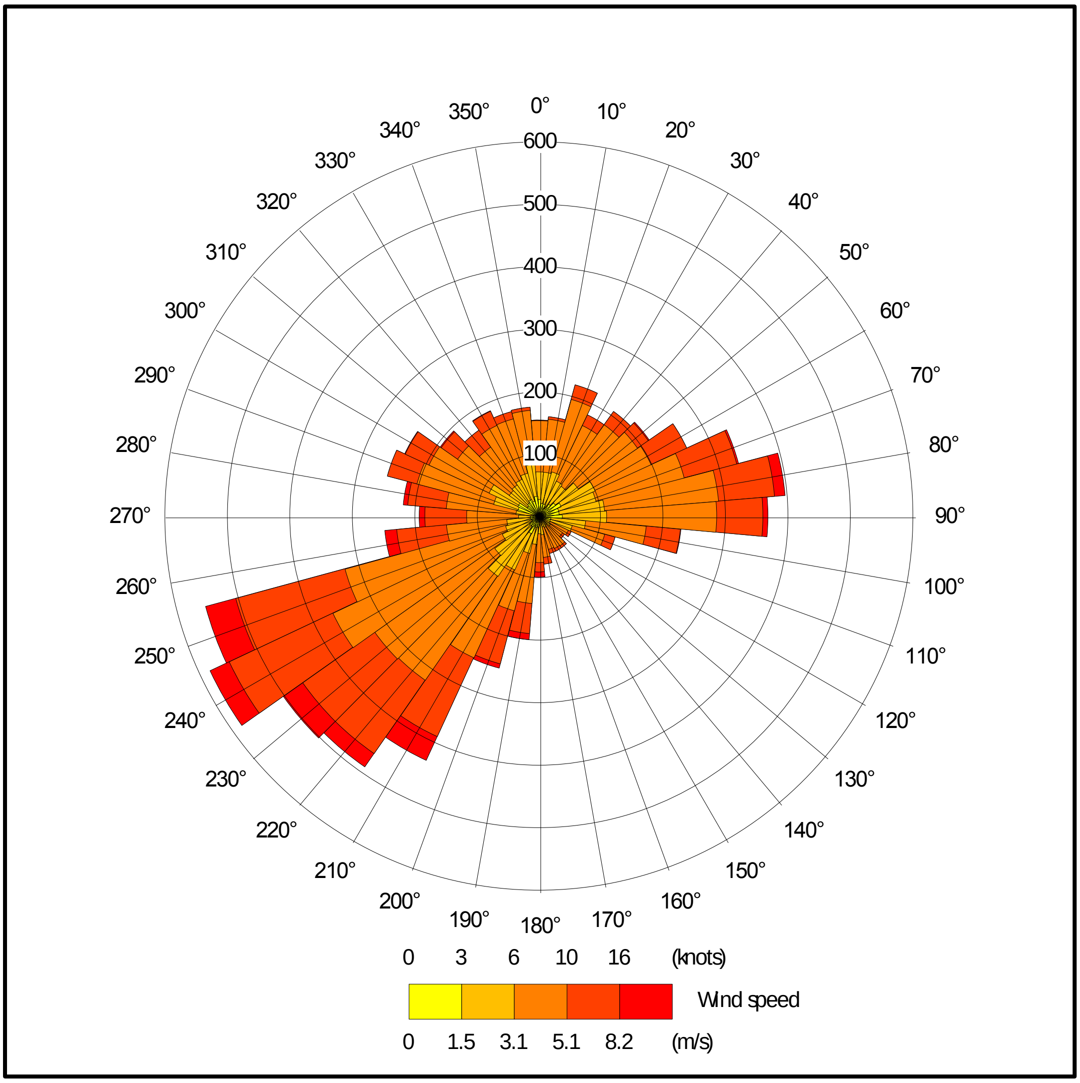

Figure 6.1: Windrose from London City Airport Meteorological Station (2013)

6.2 Risk Assessment of Dust Impacts

6.2.1 Potential Dust Emission Magnitude

The dust emission magnitude is based on the scale of anticipated works at the Site and has been classified as small, medium or large for each of the three activities; earthworks, construction and trackout. A summary of the dust emission magnitude for each activity is set out in Table 6.1.

Demolition

Dust emissions from demolition can arise from a number of activities including the de-construction of buildings, on-site crushing and screening and general disturbance of potentially dusty materials.

The building that would be demolished, although of brick and concrete construction which have the potential to generate a significant amount of dust, has a total volume of less than 1500 m^3 and is less than 10 m in height. The Site is therefore considered to have a dust magnitude of 'small' in relation to dust emissions generated by demolition activities.

Earthworks

Earthworks are those activities involved in preparing the Site for construction such as excavation of material, haulage, tipping, stockpiling and leveling.

The Site covers an area of approximately 160 m^2 and during the earthworks stage it is anticipated there would be no more than 1-2 heavy earth moving vehicles on site at any one time. There is also limited space for storage of materials on the site therefore the majority of material excavated is likely to be removed from site rather than stored in stockpiles. The Site is therefore considered to have a dust emission class of 'small' with regards to earthwork activities.

Construction

There are a number of issues that can impact the dust emission class during construction activities including the size of the building, materials used for construction, the method of construction and the duration of the build.

Although the main construction materials used for construction would be brick and concrete (potentially dusty materials), based on the current design layouts the total building volume proposed for the Site would be less than 3500 m^3. The Site is therefore considered to have a dust emission class of 'small' with regards to construction activities.

Trackout

The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout.

Given the size of the Site and nature of the development it is anticipated that there would be between 15-20 HDV movements to and from the site on a daily basis. Furthermore, due to the size of the site vehicles would not be travelling within the site area and therefore would not be travelling over unpaved roads. The Site is therefore considered to have a dust emissions class of 'small' with regards to trackout activities.

Table 6.1: Summary of Dust Emission Magnitude for each Activity

Source	Magnitude
Demolition	Small
Earthworks	Small
Construction	Small
Trackout	Small

6.2.2 Sensitivity of Area

Based on the SPG residential dwellings are considered as high sensitivity receptors in relation to both dust soiling and health effects of PM_{10}. The nearest residential properties are located directly adjacent to the north and south of the Site and also on the opposite side of Bayham Street. The overall sensitivity of the surrounding area is therefore classed as 'high' in relation to dust soiling.

As previously discussed annual mean PM_{10} concentrations in the vicinity of the Site are expected to be in the region of 25-30 µg/m^3. Given the proximity of sensitive receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be 'high' with regards human health impacts.

In relation to trackout, vehicles traveling to the Site would do so along Bayham Street from the north, due to it being a one-way road. Upon leaving the Site vehicles would travel south either along Pratt Street or Bayham Street. As a general guidance, significant impacts from trackout may occur up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. There are residential receptors located adjacent to Bahyam Street and Pratt Street within 50 m of the Site access point and within 20 m of the roadside. The sensitivity of receptors is therefore considered to be 'high' in relation to both dust soiling and human health (PM_{10}) impacts from trackout.

A summary of the sensitivity of the area surrounding the Site in relation to each activity is provided below in Table 6.2.

Table 6.2: Summary of Sensitivity of Surrounding Area

Potential Impact	Sensitivity of Surrounding Area			
	Trackout	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	High	High	High	High

6.2.3 Defining the Risk of Impacts

The dust emission magnitude as set out in Table 6.1 is combined with the sensitivity of the area (Table 6.2) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site. The risk of impacts associated with each activity is provided in Table 6.3 below and has been used to identify site-specific mitigation measures, which are discussed in Section 8 and set out in Appendix C.

Table 6.3: Summary of Risk Effects to Define Site-Specific Mitigation

Source	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Low	Low	Low
Human Health	Medium	Low	Low	Low

7 Operational Impacts

7.1.1 NO_2 Concentrations

NO_2 concentrations predicted at the Site are presented below in Table 7.1.

The receptors have been selected to represent the facades of the proposed new building at each floor up to roof height. The modelling assessment is predicting annual mean NO_2 concentrations above the annual mean objective of 40 µg/m^3 at all six receptors and at each floor of the building including roof height.

Table 7.1: Predicted Annual Mean NO_2 Concentrations at Existing Receptors (µg/m^3)

Receptor	Floor	Annual Mean NO_2
1	Ground floor	73.5
	1st floor	63.0
	2nd floor	56.9
	3rd floor	54.3
2	Ground floor	72.6
	1st floor	62.4
	2nd floor	56.8
	3rd floor	54.3
3	Ground floor	68.1
	1st floor	62.7
	2nd floor	57.5
	3rd floor	54.5
	4th floor	52.9
	Roof height	52.1
4	Ground floor	65.9
	1st floor	61.9
	2nd floor	57.5
	3rd floor	54.6
	4th floor	53.0
	Roof height	52.1
5	4th floor	52.9
	Roof height	52.1
6	4th floor	52.9
	Roof height	52.1

The highest concentrations are predicted at ground floor level along the façade fronting onto Bayham Street. Concentrations are predicted to decline with increasing height, however due to background concentrations being above the annual mean objective concentrations are predicted to remain above the objective at roof height.

As detailed previously exceedence of the 1-hour objective is only likely to occur where annual mean concentrations exceed 60 µg/m^3. Based on the predicted annual mean concentrations the 1-hour objective is likely to be exceeded at ground and 1st floor level within the Site.

The introduction of residential accommodation to the Site would result in new exposure to NO_2 concentrations above the objective therefore appropriate mitigation is considered necessary.

7.1.2 PM_{10} Concentrations

Predicted annual mean PM_{10} concentrations at the ground floor facades of the proposed new building and at the 4th floor are presented in Table 7.2.

The ADMS model is predicting annual mean PM_{10} concentrations below the objective at all six receptor locations indicating that the objective will be met at all locations within the Site.

Based on the predicted annual mean concentrations, the maximum number of days >50 µg/m^3 PM_{10} is predicted to be between 12-23 at the facades of the new building. The objective allows for up to 35 exceedences of the objective in any given year therefore the 24-hour objective is also unlikely to be breached across the Site.

Based on the predicted PM_{10} concentrations no mitigation measures are considered necessary in relation to this pollutant.

Table 7.2: Predicted Annual Mean PM_{10} Concentrations at Existing Receptors (µg/m^3)

Receptor	Floor	Annual Mean PM_{10}
1	Ground floor	28.8
2	Ground floor	28.6
3	Ground floor	27.7
4	Ground floor	27.3
5	4th floor	25.1
6	4th floor	25.1

7.1.3 PM_{10} Concentrations

Predicted annual mean $PM_{2.5}$ concentrations predicted at the Site are set out in Table 7.3.

The ADMS model is predicting annual mean $PM_{2.5}$ concentrations below the objective at the facades of the new building at all heights. No mitigation measures are therefore considered necessary in relation to this pollutant.

Table 7.3: Predicted Annual Mean $PM_{2.5}$ Concentrations at Existing Receptors (µg/m^3)		
Receptor	**Floor**	**Annual Mean $PM_{2.5}$**
1	Ground floor	19.0
2	Ground floor	19.0
3	Ground floor	18.4
4	Ground floor	18.1
5	4^{th} floor	16.8
6	4^{th} floor	16.8

8 Mitigation

8.1.1 Construction Phase

The control of dust emissions from construction site activities relies upon management provisions and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

A medium risk of effects is predicted at adjacent receptors during construction of the proposed development. The developer should therefore implement appropriate dust and pollution control measures as set out within the Mayor's SPG. A summary of these measures are set out in Appendix C. The proposed measures should be set out within an AQDMP and approved by CC prior to the commencement of any work on site.

The SPG recommends that all construction sites are monitored for the generation of air pollution. This can be in the form of visual monitoring for smaller sites but may require the use of appropriate monitoring equipment for larger sites. The requirement for monitoring should be discussed and agreed with CC and if required baseline monitoring should commence at least three months before construction work starts on site.

Following implementation of the measures recommended for inclusion within the AQDMP the impact of emissions during construction of the proposed development are unlikely to be significant.

8.1.2 Operational Phase

The assessment has predicted exceedence of the annual mean NO_2 objective at all facades of the proposed new building and exceedence of the 1-hour objective at ground and 1st floor level. Appropriate mitigation should therefore be applied to the Site to reduce exposure of future occupants to NO_2 concentrations.

There are a number of measures that can be employed at a site to reduce exposure of occupants which includes:

- The internal layout of any residential units locating habitable rooms away from the facades fronting onto the road or main sources of pollution;
- The use of mechanical ventilation providing fresh air to each residential unit, with air intakes being located in a location where pollution concentrations fall below the objective limits;
- The use of green and brown roofs, green walls and planting of trees to assist in removing pollutants from the surrounding air.

Due to the size and design of the new building it is not possible to adjust the internal layout of each residential unit to locate non-habitable rooms along the façade fronting onto Bayham Street. Furthermore, as NO_2 concentrations are predicted to exceed the objective at all facades to the front and rear of the building it is not considered beneficial in perusing this as a possible approach to mitigating the effects of air quality. However, it is proposed to install a CAMFIL City Air Filtration system to the Site. This will also include a system which continuously monitors the external environment using an Aerotrack tracer. The unit will be installed with air intakes at roof height and the system will be fitted with a purification system which includes filters and scrubbers which remove NO_2, NO_x and SO_2 from the air prior to it entering the indoor environment. Full details of the system are set out in Appendix D.

The system would be used to provide a source of clean air to each residential unit within the proposed building thus reducing the exposure of future occupants to NO_2 concentrations above the objective limits.

As an additional mitigation measure the Site will incorporate a brown roof system at 3rd and 4th floor level. This will assist in removing pollutants from the surrounding air.

As the proposed purification system would use effective filtration systems to remove NO_x and NO_2 from the air at the intake points reducing concentrations to below the objective in the internal environment no further mitigation measures are considered necessary.

8.2 Residual Effects

8.2.1 Construction Phase

The greatest potential for dust nuisance problems to occur would generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

By following the mitigation measures outlined within this appraisal the impact would be substantially minimised and residual impacts are unlikely to be significant.

8.2.2 Operational Phase

It is proposed to install a CAMFIL City Air Filtration & Purification system to the site to provide a source of clean air to all residential units. With the addition of a brown roof system to further assist in removing pollutants from the air within the vicinity of the building residential impacts are considered to be negligible.

9 Conclusion

Kairus Ltd was commissioned by Aviva to carry out an air quality assessment in connection with the commercial development proposed on dis-used brownfield land adjacent to Great Central Way, Wembley.

It is inevitable that with any development construction activities would cause some disturbance to those nearby. Dust arising from most construction activities tends to be of a coarse nature, which, through dispersion by the wind, can lead to soiling of property including windows, cars, external paintwork and laundry. However, as well as giving rise to annoyance due to soiling of surfaces from dust emissions, there is evidence of major construction activities causing increases in long term PM_{10} concentrations and in the number of days exceeding the short term PM_{10} objective of 50 μgm^{-3}.

The recently publish Mayor's SPG on assessing impacts on air quality from construction activities and determining the likely significance has been used to determine the risk of impacts occurring during the construction of the development and to identify appropriate mitigation measures to be implemented on site to reduce dust emissions and associated impacts.

Due to the proximity of nearby residential receptors the Site is considered to have a medium risk of impacts with regards to dust soiling and PM_{10} concentrations. However, following the implementation of appropriate mitigation measures impacts associated with the construction of the development are likely to be insignificant.

The ADMS dispersion model has been used predict air quality at the Site and assess its suitability for residential development. The modelling assessment has predicted annual mean and short-term NO_2 concentrations above the relevant objective limits at the Site, although concentrations of both PM_{10} and $PM_{2.5}$ are expected to fall below the relevant objectives at all locations.

It is proposed to install a CAMFIL City Air Filtration system to the Site. This will also include a system which continuously monitors the external environment using an Aerotrack tracer. The unit will be installed with air intakes at roof height and the system will be fitted with a purification system which includes filters and scrubbers which remove NO_2, NO_x and SO_2 from the air prior to it entering the indoor environment.

The system would be used to provide a source of clean air to each residential unit within the proposed building thus reducing the exposure of future occupants to NO_2 concentrations above the objective limits.

As an additional mitigation measures the Site will incorporate a brown roof system at 3rd and 4th floor level. This will assist in removing pollutants from the surrounding air.

As the proposed purification system would use effective filtration systems to remove NO_x and NO_2 from the air at the intake points reducing concentrations to below the objective in the internal environment no further mitigation measures are considered necessary.

Appendix A – Air Quality Terminology

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
μgm^{-3} micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B –Verification and Adjustment of Modelled Concentrations

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(09).

Verification of the model results has been carried out against three roadside monitoring sites located adjacent to Euston Road and Camden Road.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Figure B1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the DEFRA NO_x from NO_2 calculator available on the UK-AIR website.

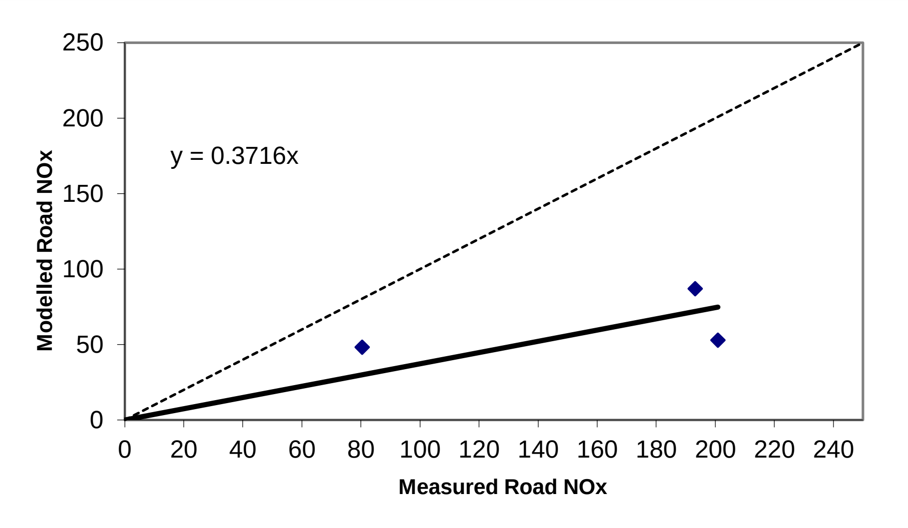

Figure B1: Comparison of Modelled Road NO_x with Measured Road NO_x

Figure B1 shows that the ADMS model is under-predicted the road-NO_x concentrations at both monitoring sites. An adjustment factor has therefore determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.3716 = 2.69). This factor has then been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the DEFRA NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration.

Figure B2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO_2, was calculated (1/1.0168 = 0.989).

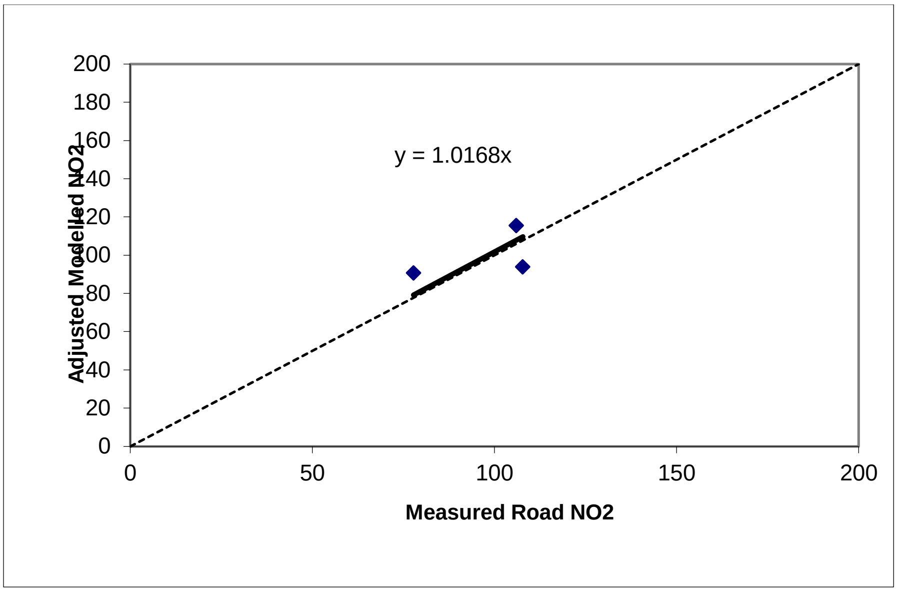

Figure B2: Comparison of Modelled NO_2 with Measured NO_x

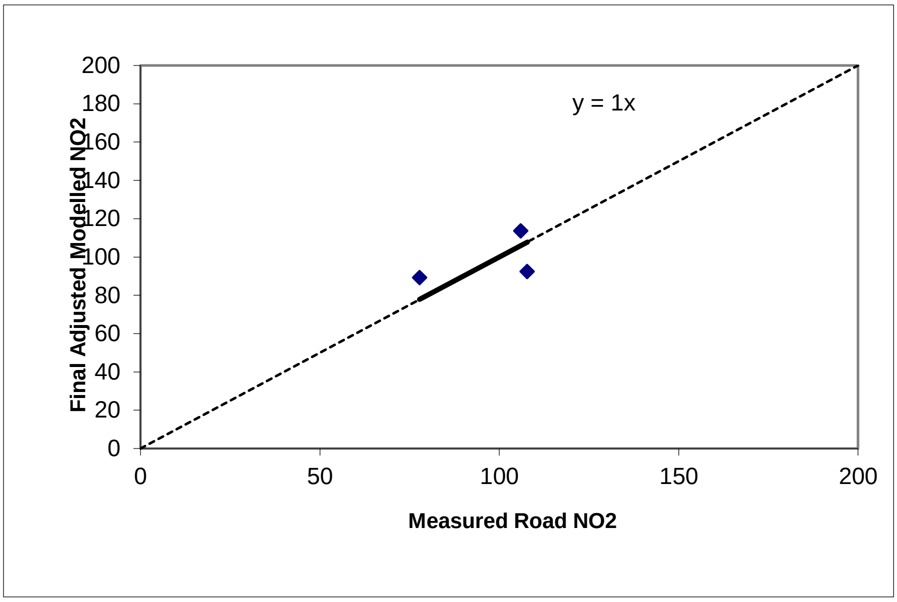

Figure B3: Comparison of Final Modelled Total NO_2 with Measured NO_2

After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO_2. The final adjustment modelled values are shown in Figure B3.

The adjustment factor of 2.69 has been applied to the modelled NO_x-road concentrations predicted at the selected receptor locations. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 concentrations and adjusted by 0.983 to provide the final predicted annual mean NO_2 concentrations at each receptor.

The predicted PM_{10} and $PM_{2.5}$ concentrations have also been adjusted using the same approach.

Appendix C – Construction Mitigation Measures

It is recommended that the following measures are incorporated into an AQDMP and approved by CCC prior to commencement of any work on site. The measures set out below summaries the measures set out within the Mayor's SPG. This guidance should be read in conjunction with this report to obtain full details of all the measures that should be applied on site.

Stakeholder engagement:

- Ensure those sensitive to impacts are notified and consulted before work commences;
- Provide an easy and effective mechanism for informing developer of concerns and issues;
- Display contact details of person responsible for dust and emissions generated from site on the site boundary;
- Keep a record of all complaints and respond to them as soon as possible;
- Make the log of complaints and action available to the local authority on request;
- Consider the potential cumulative effects of emissions should there be any other developments being constructed at the same time;

Site Inspections:

- Actively monitor the site to ensure the control of dust and emissions;
- Undertake extra site monitoring during dry and windy conditions;

Site layout:

- Locate machinery and dust generating activities away from receptors;
- Create physical distance and/or barriers between dust/emission generating activities and receptors;
- Install solid screens or barriers around dust generating activities – at least as high as any stockpiles on-site;
- Cover and seed stockpiles to prevent wind whipping;
- Remove loose materials as soon as possible.

Green Infrastructure:

- Site operators are encouraged to install green walls, screens and other vegetation to minimise the impact of dust and pollution and also improve the local environment during construction.

Site maintenance:

- Site should be bunded to prevent runoff;
- Runoff and mud should be avoided as it can lead to dust once dry;
- Hoardings, fencing, barriers and scaffolding should be regularly cleaned using wet methods, where possible, to prevent re-suspension of particulate matter;
- Regular checks of buildings within 100m of the site boundary to check for soiling due to dust, with cleaning where necessary;
- Require staff and visitors to have a change of clothes before going off-site to reduce transport of dust

Dealing with spillages:

- Use bunded areas wherever practicable;
- Regularly inspect the site area for spillages;
- Have spillage kits readily available;

- Clean spillages using agreed wet handling methods;
- Vacuum or sweep regularly to prevent the build-up of fine waste dust;
- Fit for use – should be dealt with in accordance with the Waste Management Licensing Regulations 1994;
- Inform the Environment Agency if harmful substances are spilled.

London Low Emission Zone:

- All mobile vehicles associated with construction should comply with the standards of the London Low Emission Zone. For HGV's the standard is Euro IV for PM.

Reducing vehicle idling:

- Manage the site so that vehicles do not have to wait to park safely;
- Should vehicles have to wait they should not idle. If stationary for more than a minute, they should turn off the engine.

Construction Logistic Plans:

- Develop a construction logistics plan (CLP) that allows deliveries and removals to be managed so that they are made when they are most needed, at times when they will contribute less to congestion and at locations where loading and unloading can take place safely.

Diesel or petrol generators:

- Wherever possible renewable, mains or battery powered plant items should be used.

Cutting, grinding and sawing:

- Cutting, grinding and sawing should not be conducted on-site if possible;
- Where possible, pre-fabricated material and modules should be used;
- Where these activities are required spraying water should be used to reduce dust emissions;
- In relation to scabbling the following best practice measures should be in place:
  - Pre-wash work surfaces;
  - Screen off work areas; and
  - Sweeping away

Mobile Crushing Plant:

- Notify local authority if a crusher is to be used;
- Keep a copy of the permit on-site and adhere to conditions of use at all times;
- Use best available techniques in accordance with the Process Guidance note PG 3/16 (04)12

Concrete Batching:

- Notify local authority that a concrete batcher is being used;
- Use best available techniques identified in Process Guidance PG3/1(04)12;
- Carry out these processes in an enclosure.

Chutes, conveyors and skips:

- These should be completely covered and if necessary completely enclosed;

- Drop heights should be minimised to control the fall of materials.

Bonfires:

- No burning of any material is permitted on-site;
- Any excess material should be reused or recycled on or off-site in accordance with appropriate legislation.

Earthworks:

- Reduce generation and re-suspension of dust through re-vegetating exposed areas and soil stockpiles to stablise surfaces;
- Where this is not possible use hessian and/or mulches to re-vegetate or cover with topsoil.

Construction:

- Ensure cement, sand, fine aggregates and other fine powders are sealed after use and if necessary stored in enclosed or bunded containers or silos.

Haul Routes:

- Ensure as far as possible that hard surfaces or paving are used for all haul routes, even if temporary;
- Keep haul routes and local access roads free from dust as far as possible and ensure they are swept regularly;
- Where possible this should be water-assisted to increase damping down.

Wheel Washing:

- Vehicles should be washed or cleaned before leaving site;
- For ost sites wheel wash facilities should be installed, preferably with rumble grids;
- The route from the wheel wash to the road should be paved;
- Where possible, access gates should be located at least 10 m from receptors.

Covering vehicles:

- All vehicles carrying dusty materials should be securely covered before leaving site

Emissions from Non-Road Mobile Machinery:

- All NRMM should comply with the relevant emission standards from 1st September 2015. Further details of these are set out within the Mayors SPG.

Appendix D – Details of CAMFIL Filtration System

81 BAYHAM STREET CAMDEN LONDON NW1
REVISED AIR QUALITY MANAGEMENT PROPOSAL

Aspiration
The client's aspiration is to achieve the best possible internal environmental conditions both on completion and over the life of the building. Along with triple glazing to reduce energy consumption and ameliorate the effect of noise from the street the scheme will include the CAMFIL City Air Filtration system to overcome the potential effects of pollution in Bayham Street.

Process
Desktop analysis of recent published data indicates the following:
Total traffic: 18220 (vehicles per day)

- NO_2 pollution: 2.39 (tonnes per km per year)
- NO_2 from buses: 0.94 (tonnes per km per year)
- PM_{10} pollution: 0.14 (tonnes per km per year)
- $PM_{2.5}$ pollution: 0.12 (tonnes per km per year)
- Benzene pollution: 0.07 (tonnes per km per year)

Source: "Clean Air in London" from Transport for London
Before finalising and agreeing the detailed specification a full survey and analysis of the external pollutants will be undertaken to establish the current position.

Installation
The design will incorporate both the CAMFIL City Air Filtration & Purification system (as detailed below) and measures to continuously monitor the external environment:
• Continuously monitor outdoor particles; using Aerotrack tracer;
• continuous measurement of 'wellness': (CO_2/sound/lights) and Health (PM_1/lightVOCs like formaldehydes/big VOCs) using an IAQ box.
In addition a rooftop analyser will be installed to optimize the filtration system.
The AHU to be equipped with new filters at the carbon filtration stage consisting of an M-Pleat Green M5 and a CityCarb F7 (a 2 in 1 filter for both particulate and molecular filtration);
In addition, air purifiers will be installed (CamCleaner City equipped with H13 and 2 carbon filter stages) to reinforce the filtration/scrubber system,
The two carbon filter stages will handle both big and light VOCs, achieving a 90% reduction in harmful particulates.
CAMFIL'S Hi-Flo XLT7 (class F7 filter) has a minimum filtration efficiency of 54 percent. For an F7 filter, the new standard requires no more than 35 percent. The CAMFIL units produce high efficiency, energy optimised filters that perform well above minimum requirements.

Treatment of NO_2, SO_2 & NO_x emissions using the combination of CAMFIL Citycarb & Air filtration Systems

The CAMFIL Citycarb & Camcleaner City Purification, combined unit, will remove the harmful city airborne pollutants: NO_2 , SO_2 & NO_x. Citycarb has been specifically designed to easily improve the quality of indoor air due to its "2 in 1" concept:

1. Highly effective filtration: Classed as F7 according to EN 779:2002, it stops 85% of 1 micron particles and meets the recommendations of UNICLIMA and EUROVENT 12/1-92.

2. Adsorption of odours and pollution: This specifically designed product can provide efficiencies as high as 99% for Sulphur Dioxide, the main pollutant in urban environments.

The CamCleaner City Air Purifier works in combination with the Citycarb Unit and is extremely effective. It runs quietly in the background and re-circulates the clean purified air with a silent running performance that consumes little energy. This unit also contains high efficiency molecular gas filtration that removes NO_2.

Appended documents: City M Air Purifier and Citycarb product sheets, Technical Specification for Citycarb and City Air Purification Systems and Euston Square Case Study 2014.