University College London Hospitals NHS
NHS Foundation Trust

Demolition of the existing buildings and redevelopment

for a building of 6 storeys in height including ground and 3 storeys basement,

for use a specialist head and neck facility (Class D1)

Former University College London (UCL) Student Union and Royal Ear Hospital,

Huntley Street, Bloomsbury

Air Quality Assessment

February 2015

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Project:	Demolition of the existing buildings and redevelopment for a building of 6 storeys in height including ground and 3 storeys basement, for use a specialist head and neck facility (Class D1)		
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Jacobs was commissioned to undertake an air quality assessment for the proposed University College London Hospital (UCLH) development in the London Borough of Camden (LBC). This assessment was required as the development is located in an area of poor air quality, and the Sustainability Officer (SO) responsible for air quality management for the LBC requested that a detailed modelling study was carried out. The aim of the study was to assess the potential impacts on new sensitive receptors to the existing poor air quality. At the request of the LBC, an air quality neutral assessment was also conducted for the Proposed Development.

The results show that there are predicted to be no exceedences of the air quality objectives (AQOs) for annual mean PM_{10}. For PM_{10} the highest concentrations at ground level are at Receptor 7 where the concentration is predicted to be 25.2 µg/m^3. The 24 hour mean PM_{10} concentrations are not forecast to exceed 50 µg/m^3 more than the AQO of 35 days; the maximum is 13 days per year predicted at ground level.

The results further show that, similar to many locations in central London, there are predicted to be exceedences of the AQOs for annual mean nitrogen dioxide at all receptors when the Proposed Development is scheduled for completion in 2018. This is due to the estimated background nitrogen dioxide concentration of 38.9 µg/m^3 which nearly exceeds the AQO. On this basis, it is recommended that mechanical ventilation is installed and there are no opening windows on any façade of the Proposed Development.

The Proposed Development will not generate additional road traffic, and so will not have an impact on local air quality due to emissions from road traffic.

The assessment of emissions from the energy centre show that, even taking into account the worst case operating conditions, the annual mean nitrogen dioxide process contribution from the energy centre is less than 1% of the air quality objective at the relevant receptor locations. Therefore, the process emissions from the energy centre are considered to be insignificant.

The results of the air quality neutral assessment for the development show that when comparing the Building Emissions Benchmark to the predicted building emissions, additional mitigation is not required.

The results of the construction dust assessment show that although dust is likely to occur from site activities through demolition and construction, this can be reduced through appropriate mitigation measures.

Although annual mean nitrogen dioxide levels are predicted to exceed the AQOs at the Proposed Development when it is scheduled to be completed in 2018, this is due to the estimated background nitrogen dioxide concentrations which are likely to nearly exceed the AQO for nitrogen dioxide, which is in common with most locations within central London. Recommendations have been made to reduce the impact of the air quality to the new receptors at the UCLH development (i.e. appropriate positioning of HVAC air inlets) and it is thus concluded that the proposed development is acceptable from an air quality perspective.

1 Introduction

Jacobs was commissioned to undertake an air quality assessment for the proposed University College London Hospital (UCLH) development in the London Borough of Camden (LBC).

The proposed development involves the demolition of the former University College London (UCL) Student Union and Royal Ear Hospital buildings, and redevelopment for a 6 storey building including ground and 3 storey basement. The basement levels will accommodate the specialist Head and Neck out-patient facility with the upper storeys accommodating services from the Royal National Throat Nose and Ear Hospital and the Eastman Dental Hospital. Following any successful planning application, the proposals are intended to be operational in 2018.

This assessment was required as the development is located in an area of poor air quality, and the Sustainability Officer (SO) responsible for air quality management for the LBC requested that a detailed modelling study was carried out. The aim of the study was to assess the potential impacts on new sensitive receptors within the development to the existing levels of air quality as there will be an immaterial increase in road traffic accessing and leaving the proposed development.

This assessment also considers the impacts of the proposed on-site energy centre at onsite receptors. The energy centre will consist of three 0.6 MW_{th} gas fuelled boilers, a 0.2 MW_{th} gas fuelled CHP engine and a 1500 kVa electrical generator. At the request of the SO, an assessment of whether the Proposed Development could connect to the Camden District Heating Network and thus negate the need for a stand-alone CHP was conducted. Consultation between the client and Camden District Heating Network concluded that the District Heating Network does not have the capacity to incorporate the Proposed Development in to the existing UCLH Heating Network and thus, a CHP is required for the Proposed Development.

The application site is bounded by Capper Street to the North, Shropshire Place to the West, and Huntley Street to the East. The location of the proposed development site is shown in Figure 1.

Detailed dispersion modelling was used to assess air quality at points on the façade of the proposed UCLH building. Concentrations of nitrogen dioxide and particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) were predicted and compared to the relevant health-based air quality objectives. The assessment was carried out for the year 2018, when the proposed development is anticipated to be completed. A detailed dispersion modelling study was also carried out on emissions of nitrogen dioxide from the proposed energy centre.

A construction dust assessment has been completed to assess the potential impact of any demolition or construction activities and the appropriate mitigation to minimise any potential impacts.

Chapter 2 outlines relevant planning policy and air quality regulations. Chapters 3 and 4 set out the assessment methodology. Chapter 5 sets out the results of the dispersion modelling and air quality neutral assessment. Chapter 6 presents the construction dust assessment and the conclusions are presented in Chapter 7. Appendix 1 describes the model verification study, Appendix 2 sets out the relevant modelling input data and Appendix 3 sets out the Construction Dust Assessment.

2 Planning Policy and Air Quality Regulations

2.1 Planning Policy

2.1.1 National Planning Policy

The National Planning Policy Framework (NPPF)[1] was published in March 2012. As part of the NPPF, there are various references to air quality and pollution, such as in Section 11 (Conserving and enhancing the natural environment) sub paragraph:

> *"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; and"*

Sub paragraph 120 in Section 11 of the NPPF states:

> *"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."*

Sub paragraph 124 in Section 11 of the NPPF considers air quality in the following statement:

> *"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."*

2.1.2 Regional Planning Policy

Policy 7.14 of the London Plan (2011)[2] recognises the importance of tackling air pollution and improving air quality to London's development and the health and well-being of its people. Policy 7.14 provides guidance for planning decisions in relation to the effects of developments on air quality, for example, that developments should minimise increased exposure to existing poor air quality and promote sustainable design to reduce emissions during construction and operation of the development and not lead to a further deterioration of existing poor air quality.

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1 Department for Communities and Local Government, National Planning Policy Framework, March 2012.

2 Greater London Authority, The London Plan, Spatial Development Strategy for Greater London, October 2013 and subsequent amendments

Policy 7.14 of the London Plan also states that boroughs should have policies within their Local Development Framework that seek reductions in the levels of pollutants referred to in the Air Quality Strategy and that boroughs should also take account of the outcomes of the Local Air Quality Management process such as Action Plans, particularly within Air Quality Management Areas.

2.1.3 Local Planning Policies

Camden Local Development Framework – Core Strategy (2012)

The Camden Core Strategy[3] is the central document of the Local Development Framework for the LBC, and sets out the spatial vision, objectives, and policies for managing development in Camden. There are several references related to the environment including references to air quality and pollution, paragraph 22 in the introduction states:

> *"Camden has many attractive and historic neighbourhoods (such as Hampstead, Highgate, Primrose Hill and Bloomsbury) and numerous parks and open spaces (ranging from local playgrounds to Hampstead Heath). These are a significant reason that the borough is such a popular place to live, work in and visit. We need to manage change and growth so that they take place in a way that respects the character, heritage and distinctiveness of Camden's valued and special places. We also need to continue to try to enhance our local environment, for example by reducing air pollution and improving our streets and public spaces."*

Paragraph 16.14 states:

> *"Camden suffers from poor air quality which impacts on human health, particularly the very young, older people and those with existing heart and lung conditions. The avoidance of localised air pollution is therefore very important in avoiding a potential negative impact on health and on the environment. The Council has declared the whole borough an Air Quality Management Area (AQMA) for failing to meet the government's health based air quality objectives for nitrogen dioxide and particulate matter. An Air Quality Action Plan has been produced setting out measures to reduce air pollution emissions from a variety of sources including new developments. Policy DP32 in our Camden Development Policies Local Development Framework[4] document sets out how we will expect developments to reduce their impact on air quality. Please also see CS11 – Promoting sustainable and efficient travel for more on our approach to improving air quality through transport measures."*

2.2 Legislation

Air quality is an issue of potential significance at international, national and local levels. While there are undoubtedly important ramifications for global and national air quality from a wide range of developments, as recognised by numerous international conventions and European Directives, the primary focus of this assessment is the potential impact of local air quality on the scheme.

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3 London Borough of Camden Local Development Framework Core Strategy, 2013 Revision

4 Camden Local Development Framework, Camden Development Policies, Adopted version 2010.

2.2.1 Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)

The focus on local air quality is reflected in the air quality objectives set out in the Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations Air Quality Strategy for England, Scotland, Wales and Northern Ireland[5], which, although not mandatory, represents Government policy on air quality. The strategy presents measures to control and improve the quality of air in the UK and reflects the increasing understanding of the potential health risks associated with poor air quality and the benefits that can be gained from its improvements.

The air quality objectives relevant to this assessment, which are those commonly close to or in excess of statutory levels in UK urban areas, are set out in Table 1. The Air Quality Objectives (AQOs) relevant to this assessment are laid down in the Air Quality Standards Regulations[6] .

Table 1: Relevant Air Quality Objectives

Substance	Statistic	Concentration ($\mu g/m^3$)
Nitrogen Dioxide	Annual mean	40
	One hour mean, not to be exceeded more than 18 times per year (equivalent to the 99.79th percentile of hourly means)	200
Particulate Matter (PM_{10})	Annual Mean	40
	24 hour mean, not to be exceeded more than 35 times per year (equivalent to the 90.4th percentile of 24-hour means)	50

2.2.2 Local Air Quality Management

Under the Environment Act 1995, local authorities are required to review air quality and assess whether the air quality standards and objectives, set out by the UK Air Quality Strategy, are being achieved. This process is referred to as Local Air Quality Management (LAQM).

Where local authorities have identified areas where the air quality objectives are exceeded or are at risk of being exceeded, an Air Quality Management Area (AQMA) is declared and an Air Quality Action Plan (AQAP) is developed to work towards compliance with the objectives. The whole of the LBC has been designated as an AQMA for the annual mean AQO for nitrogen dioxide (NO_2) and the short term objective (24-hour mean) for particulate matter (PM_{10}) which is why detailed dispersion modelling has been requested by the LBC.

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5 Department for Environment, Food and Rural Affairs and the Devolved Administrations, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, July 2007

6 The Air Quality Standards Regulations 2010 – No. 1001

2.3 Guidance

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

The LAQM.TG(09) technical guidance note[7] provides guidance on the use of atmospheric dispersion models, in addition to techniques for verification of model predictions of road traffic emissions. The guidance also provides examples of where the air quality objectives should be applied. Annual mean, 24-hour mean and hourly mean results (as used in this assessment) should be compared to the relevant objectives in all locations where members of the public might be regularly exposed to the pollutants.

2.3.1 Environmental Protection UK, Development Control: Planning for Air Quality (2010 Update)

The Environmental Protection UK (EPUK) guidance[8] aims to ensure air quality is accurately accounted for in the UK development control process whilst highlighting the importance of good air quality levels within the local development framework. The guidance focuses primarily on the impact of traffic emissions of a proposed development. The guidance includes advice on the need for detailed assessments, assessment methodologies, describing air quality impacts and assessing their significance. Factors to judge the significance of a proposed development in relation to air quality are detailed in this guidance and are listed in Table 2. The most relevant factor for this development is factor two relating to the introduction of exposure into an existing area of poor air quality.

Table 2: Significance factors for developments

Factors to Judge Overall Significance
Number of properties affected by slight, moderate or major air quality impacts and a judgement on the overall balance
Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.
The magnitude of the changes and the descriptions of the impacts at the receptors
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced
Uncertainty, including the extent to which worst-case assumptions have been made

7 Defra and the Devolved Administrations, Local Air Quality Management, Technical Guidance LAQM.TG(09), February 2009

8 Environmental Protection UK, Development Control: Planning for Air Quality (2010 Update)

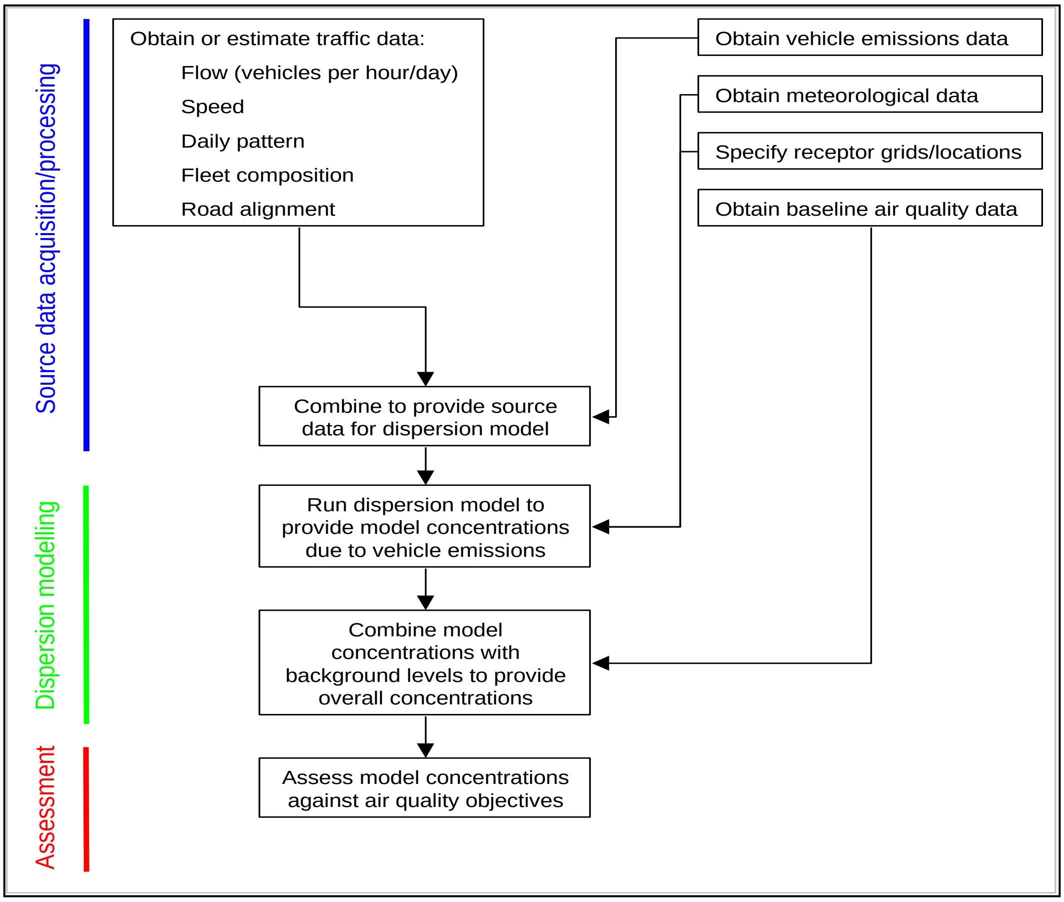
3 Methodology and Study Inputs – Combustion Emissions

3.1 Outline of Method

3.1.1 Road Traffic Emissions

The overall methodology was agreed with the SO at the LBC prior to undertaking the assessment. The aim of the assessment was to calculate the annual mean concentrations of nitrogen dioxide and PM_{10} at specified receptor locations once the proposed development is completed. The assessment modelled emissions from the adjacent road network to determine the pollutant concentrations at the identified receptor locations. This was carried out using the ADMS-Roads dispersion model, version 3.4. A summary of the dispersion modelling methodology is set out in Diagram 1.

Diagram 1 Dispersion modelling assessment structure



The predicted concentrations of these pollutants were compared with the relevant air quality objectives (see Table 1) to identify any potential exceedences and to assess whether the proposed development is acceptable from an air quality perspective. The following sections of this chapter set out the methodology and study inputs in more detail. A model verification exercise was undertaken to provide a higher level of confidence in the predicted concentrations in the vicinity of the roads assessed and this is discussed in further detail in Section 3.8.

3.1.2 Energy Centre Emissions

A current UK industry standard atmospheric dispersion model (ADMS Version 5) was used to model emissions of oxides of nitrogen from the proposed on-site energy centre. The ADMS modelling package was selected because this model is fit for the purpose of modelling the emissions from this type of combustion activity. Version 5 is the latest version of this model. ADMS 5 is widely used in the UK as a current industry standard model for dispersion from point sources, such as the exhaust stacks at this site.

The model takes, as a starting point, information on emissions from each source, including:

- Release rate of the substances under consideration;
- Release temperature;
- Release velocity or volumetric flow;
- Release point location;
- Release point height;
- Release point diameter; and
- The location and dimensions of nearby buildings.

Information characterising a set of meteorological conditions is also required. This includes the wind speed, wind direction and information relating to the atmospheric stability. This information is normally provided in the form of sequential hourly measurements, obtained from the nearest or most representative meteorological station. Given this information, the model provides an estimated concentration of the substance of interest at a specified location. This process is repeated for each hour in the year, and at each location under consideration, to build up an estimate of long-term mean and short-term peak concentrations over an area of interest.

In any modelling study, there will be a degree of uncertainty in the model results. In the case of atmospheric dispersion modelling, models are generally more reliable for long period means than short period means. Models are usually more reliable over intermediate distances (100 m to 1000 m) than very close to the source or more distant from the source. This reflects the range of data that have been used to compile the models. To allow for these uncertainties, a conservative approach has been adopted in this study; these are described in Section 3.10.

3.2 Background Concentrations

LBC carries out a continual process of review and assessment of air quality within the local authority area for the purposes of LAQM. The whole borough has been declared as an AQMA due to elevated annual mean concentrations of nitrogen dioxide and 24-hour mean concentrations of PM_{10}.

Air pollution concentrations are measured by LBC at a number of locations across the borough. The most relevant monitoring data to determine background air quality concentrations for assessing the impacts of the proposed development are set out in Table 3. These include measurements recorded at London Bloomsbury urban background automatic monitoring station[9]. Background concentrations for oxides of nitrogen, nitrogen dioxide, PM_{10} were obtained from background pollutant concentration maps provided by Defra via the UK Air Information Resource[10]. These background data account for general pollution in the vicinity of the site and are provided for each 1km by 1km grid square across the UK. The values for the grid square corresponding to the development site location are included in Table 3. For this assessment the data from the London Bloomsbury automatic monitor was considered as the most appropriate to represent background concentrations of nitrogen dioxide due to its proximity to the site. The measured 2013 concentration was scaled to the assessment year of 2018 using the 2015 to 2018 factor from the Defra background map data (assuming that concentrations will not decline as much as forecast in the Defra background maps). The overall approach is consistent with the approach for the air quality assessment undertaken for the Proton Beam Therapy Unit (Phase 4)[11]. For all other pollutants, the Defra background map values were used.

Table 3: Background air quality data

Pollutant	Year	Concentration ($\mu g/m^3$)	Description
Nitrogen dioxide	2015	44.1	Background map value for the 1 km x 1 km grid square centred on site (529509, 181992)
	2018	39.0	
	2013	44.0	London Bloomsbury, urban background automatic monitor, (530120, 182034)
	2018	38.9	London Bloomsbury, urban background automatic monitor, (530120, 182034) scaled to 2018 using same factor from background map values (~0.885)
PM_{10}	2018	24.2	Background map value for the 1 km x 1 km grid square centred on site (529509, 181992)

9 London Borough of Camden, 2013 Air Quality Progress Report for London Borough of Camden, April 2014

10 UK Air Information Resource website (UK-AIR); http://uk-air.defra.gov.uk/. February 2015

11 SKM Enviros, University College London NHS Foundation Trust Phase 4 & Proton Beam Therapy, Air Quality Assessment, Final Report 18 November 2013

3.3 Traffic Data

3.3.1 Traffic Flows

Traffic data for the assessment was calculated using annual average daily traffic (AADT) traffic count data from the Department for Transports website[12] for 2013. The roads used were Euston Road, Tottenham Court Road, Gower Street/Bloomsbury Street, Upper Woburn and Goodge Street. Additional AADT traffic count data for Huntley Street, Capper Street and Torrington Place was provided by Jacobs traffic consultants. The Proposed Development would not lead to material increase in traffic flows on the roads surrounding the site, with no on-site car parking provision, limited on-street parking and the availability of public transport infrastructure.

The traffic flow data used in the assessment are set out in Table 4 and additional information on road link widths and vehicle speeds are set out in Appendix 2. Many of the roads included within the model are located a considerable distance from the Proposed Development and would not materially contribute to concentrations of pollutants. However, these have been included to provide a conservative approach.

[12] Department for Transport, http://www.dft.gov.uk/traffic-counts. February 2015

Table 4: Traffic data – 2018

Year	Road	Road Link	Description	Without development		
				AADT	LDV	HDV
2018	Euston Road	ER1, ER2, ER3	Euston Road from A400 junction to Bloomsbury Street junction	59,460	55,894	3,566
		ER4, ER5, ER6, ER7, ER8	Euston Road from Tottenham Court Road to junction with Cartwright Gardens	41,005	36,322	4,683
	Tottenham Court Road	TCR1, TCR2, TCR3, TCR4, TCR5, TCR6, TCR7, TCR8, TCR9, TCR10, TCR11, TCR12, TCR13	Tottenham Court Road from junction with Euston Road to junction with Goodge Street	21,316	19,249	2,067
		TCR14, TCR15, TCR16, TCR17	Tottenham Court Road from junction with Goodge Street to junction with Great Russell Street	13,732	12,038	1,694
	Bloomsbury Street	BS1, BS2, BS3, BS4, BS5, BS6, BS7, BS8, BS9, BS10	Bloomsbury Street from junction with Euston Road to junction with New Oxford Street	12,215	10,231	1,984
	Upper Woburn	UW1, UW2	Upper Woburn Place from junction with Euston Road to junction with Tavistock Road	14,352	11,696	2,656
	Goodge Street	GS1, GS2	Goodge Street from junction with Tottenham Court Road to junction with Wells Street	6,113	5,857	256
	Torrington Place	TP1, TP2	Torrington Place from junction with Tottenham Court Road to junction with Gower Street	5,279	5,226	53

Year	Road	Road Link	Description	Without development		
				AADT	LDV	HDV
2018	Capper Street	CA1, CA2	Capper Street from junction with Tottenham Court Road to junction with Huntley Street	106	105	1
	Huntley Street	HU1, HU2, HU3, HU4	Huntley Street from junction with Grafton Way to junction with Chenies Street	2,727	2,700	27

LDV = Light Duty Vehicle (motorcycles, cars, taxis, light goods vehicles <3.5 tonnes)

HDV = Heavy Duty Vehicle (Lorries and buses/coaches >3.5 tonnes)

3.3.2 Road Geometry and Vehicle Speed

The alignment of the road links was taken from Ordnance Survey digital mapping data of the study area. The road links have been split into sections with different traffic flows and speeds and are shown in Figure 1. The vehicle speeds were based on road speed limits and also took into account the presence of roundabouts, junctions and traffic lights. The majority of roads surrounding the development are considered to be street canyons and have therefore been modelled in this way, information on road link widths and vehicle speeds are set out in Appendix 2.

3.3.3 Emissions Factors

This assessment utilised the recently revised vehicle emissions factors which provide a more accurate estimate of the emissions of oxides of nitrogen (NOx) from road vehicles for assessment purposes. The updated emissions factors (Emissions Factor Toolkit version 6.2) were released by Defra and the Devolved Administrations in 2015 and were incorporated by CERC (the developer of the ADMS-Roads dispersion modelling software) into the ADMS-Roads dispersion model through the release of version 3.4 of ADMS-Roads. This latest version, containing the most up to date data on emission factors from road vehicles, was utilised for the revised assessment.

3.3.4 Time Varying Emissions

Time varying emission factors were derived from the Department for Transport's Road Traffic Statistics[16] which contains the motor vehicle distribution by time of day for the UK. The proportion of vehicle movements per hour of the day for the average weekday, Saturday and Sunday was calculated from hourly Department for Transport count data and input into the dispersion model. These are shown in Table 5 and represent the normal diurnal pattern of hourly road traffic in the UK.

Table 5: Time varying emission factors

Hour	Weekday	Saturday	Sunday
00:00-01:00	0.152	0.271	0.298
01:00-02:00	0.107	0.177	0.186
02:00-03:00	0.092	0.141	0.124
03:00-04:00	0.107	0.141	0.112
04:00-05:00	0.180	0.177	0.124
05:00-06:00	0.421	0.282	0.186
06:00-07:00	1.018	0.483	0.298
07:00-08:00	1.718	0.765	0.459
08:00-09:00	1.768	1.130	0.683
09:00-10:00	1.437	1.518	1.117
10:00-11:00	1.357	1.860	1.602
11:00-12:00	1.388	2.025	1.900
12:00-13:00	1.418	1.977	1.962
13:00-14:00	1.454	1.860	1.887
14:00-15:00	1.527	1.730	1.838
15:00-16:00	1.662	1.660	1.887
16:00-17:00	1.884	1.648	1.937
17:00-18:00	1.909	1.601	1.825
18:00-19:00	1.499	1.365	1.602
19:00-20:00	1.022	1.036	1.341
20:00-21:00	0.707	0.742	1.043
21:00-22:00	0.526	0.553	0.757
22:00-23:00	0.391	0.471	0.509
23:00-00:00	0.258	0.388	0.323

3.4 Energy Centre Emissions

3.4.1 Emissions Data

Table 6 presents the input parameters specified within the ADMS dispersion model for the detailed dispersion modelling of the energy centre emissions.

No emissions data are available for the proposed energy centre. Therefore, emissions data for the boilers and CHP engine were based on assumptions regarding the maximum theoretical volume of natural gas used by the boilers, based on the thermal input. The emission concentrations of oxides of nitrogen for the boilers and CHP were assumed to be 40 mgNOx/kWh and 95 mgNOx/kWh (Band B) respectively, as set out in the Sustainable Design and Construction Supplementary Planning Guidance[13].

The boilers and CHP are gas fired but the boilers have the capability of firing on light fuel oil should there be an interruption in the gas supply. Therefore, this assessment is based on the normal operation of the plant firing on natural gas.

The modelling is based on two boilers and the CHP engine operating simultaneously for the full duration of the year. Only two boilers have been modelled as in practice, the three boilers proposed will operate on a run / assist and standby programme.

Table 6: Emissions data

Description	OS Grid Coordinates (m)		Stack height (m)	Exit diam (m)	Flow rate (Am^3/s)	Flow rate (Nm^3/s)	Temp	NOx Concentration	NOx Release rate
	Easting	Northing					(oC)	mg/m^3	g/s
LTHW Boiler 1	529504	182083	27.6	0.3	0.30	0.18	140	40	0.007
LTHW Boiler 2	529504	182083	27.6	0.3	0.30	0.18	140	40	0.007
CHP	529503	182082	27.6	0.1	0.10	0.06	120	95	0.006

Note 1 – Boiler 1 and 2 share a combined flue stack

3.4.2 Buildings

Buildings or other structures can have a significant influence on local air flows that, under certain circumstances, may draw an emission plume down towards ground level. This is referred to as “building downwash”. The proposed site building is likely to influence the dispersion of emissions from the energy centre exhaust stacks and has, therefore, been considered in the assessment of emissions from the energy centre. Table 7 presents the building details.

[13] Sustainable Design and Construction Supplementary Planning Guidance, London Plan 2011 Implementation Framework, April 2014

Table 7: Building details

Description	Shape	Centre Point Grid Ref		Height	Length	Width	Angle with North (˚)
		Easting (m)	Northing (m)	(m)	(m)	(m)	
UCLH Building	Rectangular	529520	182055	24.6	70	16	325
Building 1	Rectangular	529367	182035	20	79	58	325
Building 2	Rectangular	529441	182099	18	63	93	325
Building 3	Rectangular	529520	182154	20	54	64	323
Building 4	Rectangular	529419	181949	20	81	43	325
Building 5	Rectangular	529487	182007	22	95	75	324
Building 6	Rectangular	529551	182010	24	35	18	325
Building 7	Rectangular	529576	182075	15	109	67	325
Building 8	Rectangular	529459	181894	16	36	45	326
Building 9	Rectangular	529550	181930	15	60	101	328
Building 10	Rectangular	529635	181951	17	122	17	325

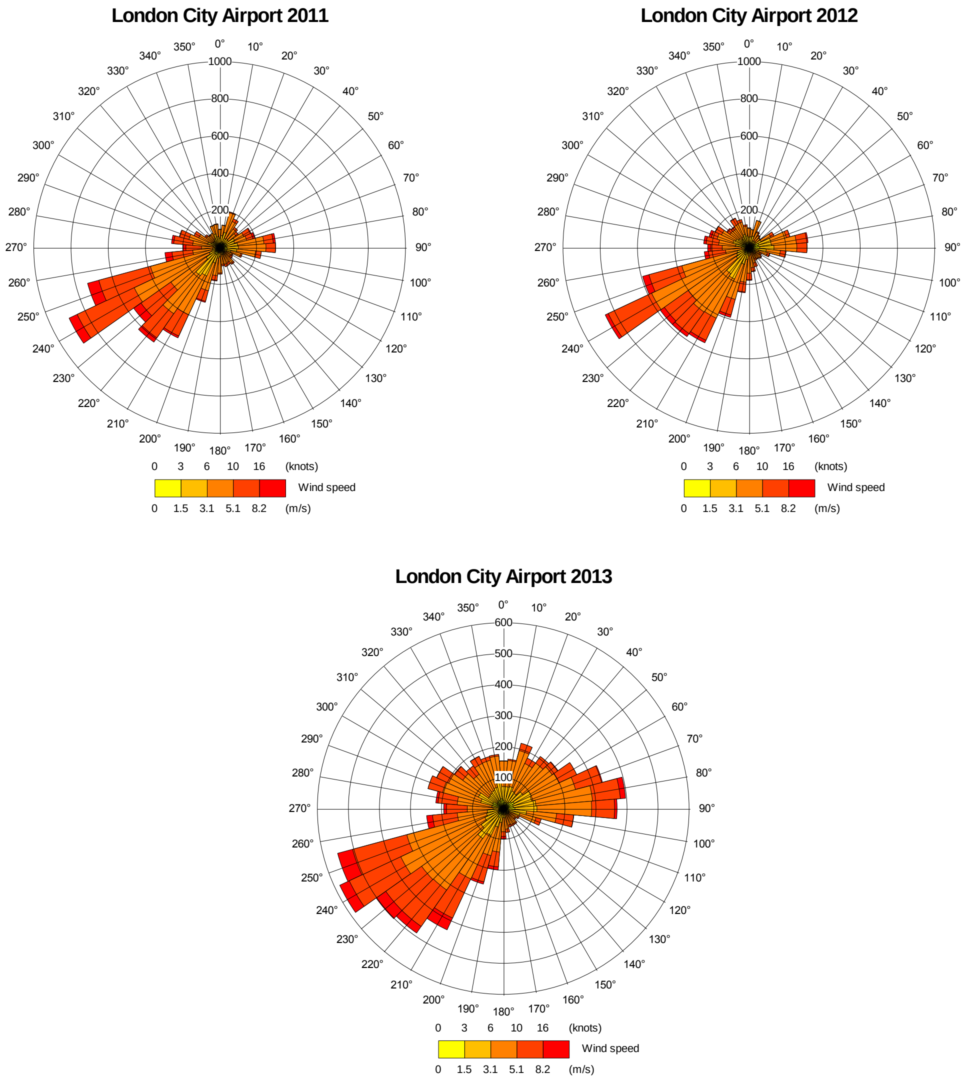
3.4.3 Hours of Operation

For the purposes of the modelling study, it has been assumed that two boilers and the CHP will operate continuously at maximum load. As discussed previously, in practice the energy centre is unlikely to operate at this capacity.

3.5 Meteorological Data

As agreed with the SO, the meteorological data used were recorded at London City Airport Weather Station, for the years 2011, 2012 and 2013. London City Airport Weather Station is located approximately 12 km east south east of the development site. Wind roses are presented in Diagram 2. This data was used for the modelling of emissions from road traffic and the proposed energy centre.

Diagram 2: Wind Roses



3.6 Surface Roughness

The surface roughness value used was 1.0 m, as the study area is in an urban location. The surface roughness used for London City Weather Station was also 1.0 m.

3.7 Assessment Locations

3.7.1 Road Traffic Emissions Assessment

For the assessment of emissions from the road traffic, levels of air pollutants have been estimated at 7 potentially sensitive locations (Figure 2), which represent the new receptors at the façade of the Proposed Development. The receptors on the façade of the Proposed Development building have been modelled at two heights, firstly at ground level and secondly at 25 m above ground level to represent the roof of the building. The modelled receptor points are described in Table 8 and are shown in Figure 1.

Table 8: Assessment locations

Receptor	Description	X	Y	Height (m)
R1	Façade – Shropshire Place	529523	182028	0, 25m
R2	Façade – Shropshire Place	529509	182050	0, 25m
R3	Façade – Shropshire Place/Capper Street	529488	182077	0, 25m
R4	Façade – Capper Street	529496	182083	0, 25m
R5	Façade – Capper Street/Huntley Street	529503	182089	0, 25m
R6	Façade – Huntley Street	529525	182063	0, 25m
R7	Façade – Huntley Street	529541	182041	0, 25m

3.7.2 Energy Centre Assessment

For the assessment of emissions from the energy centre, a receptor grid was set up covering the Proposed Development and the area in the vicinity of said development. The grid was centred on the energy centre and extended 400 m in each cardinal direction at 5 m intervals. The grid was modelled from ground level to 25 m above ground level to represent the roof of the building, at four height intervals (0m, 8m, 17m and 25m). The maximum concentration on this grid at each height was then used for this assessment.

3.8 Calculation of Concentrations

3.8.1 Road Traffic

Annual mean concentrations of pollutants from the road traffic emissions were modelled at the receptor locations. For nitrogen dioxide, the total concentrations were determined using the "NOx to NO_2 conversion spreadsheet" tool available from the Defra UK-AIR website10. Modelled concentrations of the road contribution of oxides of nitrogen (NOx) were corrected using the factor calculated in the verification study, as set out in Appendix 1, and entered into the spreadsheet tool along with the relevant general inputs and background concentrations.

The numbers of exceedences of the 24-hour mean PM_{10} air quality objective were calculated from the predicted annual mean PM_{10} concentrations using the method set out in the Technical Guidance note LAQM.TG (09).

3.8.2 Energy Centre

Emissions of NOx from a combustion plant consist of the gases nitric oxide (NO) and nitrogen dioxide (NO_2). It is only NO_2 that is of concern in terms of direct health and environmental effects. However NO is a source of NO_2 in the atmosphere. The gases are in equilibrium in the air, with NO predominating at the stack exit. Typically, NOx produced by combustion consists of 95 per cent NO and 5 per cent NO_2 at source.

In rural areas, where the atmosphere is relatively unpolluted, the oxidation process occurs rapidly downwind of the release point and NO_2 is the predominant species. However, in more polluted areas where the oxidizing capacity of the atmosphere may be limited, NO predominates. Urban areas are generally typical of this limited oxidation pattern.

When assessing the impacts on air quality of emissions to atmosphere from combustion sources, it is important that realistic estimates are made of how much NO has been oxidised to NO_2 at all receptors considered.

The rate of oxidation of NO to NO_2 depends on both the chemical reaction rates and the dispersion of the plume in the atmosphere. The oxidation rate is dependent on a number of factors that include the prevailing concentration of ozone, the wind speed and the atmospheric stability.

One method of estimating the proportion of the NOx that will be in the form of nitrogen dioxide at ground level, in the study area, is the empirical estimates made by Janssen et al[14]. Between 1975 and 1985 about 60 sets of measurements were made of the concentrations of NO and NO_2 in various power station plumes. From the data collected Janssen et al suggests an empirical relationship for the percentage oxidation in the plume based on downwind distance, season of the year, wind speed and ambient ozone concentration. This can be described by the following equation:

$$\left(\frac{[NO_2]}{[NO_x]}\right) = A\left(1 - e^{-\alpha x}\right)$$

where x is the distance downwind (km) of the emission point, A is a coefficient dependent on ozone concentration and the intensity of sunlight and α is related to wind speed and ozone concentration.

The A coefficient can be determined from the expression: -

$$A = \left(\frac{k_2}{k_1[O_3]} + 1\right)^{-1}$$

Where k1 is the second order rate constant for the reaction of NO with O3 and k2 is the rate constant for the photo-dissociation of NO_2. Janssen et al uses a value for k1 of 29 ppm-1 min-1 determined by Becker and Schurath in 1975[15]. The value for k2 is dependent on the intensity of sunlight at a particular location and Janssen et al quotes values determined by Parrish et al in 1983[16] of between 0 in the dark and 0.55 min-1 in full sunlight. Janssen obtains an average rate constant of 0.25 min-1 from measurements taken in the Netherlands. This value has been considered typical of the photolytic rate constant of NO_2, k2, expected in London.

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14 L.H.J.M. Janssen, J.H.A. Van Wakeren, H. Van Duuren and A.J. Elshout, A Classification of NO Oxidation Rates in Power Plant Plumes Based on Atmospheric Conditions, *Atmospheric Environment* Vol. 22, No. 1, pp. 43 – 53, 1988

15 Becker K. H. and Schurath U. Der Einfluss von Stickstoffoxiden auf atmospharische Oxidationsprozesse. *Staub* Vol. 35, pp. 156-161, 1975

16 Parrish D. D., Murphy P. C., Albritton D. L. and Fehsenfeld F.C. The measurement of the photodissociation rate of NO_2 in the atmosphere, *Atmospheric Environment* Vol. 17, pp. 1365-1379, 1983

Ozone is currently monitored at several sites across London (available at www.londonair.org.uk). Annual average data at the closest local site which is London Bloomsbury is set out in Table 9.

Table 9: Monitored Annual Mean Ozone Data

Site	Annual mean (ppb)	Year
London Bloomsbury	26	2012

Taking the local monitored ozone concentration from the table (26 ppb) gives the following for the proposed development site: -

$$A = \left(\frac{0.25}{29 * 0.026} + 1 \right)^{-1} = 0.75$$

The value of α has been determined experimentally by Janssen et al. Because α is not believed to be a function of the intensity of solar radiation, it is assumed here that it is independent of latitude and can, therefore, be applied equally to plumes anywhere in the world. Notwithstanding expectations, some seasonal variation of α was observed (higher values in summer, lower values in winter) and therefore it has been necessary to consider the maximum potential value here. Table 10 shows values of α determined by Janssen.

Table 10: Worst Case Values of α used for the Determination of NOx Conversion Factors

Background ozone concentration (ppb)	Wind speed at plume height		
	0 – 5 m/s	5 – 15 m/s	> 15 m/s
120 – 200	0.40	0.65	0.8
60 – 120	0.2	0.35	0.45
40 – 60	0.15	0.25	0.35
30 – 40	0.1	0.15	0.25
20 – 30	0.1	0.1	0.15
10 – 20	0.1	0.1	0.1
0 – 10	0.05	0.05	0.05

As the wind speed is not likely to exceed 15 m/s at plume height (i.e. above 25m); therefore, for an ozone concentration of 26 ppb (i.e. the 20 – 30 ppb category), Table 4.5 yields a value for α of 0.1.

The overall empirical formula suggested by Janssen et al to describe NOx conversion with distance at the proposed plant becomes:

$$\left(\frac{[NO_2]}{[NO_x]} \right) = 0.75 * \left(1 - e^{-0.1x}\right)$$

This equation has therefore been used to calculate a specific maximum conversion rate at various distances from the source to give more realistic concentrations of NO_2 due to emissions of NOx from the modelled combustion units. Table 11 below sets out the calculated conversion factors for various distances from the Proposed Development site using the above approach. This Janssen method was utilised to determine a more realistic conversion factor to calculate the proportion of the emitted NOx as NO_2 within the study area. To err on the side of caution, the calculated conversion factor has been double to ensure a conservative approach. The conversion factor ranged between 10% and 17% within the study area.

Table 11: Calculated values of the conversion of NOx to NO_2 as a percentage with distance

Downwind Distance (km)	Conversion Factor (%) – Janssen Formula
0.1	12%
0.25	15%
0.4	17%

3.9 Verification of Road Traffic Emissions Modelling

The measurements recorded by two diffusion tubes and one automatic monitoring station, near to the proposed UCLH development site (LBC reference: CA11, CA21 and CD9), were used in the verification study to calculate a combined adjustment factor to apply to the dispersion modelling predictions. These monitors were chosen due to their location within the AQMA and the proximity to the proposed development site. The model verification exercise is set out in detail in Appendix 1. It showed that the model under-predicted the road contribution of oxides of nitrogen. A factor of 2.6 was derived from the verification exercise, which was used to scale the modelled road contribution of oxides of nitrogen. This factor was also used to scale up the PM_{10} results in the absence of a specific adjustment factor for PM_{10}.

3.10 Conservative Assumptions

3.10.1 Uncertainty

There are always uncertainties in dispersion models in common with any environmental modelling study, because a dispersion model is no more than an approximation to the complex processes which take place in the atmosphere. Some of the key factors which lead to uncertainty in atmospheric dispersion modelling are as follows:

- The quality of the model output depends on the accuracy of the input data that goes into the model. Where model input data are a less reliable representation of the true situation, the results are likely to be less accurate;
- The meteorological datasets used in the model are not likely to be completely representative of the meteorological conditions at the site. However, the most suitable available meteorological data were chosen for the assessment;
- Models are generally designed on the basis of data obtained for large scale point sources, and may be less well validated for modelling emissions from smaller scale sources;

- The dispersion of pollutants around buildings is a complex scenario to replicate. Dispersion models can take account of the effects of buildings on dispersion. However, there will be greater uncertainty in the model results when buildings are included in the model; and

- Modelling does not specifically take into account individual small-scale features such as vegetation, local terrain variations and off-site buildings. The roughness length (z_o) selected is suitable to take account of the typical size of these local features.

To take account of these uncertainties and to ensure the predictions are more likely to be over-estimates than under-estimates, the conservative assumptions described below have been used for this assessment.

3.10.2 Conservative assumptions

The conservative assumptions adopted in this study are summarised below:

- It was assumed that both boilers and the CHP engine were in continuous maximum operation throughout the year. This will not be the case during normal operations as the boilers will operate on a run/assist/standby programme. In addition, the plant is not likely to operate at continuous maximum load due to varying heat or power demand for the site;

- The study is based on emissions from the plant being continuously at the emission limits for the proposed plant;

- The highest predicted concentrations obtained using any of the three different years of meteorological data have been used in this assessment.

- The highest predicted concentration at any of the sensitive human locations included in the assessment of environmental effects. Concentrations at other locations are likely to be less than the maximum values presented.

4 Methodology and Study Inputs –Air Quality Neutral Assessment

4.1 Outline of Method

An assessment of the Proposed Development has been undertaken in line with the policy requirements of Supplementary Planning Guidance (SPG)17 produced by the Greater London Authority (GLA). This sets out a requirement for an "Air Quality Neutral" assessment.

The assessment is based on first establishing a benchmark for the different land use classes associated with the Proposed Development. These are split into benchmarks for building emissions (Building Emissions Benchmarks) and transport emissions (Transport Emissions Benchmarks). The actual emissions associated with the building and transport emissions are then calculated for the Proposed Development and compared to the relevant benchmarks to determine compliance with the air quality neutral policy. If the benchmarks cannot be achieved, the guidance recommends that additional mitigation or off-setting is considered.

However, transport emissions have been omitted from this assessment due to the nature of the proposed development and the absence of relevant data specific to its land use category. The assessment was carried out in line with the Air Quality Neutral Planning Support Update: GLA 80371[18].

4.1.1 Building Emissions Benchmark

Two Building Emission Benchmarks (BEBs) have been defined, one for NOx and one for PM_{10}, for a series of land-use classes. It is not necessary for a developer to demonstrate compliance with the PM_{10} benchmark where gas is the only fuel used on site. On this basis, PM_{10} was not included for this aspect of the assessment. Benchmarks are calculated based on the different gross floor areas for each development use, these benchmarks were then added together to provide a total building emissions benchmark to compare the Proposed Development to. This benchmark is shown in Table 12.

Table 12: Building emissions benchmark

Class	Gross Floor Area	Building Emissions Benchmarks (NOx)	
	m2	g/m2/annum	kg/annum
D1 (Non-residential institutions)	12,013	516,559	517
Total Benchmark			517

17 Sustainable Design and Construction Supplementary Planning Guidance, London Plan 20111, April 2014.

18 Air Quality Consultants, Air Quality Neutral Planning Support Update: GLA 80371, April 2014

4.1.2 Building Emissions

The proposed building NOx emissions have been based on the energy centre emissions set out in Section 3.4.1. We have assumed emissions which more represent the typical operating hours as advised by the projects engineers. The project engineers advised that the CHP will operate for 6,258 hours per year at full load or 7976 hours per year if including partial load. The boilers were advised to operate for a total of 3,326 hours per year. For this assessment, we have assumed 8760 operating hours (i.e. the full year) at full load for the CHP and one boiler – this represents a conservative approach based on the typical operating hours and loads. The total building emissions are shown in Table 13.

Table 13: Building emissions

Energy Centre Component	Total Building Emission (NOx) kg/annum
CHP	187
Boilers	233
Total	420

The emissions have then been compared to the benchmarks summarised in Table 14 to determine whether the development is acceptable from an air quality perspective and if additional mitigation is required.

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5 Results

5.1 Road Traffic Emissions

The dispersion model results using 2018 emissions data are set out in Tables 14 to 16. The Tables give the following information:

- Air quality objective (AQO) for each substance under consideration;
- The total forecast concentration of the substance for 2018 which is the earliest date that the development is forecast to be completed (adjusted by the factor derived from the verification study);

The total forecast concentration of the substance is presented at two heights, 0 m to represent ground level concentrations and 25 m to represent the roof height of the building.

Table 14: Modelled annual mean nitrogen dioxide concentrations at receptor locations

Receptor		Modelled Annual Mean NO_2 Concentrations ($\mu g/m^3$)	
		0 m	25 m
Air quality objective – 40 $\mu g/m^3$			
Proposed Development façade receptors			
R1	Façade facing Shropshire Place	44.0	40.5
R2	Façade facing Shropshire Place	43.9	40.5
R3	Façade facing Shropshire Place/Capper Street	44.1	40.6
R4	Façade facing Capper Street	44.2	40.6
R5	Façade facing Capper Street/Huntley Street	44.6	40.6
R6	Façade facing Huntley Street	45.8	40.6
R7	Façade facing Huntley Street	45.8	40.5

Table 15: Modelled annual mean PM_{10} concentrations at façade receptor locations

Receptor		Modelled Annual Mean PM_{10} (µg/m^3)	
		0 m	25 m
Air quality objective – 40 µg/m^3			
UCLH façade receptors			
R1	Façade facing Shropshire Place	24.8	24.3
R2	Façade facing Shropshire Place	24.8	24.3
R3	Façade facing Shropshire Place/Capper Street	24.8	24.4
R4	Façade facing Capper Street	24.8	24.4
R5	Façade facing Capper Street/Huntley Street	24.9	24.4
R6	Façade facing Huntley Street	25.2	24.4
R7	Façade facing Huntley Street	25.2	24.3

Table 16: 24-hour mean PM_{10} concentrations at façade receptor locations

Receptor		Days exceeding 50 µg/m^3	
		0 m	25 m
Air quality objective – <35 days per year			
UCLH façade receptors			
R1	Façade facing Shropshire Place	12	11
R2	Façade facing Shropshire Place	12	11
R3	Façade facing Shropshire Place/Capper Street	12	11
R4	Façade facing Capper Street	12	11
R5	Façade facing Capper Street/Huntley Street	12	11
R6	Façade facing Huntley Street	13	11
R7	Façade facing Huntley Street	13	11

The results in Tables 17 and 18 show that in 2018, there are predicted to be no exceedences of the AQOs for PM_{10}. For PM_{10} the highest concentrations at ground level are predicted at Receptor 7 where the concentration is predicted to be 25.2 µg/m^3, the highest concentration forecast at 25m is 24.4 µg/m^3, which is predicted at Receptor 5. The 24 hour mean PM_{10} concentrations are not forecast to exceed 50 µg/m^3 more than the AQO of 35 days; the maximum is 13 days per year predicted at ground level for Receptors 6 and 7.

The results in Table 16 show that in 2018, there are predicted to be exceedences of the AQO for annual mean nitrogen dioxide at all receptors and at all modelled heights; this is due to the estimated background nitrogen dioxide concentration of 38.9 µg/m^3 which nearly exceeds the AQO. The maximum ground level annual mean nitrogen dioxide is 45.8 µg/m^3 predicted at Receptor 6 and 7 (i.e. the façade facing Huntley Street); at a height of 25m, an annual mean nitrogen dioxide concentration of between 40.5 µg/m^3 to 40.6 µg/m^3 was predicted at all receptors regardless of the façade. The development itself will not generate additional road traffic, and so will not have an impact on local air quality due to emissions from road traffic.

The results in Table 16 demonstrate that the façade of the Proposed Development facing Huntley Street will be subject to higher levels of nitrogen dioxide. However, due to nitrogen dioxide concentrations exceeding the AQO at all facades of the Proposed Development, it is recommended that mechanical ventilation is installed and there are no opening windows for the Proposed Development.

At all receptors there are still predicted to be exceedences of the AQO for annual mean nitrogen dioxide concentrations at 25 m above ground level; this is due to the background concentration of nitrogen dioxide in the area being close to the objective. For this assessment it has been assumed that the background concentration of nitrogen dioxide remains constant regardless of height - in reality this would not be the case; a decrease in background levels of nitrogen dioxide concentrations would normally be expected with height.

The design of the hospital building includes for all air intakes connected to the heating ventilation and air conditioning (HVAC) units to be located on the façade of the Proposed Development facing Shropshire Place on the fourth and fifth storey. The air quality levels at this location are likely to be better than those at the façade of the Proposed Development adjacent to Huntley Street. Therefore, the proposed location of the HVAC units is considered to be a suitable location.

5.2 Energy Centre

The results in Table 17 present the maximum nitrogen dioxide concentrations as a result of emissions from the energy centre, including the emissions from the two boilers and CHP engine. The results presented are the maximum concentrations on the modelled receptor grid for any of the three years of meteorological data included in the assessment at 8 m intervals. The process contributions at all other locations, including the adjacent hospital, will be less than those presented below.

The tables give the following information:

- Air quality objective (AQO);
- Estimated annual mean baseline concentration taken from the London Bloomsbury urban background automatic monitoring station (see Section 3.2);
- Process Contribution (PC), the maximum modelled concentration of the substance due to the energy centre alone;
- PC as a percentage of the air quality objective.

Table 17: Nitrogen dioxide concentrations from emissions from the energy centre

Receptor height	Averaging period	Air Quality Objective (AQO) (µg/m^3)	PC (µg/m^3)	PC / AQO (%)
Ground level	Annual mean	40	0.1	0.2%
8 m			0.1	0.2%
17 m			0.1	0.2%
25 m			0.6	1.5%
Ground level	1 hour mean (99.8th %ile)	200	0.2	0.1%
8 m			0.3	0.1%
17 m			0.5	0.3%
25 m			3.3	1.7%

The results in Table 17 show that, even taking into account the worst case operating conditions, the annual mean nitrogen dioxide process contribution from the energy centre is less than 1% of the air quality objective at all of the heights considered with the exception at a height of 25 m. At a height of 25m, the maximum concentration is predicted to occur within a very short distance of the stack (approximately 20m to the east northeast of the stack). At this location there are no buildings and therefore no receptors at a height of 25m. The residential properties on the north side of Huntley Street opposite the Proposed Development building are approximately 15m in height and therefore the maximum concentration would be 0.1 µg/m^3 or less (i.e. 0.2% or less of the annual mean air quality objective). The contour plot of the predicted process contribution to annual mean nitrogen dioxide concentrations at a height of 25m is shown in Figure 3. This shows that the 0.4 µg/m^3 contour (i.e. representing 1% of the annual mean air quality objective value) is confined to a relatively small area and does not intersect with any buildings or potential receptor locations.

Additional modelling demonstrated that the predicted annual mean nitrogen dioxide process contribution at the proposed air intakes on the fourth and fifth storey on the façade of the Proposed Development facing Shropshire Place are 0.1 µg/m^3 (which is significantly lower than 1% of the air quality objective).

The predicted 1-hour mean concentrations are all significantly below 10% of the short-term air quality objective, and this represents an insignificant impact according to the relevant Environment Agency guidance[19].

As discussed previously, for this assessment it was assumed that both boilers and the CHP engine were at continuous maximum load for the duration of the year. This will not be the case during normal operations as the three boilers will operate on a run/assist/standby programme. The total annual mean concentrations will exceed the air quality objective (see results for road traffic emissions assessment) due to the elevated baseline concentration and contribution from nearby roads. However, the process emissions from the energy centre is considered to be insignificant.

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[19] Environment Agency, H1 Annex F – Air Emissions, version 2.2, December 2011

5.3 Air Quality Neutral Assessment

The comparison of the Proposed Development to the benchmarks for the building emissions are set out in Table 18.

Table 18: Comparison to Building Emissions Benchmarks

Building Emissions Benchmark	Total Building Emission	Comparison to Benchmark	Mitigation Required?
kg/annum			
517	420	-97	Mitigation not required

The results in Table 18 demonstrates that the Proposed Development leads to emissions of NOx which are lower than the emissions benchmark, thus additional mitigation is not considered to be required.

6 Construction Impacts

6.1 Introduction

Major construction sites can give rise to increasing long term and short term PM_{10} concentrations at off-site locations and may also cause annoyance due to the soiling of surfaces by dust unless the appropriate mitigation measures are implemented. The impacts of dust therefore need to be addressed.

The assessment of dust during construction has been carried out using a qualitative risk-based appraisal with reference to the Proposed Developments location in relation to sensitive locations, the planned process and Proposed Development characteristics, as described in the Institute of Air Quality Management (IAQM) guidance[20]. The London Plan supplementary planning guidance on the control of dust during demolition and construction[21] have been considered in this assessment as requested by LBC.

6.2 Potential Sources

The key potential construction air quality emission sources are:

- Excavation/demolition activities;
- Earthworks;
- Construction vehicle movement: vehicles moving on and around the Proposed Development emitting exhaust particulate and re-suspending loose material on the road;
- Material transfer: spillage from transferring material around the Site, wind picking up dust from material stock piles, particulate lifted from open container vehicles by the wind generated from the vehicle movement; and
- Passing vehicles: Material tracked out on the wheels of site traffic and re-suspended by passing traffic.

The temporary nature of construction differentiates it from other fugitive dust sources as to the estimation and control of emissions. The construction process consists of a series of different operations, each with its own duration and potential for dust generation. Emissions from any single construction site can be expected to have a definable beginning and end and to vary substantially over different phases of the construction process and over different tasks within each phase. There are potentially sensitive locations near to the Proposed Development. If the construction phase were to produce excessive emissions of dust, the impact on these sensitive locations could potentially be significant due to their close proximity.

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20 The Institute of Air Quality Management. Guidance on the assessment of dust from demolition and construction, February 2014

21 Greater London Authority, The Control of Dust and Emissions During Construction and Demolition, Supplementary Planning Guidance, July 2014

With regard to assessing the cumulative impact of local proposed developments, the London Plan supplementary planning guidance on the control of dust during demolition and construction[15] states that;

> *"The potential cumulative effects of emissions from several development sites should be considered and managed between the sites. For high risk sites, liaison meetings should be held with site managers of other high risk construction sites within 200m of the site boundary to ensure plans are co-ordinated and dust and particulate matter emissions are minimised."*

The construction dust assessment comprises a qualitative risk-based appraisal of potential sources of dust and the impacts at the sensitive locations close to the Proposed Development. If required, a suite of recommended mitigation measures can be used to minimise the impact of dust during the construction phase of the development. The mitigation measures are generally suitable for inclusion in a CEMP or an Air Quality and Dust Management Plan (AQDMP)[21], which would normally be agreed with the Council prior to commencement of activity on the Proposed Development site, usually by a condition on the planning permission. The assessment is based on the IAQM guidance[22].

6.3 Assessment Methodology

The methodology in the guidance provides an assessment on three separate dust effects, which are:

- 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}

Full details of the methodology used for the assessment of construction dust emissions, and the relevant study inputs, are set out in Appendix 3.

6.4 Demolition and Construction – Dust Assessment

An assessment of construction impacts was undertaken in accordance with the IAQM methodology outlined above.

Step 1- Screen the Need for a Detailed Assessment

There are receptors within 350 m of the site boundary and receptors within 50 m of the main construction access roads to the site (up to 50 m from the site entrance). Therefore, further assessment is required and so needs to proceed to Step 2 – Step 4.

The risks of impacts on ecological receptors were screened out as there are no habitat sites within 50 m of the Site or access roads up to 50 m from the site entrance.

[22] The Institute of Air Quality Management. Guidance on the assessment of dust from demolition and construction, February 2014

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Step 2A - Define the potential dust emission magnitude

Using the definitions of dust emission classes provided in the methodology, the descriptor of each activity is summarised below.

Demolition: The Proposed Development will be built on previously developed land which will involve the demolition of the existing site buildings. The volume of demolition works associated with the Proposed Development will be less than 20,000m^3 (existing building 15,325 m^3). On this basis, the assessment for demolition is based on a dust emission class of "**Small**".

Earthworks: As the construction site area is less than 2,500 m^2 and it is anticipated that less than 10,000 tonnes of material will be moved, the proposed earthworks have been classified as a dust emission class of "**Small**".

Construction: The total proposed building volume is approximately 53,250 m^3 and there is a significant amount of construction required for the full development of the site. Therefore the assessment for construction is based on a dust emission class of "**Medium**".

Trackout: The number of daily Heavy Duty Vehicle (HDV) trips is estimated to be 20, on this basis, the assessment for trackout is based on a dust emission class of "**Small**".

Table 19 presents the dust emission magnitude for each activity based on the criteria set out in the methodology.

Table 19: Dust emission magnitude

Activity	Dust emission magnitude
Demolition	Small
Earthworks	Small
Construction	Medium
Track out	Small

Step 2B - Define the sensitivity of the area

The Proposed Development is surrounded by residential receptors to the north, east and south, in some directions there are receptors within 20 m of the site boundary. If the construction phase of the development were to produce excessive dust emissions it is possible that significant impacts may be experienced at these properties if suitable mitigation measures are not employed. The wind rose for 2013, for the London City Airport meteorological station is shown in Diagram 2). This shows that the predominant wind direction is from the south west, meaning that receptors to the north east of the site would be most susceptible to any potential fugitive dust emissions during construction. The nearest residential receptors to the north east of the development are approximately 20 m away.

Table 20: Sensitivity of the area

Activity	Sensitivity of the surrounding area			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	High	High	High	High
Human health	High	High	High	High
Ecological	N/A – screened out from the assessment			

Table 20 shows that based on the baseline PM_{10} concentrations, the number of receptors in the area and the distance to the various sources the sensitivity of the site is high for dust soiling and human health impacts during all stages of the development.

Step 2C - Define the risk of impacts

Using the dust emission magnitude for the various activities in Table 21 and the sensitivity of the area provided in Table 20, the definition of the risk for each activity, is provided in Table 21.

Table 21: Summary dust risk

Potential impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium	Low	Medium	Low
Human health	Medium	Low	Medium	Low
Ecological	N/A – screened out from the assessment			

Step 3 – Site Specific Mitigation

During the demolition and construction phases of the development it will be important to control dust levels for the risk sources identified in Table 21. In order to avoid significant impacts from dust during the demolition and construction phases, a number of mitigation measures and dust control actions will need to be put in place at the site.

These measures have been specified in the IAQM guidance[23] and are suitable to mitigate dust emissions for sites such as the Proposed Development. Measures such as those specified in the guidance would normally be sufficient to reduce construction dust nuisance to a minor impact. These measures are listed in Tables 24 to 29.

As specified above, the measures to control dust emissions and monitor the effectiveness of the mitigation would be agreed formally with LBC as part of a CEMP

23 The Institute of Air Quality Management. Guidance on the assessment of dust from demolition and construction, February 2014

or AQDMP. It is anticipated that this would be achieved through the setting of an appropriate planning condition.

The London Plan supplementary planning guidance on the control of dust during demolition and construction[21] recommends that cumulative effects of emissions should be considered for high risk developments with other high risk developments within 200m of the site boundary. As the Proposed Development is mainly classified as a medium or low risk site before the application of any mitigation measures, it is not considered necessary to liaise with any other proposed developments within 200 m of the site boundary whose demolition or construction periods may coalesce. However, there is currently the UCLH redevelopment of the former Odeon site and demolition of the Rosenheim Building to provide medical facilities and a retail unit in a seven storey development. This is located approximately 100m north west of the site and is likely to overlap with the Proposed Development and therefore contribute to cumulative dust impacts. Some form of liaison between the two developments is recommended.

6.5 Mitigation Measures

6.5.1 Demolition and Construction

The results of the construction dust assessment summarised in Table 21 indicate that the Proposed Development would be likely to lead to adverse impacts due to demolition and construction unless appropriate mitigation measures were implemented.

Mitigation measures for construction dust emissions are recommended within the IAQM guidance, these mitigation measures are displayed in Tables 22 to 27 with a recommendation as to whether or not they should be applied to the Proposed Development and implemented through an appropriate CEMP or AQDMP. The recommendations are based on the risk levels identified in the dust assessment undertaken in accordance with the IAQM guidance set out earlier in this chapter.

Other guidance will also be considered when developing the mitigation measures for inclusion within the CEMP or AQDMP. The guidance included the supplementary planning guidance on the control of dust during demolition and construction[21]. Where these guidance documents recommend mitigation measures which supplement those within the IAQM guidance (i.e. those set out in Tables 24 to 29 below), these additional measures will also be considered for inclusion within the CEMP or AQDMP. As discussed previously, the CEMP or AQDMP will be agreed with LBC prior to commencement of construction.

Table 22: Mitigation for all sites: Communications

Mitigation Measure	Highly recommended / Desirable / Not required
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	Highly recommended
2. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	Highly recommended
3. Display the head or regional office contact information.	Highly recommended

Table 23: Mitigation for all sites: Dust Management

Mitigation Measure	Highly recommended / Desirable / Not required
4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.	Highly recommended
Site management	
5. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	Highly recommended
6. Make the complaints log available to the local authority when asked.	Highly recommended
7. Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	Highly recommended
8. Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	Not recommended – although may be appropriate for other UCLH sites within 200m

Mitigation Measure	Highly recommended / Desirable / Not required
Monitoring	
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.	Desirable
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	Highly recommended
11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	Highly recommended
12. Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	Highly recommended
Preparing and maintaining the site	
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Highly recommended
14. Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	Highly recommended
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.	Highly recommended
16. Avoid site runoff of water or mud.	Highly recommended
17. Keep site fencing, barriers and scaffolding clean using wet methods.	Highly recommended
18. Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	Highly recommended
19. Cover, seed or fence stockpiles to prevent wind whipping.	Highly recommended

Mitigation Measure	Highly recommended / Desirable / Not required
Operating vehicle/machinery and sustainable travel	
20. Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable.	Highly recommended
21. Ensure all vehicles switch off engines when stationary - no idling vehicles.	Highly recommended
22. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Highly recommended
23. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	Desirable
24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	Highly recommended
25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	Desirable
Operations	
26. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Highly recommended
27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Highly recommended
28. Use enclosed chutes and conveyors and covered skips.	Highly recommended
29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	Highly recommended
30. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	Highly recommended
Waste management	
31. Avoid bonfires and burning of waste materials.	Highly recommended

Table 24: Measures specific to Demolition

Mitigation Measure	Highly recommended / Desirable / Not required
32. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	Desirable
33. Ensure effective water suppression is used during demolition operations. Hand held spays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	Highly recommended
34. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	Highly recommended
35. Bag and remove any biological debris or damp down such material before demolition.	Highly recommended

Table 25: Measures specific to Earthworks

Mitigation Measure	Highly recommended / Desirable / Not required
36. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Not required
37. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	Not required
38. Only remove the cover in small areas during work and not all at once	Not required

Table 26: Measures specific to Construction

Mitigation Measure	Highly recommended / Desirable / Not required
39. Avoid scabbling (roughening of concrete surfaces) if possible	Desirable
40. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	Highly recommended
41. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	Desirable
42. For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	Desirable

Table 27: Measures specific to Trackout

Mitigation Measure	Highly recommended / Desirable / Not required
43. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	Desirable
44. Avoid dry sweeping of large areas.	Desirable
45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Desirable
46. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Not required
47. Record all inspections of haul routes and any subsequent action in a site log book.	Desirable
48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	Not required
49. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	Desirable
50. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	Not required
51. Access gates to be located at least 10 m from receptors where possible.	Not required

6.6 Conclusions

An assessment of the potential impact of dust emissions from the construction phase of the Proposed Development at Huntley Street, Camden has been carried out. The objective of the assessment was to identify whether the development itself would cause a significant impact on local air quality during the construction phases due to dust emissions.

The appraisal of the potential dust levels associated with the construction of the proposed development at the site shows that, although dust is likely to be generated from site activities and the site would be classed as a "Medium risk site" for Demolition and Construction and a "Low risk site" for Earthworks and Trackout activities, these risks can be reduced effectively through appropriate mitigation measures. Some degree of dust impact may be possible at nearby sensitive locations if the dust is not properly mitigated or there is a failure of the control measures (e.g. a failure of the water supply for dust suppression) and this could lead to a short-term dust annoyance.

The measures to control dust emissions and monitor the effectiveness of the mitigation would be agreed formally with LBC as part of a CEMP or equivalent management plan. It is anticipated that this would be achieved through the inclusion of an appropriate planning condition.

Therefore, providing the mitigation measures are in place and appropriately managed during the construction phase, it is concluded that the Proposed Development is suitable from an air quality perspective.

7 Conclusion

An assessment of the site suitability for the Proposed Development in terms of air quality has been undertaken at the request of LBC. This assessment was required as the development is located within the LBC AQMA, and the aim of the study was to assess the levels of pollutants in relation to the relevant air quality objectives at the Proposed Development due to the existing poor air quality within the area. This assessment also considers the impacts of the proposed on-site energy centre.

The results show that there are predicted to be no exceedences of the AQOs for annual mean PM_{10}. For PM_{10} the highest concentrations at ground level are at Receptor 7 where the concentration is predicted to be 25.2 µg/m^3. The 24 hour mean PM_{10} concentrations are not forecast to exceed 50 µg/m^3 more than the AQO of 35 days; the maximum is 13 days per year predicted at ground level.

The results further show that, similar to many locations in central London, there are predicted to be exceedences of the AQOs for annual mean nitrogen dioxide at all receptors when the Proposed Development is scheduled for completion in 2018. This is due to the estimated background nitrogen dioxide concentration of 38.9 µg/m^3 which nearly exceeds the AQO. On this basis, it is recommended that mechanical ventilation is installed and there are no opening windows on any façade of the Proposed Development.

The Proposed Development will not generate additional road traffic, and so will not have an impact on local air quality due to emissions from road traffic.

The assessment of emissions from the energy centre show that, even taking into account the worst case operating conditions, the annual mean nitrogen dioxide process contribution from the energy centre is less than 1% of the air quality objective at at relevant receptor locations. Therefore, the process emissions from the energy centre are considered to be insignificant.

The results of the air quality neutral assessment for the development show that when comparing the Building Emissions Benchmark to the predicted building emissions, additional mitigation is not required.

The results of the construction dust assessment carried out in Section 6 show that although dust is likely to occur from site activities through demolition and construction, this can be reduced through appropriate mitigation measures.

Although annual mean nitrogen dioxide levels are predicted to exceed the AQOs at the Proposed Development when it is scheduled to be completed in 2018, this is due to the estimated background nitrogen dioxide concentrations which are likely to nearly exceed the AQO for nitrogen dioxide, which is in common with most locations within central London. Recommendations have been made to reduce the impact of the air quality to the new receptors at the UCLH development (i.e. appropriate positioning of HVAC air inlets) and it is thus concluded that the proposed development is acceptable from an air quality perspective.

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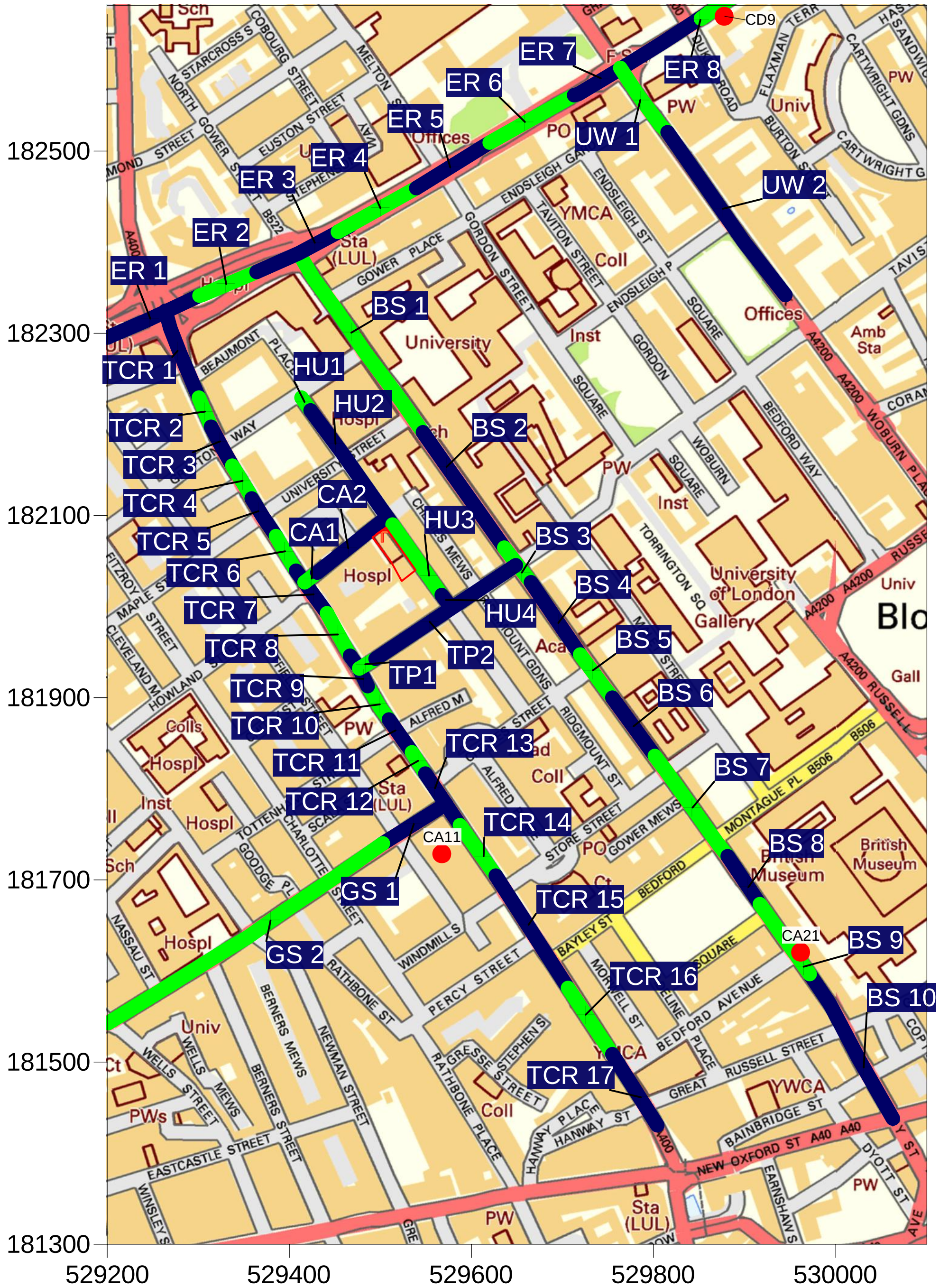
Figures



KEY:

Site location

Monitoring locations used for verification

CHP and Boiler flue locations

TCR 1 Modelled road links

N

 Produced Using Surfer File name: Figure1

University College London Hospital NHS Foundation Trust Development

Scale: As shown		Project: KU022100	
Content: DAH		Drawn: DAH	
Checked: SB		Date: Feb 2015	

FIGURE 1

Location of Proposed Development Site, Modelled Road Links and Monitoring Locations

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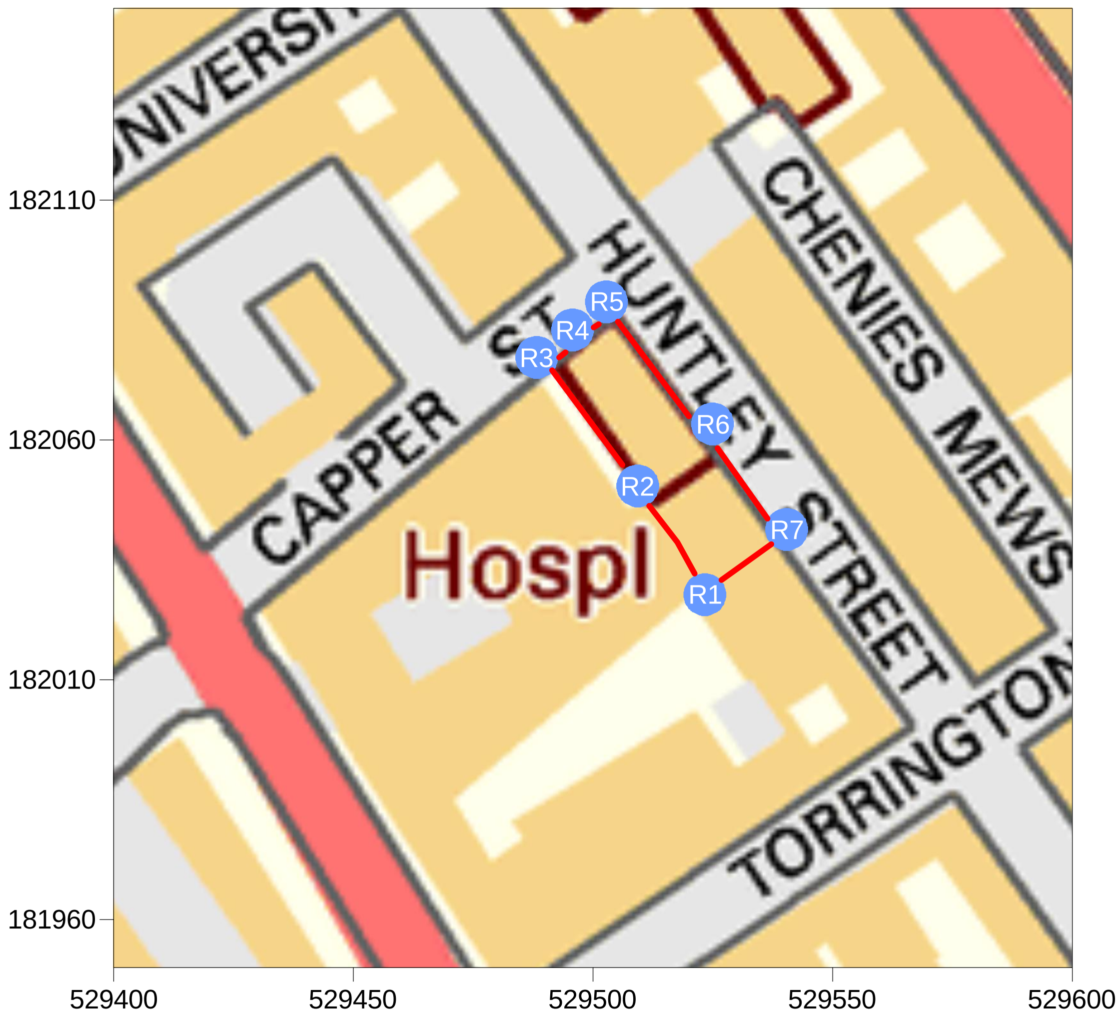

KEY:

Site location

Receptors

N

 Produced Using Surfer File name: Figure2

University College London Hospital NHS Foundation Trust Development

FIGURE 2
Location of Proposed Development Site and Receptors

Scale:	As shown	Project:	KU022100
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Checked:	SB	Date:	Feb 2015

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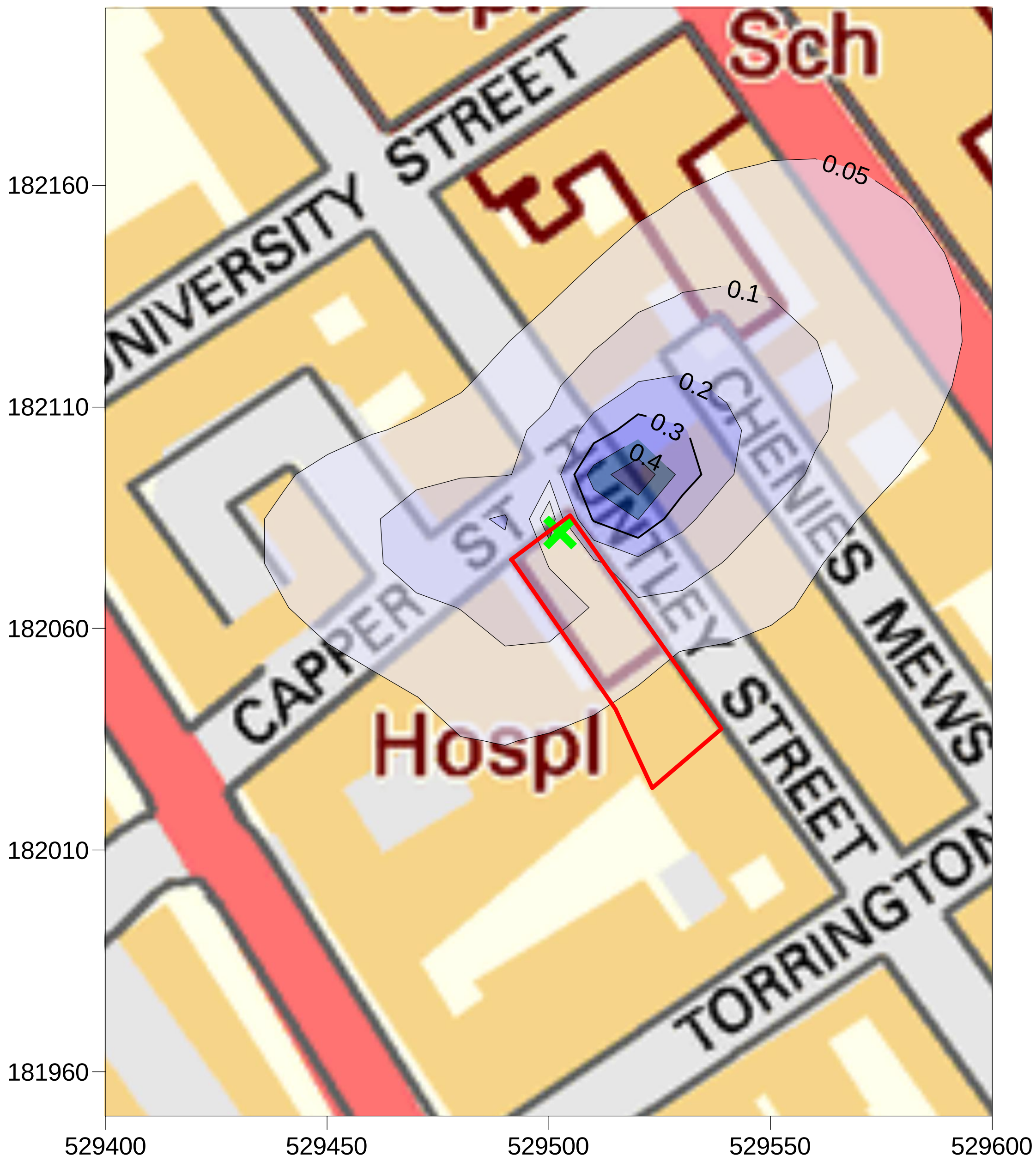

KEY:

Site location

CHP and Boiler flue locations

0.05 - 0.1 µg/m3

0.1 - 0.2 µg/m3

0.2 - 0.3 µg/m3

0.3 - 0.4 µg/m3

0.4 - 0.5 µg/m3

>0.5 µg/m3

N

University College London Hospital NHS Foundation Trust Development

FIGURE 3

Annual mean nitrogen dioxide process contributions, 2011 meteorological data

Scale:	As shown	Project:	KU022100
Content:	DAH	Drawn:	DAH
Checked:	SB	Date:	Feb 2015

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Appendices

Appendix 1 Verification Study

A model verification exercise was undertaken to minimise any disparity between the modelling and monitoring results obtained by the London Borough of Camden and to provide a higher level of confidence in the predicted concentrations in the vicinity of the roads assessed. Any disparities are likely to be a combination of uncertainties in traffic flows, speeds, emissions estimates, background concentrations, meteorological data, model input parameters such as surface roughness and the overall limitations of the dispersion model.

Table A1.1 Model verification traffic inputs

Year	Road	Road Link	With development		
			AADT	LDV	HDV
2013	Euston Road	ER1, ER2, ER3	59460	55894	3566
		ER4, ER5, ER6, ER7, ER8	41005	36322	4683
	Tottenham Court Road	TCR1, TCR2, TCR3, TCR4, TCR5, TCR6, TCR7, TCR8, TCR9, TCR10, TCR11, TCR12, TCR13	21316	19249	2067
		TCR14, TCR15, TCR16, TCR17	13732	12038	1694
	Bloomsbury Street	BS1, BS2, BS3, BS4, BS5, BS6, BS7, BS8, BS9, BS10	12215	10231	1984
	Upper Woburn	UW1, UW2	14352	11696	2656
	Goodge Street	GS1, GS2	6113	5857	256

This verification study was conducted in line with the guidance set out in LAQM.TG (09). The 2013 annual mean nitrogen dioxide measurements recorded at three locations within the Camden AQMA were used in the verification exercise. The model was run using the 2013 meteorological data set and using 2013 traffic data and emissions (see Table A1.1).

The London Bloomsbury automatic monitoring station data for 2013 for nitrogen dioxide was used for this verification exercise (see Table 3).

The initial assessment of the model results at the diffusion tube location indicated that the model was under-estimating the nitrogen dioxide concentrations. These results are outlined in Table A1.2.

Table A1.2 Comparison of modelled and monitored nitrogen dioxide concentration

Site ID	Monitor Type	Site Type /Description	Background NO_2 (µg/m^3)	Monitored total NO_2 (µg/m^3)	Modelled total NO_2 (µg/m^3)	% Difference
11	DT	Kerbside	44.0	88.1	89.9	2%
21	DT	Roadside	44.0	76.1	86.4	13.6%
ER	AM	Roadside	44.0	106.0	97.6	-8%

Note: DT = Diffusion tube; NO_2 = nitrogen dioxide, AM = automatic monitor

A verification study was conducted to minimise any disparity between the modelling and monitoring results obtained by the London Borough of Camden. The outcome of the verification study at the assessed monitoring location is set out in Table A1.3.

Table A1.3 Nitrogen dioxide verification study model results

Site ID	Monitored total NO_2 (µg/m^3)	Monitored total NOx (µg/m^3)	Background NO_2 (µg/m^3)	Monitored road contribution NO_2 (µg/m^3)	Monitored road contribution NOx (µg/m^3)	Modelled road contribution NOx (µg/m^3)
11	88.1	135.7	44.0	44.1	135.7	54.9
21	76.1	92.2	44.0	32.1	92.2	49.8
ER	106.0	205.8	44.0	62.0	205.8	66.3

Note: NO_2 = nitrogen dioxide; NOx = oxides of nitrogen

The ratio of the monitored road contribution of oxides of nitrogen to the modelled road contribution of oxides of nitrogen was plotted and determined to be a factor of 2.6. This factor was used to adjust the modelled road contribution of oxides of nitrogen from the assessment models. This factor was also applied to the PM_{10} results.

Appendix 2 Details of the Modelled Road Links

Table A2.1 Details of the Modelled Road Links

Road Link	Road width (m)	Canyon height	Speed (km/h)	
		(m)	LDV	HDV
TCR 1	30	30	25	20
TCR 2	25	30	17	12
TCR 3	25	30	25	20
TCR 4	25	30	17	12
TCR 5	25	30	25	20
TCR 6	25	30	17	12
TCR 7	25	30	25	20
TCR 8	25	30	17	12
TCR 9	25	30	25	20
TCR 10	25	30	17	12
TCR 11	25	30	25	20
TCR 12	25	30	17	12
TCR 13	25	30	25	20
TCR 14	25	30	17	12
TCR 15	25	30	25	20
TCR 16	25	30	17	12
TCR 17	25	30	25	20
GS 1	15	30	17	12
GS 2	15	30	25	20
BS 1	18.5	30	17	12
BS 2	18.5	30	25	20
BS 3	18.5	30	17	12
BS 4	18.5	30	25	20
BS 5	18.5	30	17	12
BS 6	18.5	30	25	20
BS 7	18.5	30	17	12
BS 8	18.5	30	25	20
BS 9	18.5	30	17	12
BS 10	18.5	30	25	20
ER 1	25	0	20	15
ER 2	25	0	30	25
ER 3	30	30	20	15
ER 4	30	30	30	25

Road Link	Road width (m)	Canyon height (m)	Speed (km/h)	
			LDV	HDV
ER 5	30	30	20	15
ER 6	21	0	30	25
ER 7	30	30	20	15
ER 8	30	30	30	25
UW 1	20	30	20	15
UW 2	20	30	30	25
TP1	18	18	9	9
TP2	16	18	30	25
CA1	10	16	15	10
CA2	12	16	30	25
HU1	16	25	15	10
HU2	16	25	35	30
HU3	16	16	35	30
HU4	15	25	9	9

Appendix 3 Construction Phase – Construction Dust Assessment

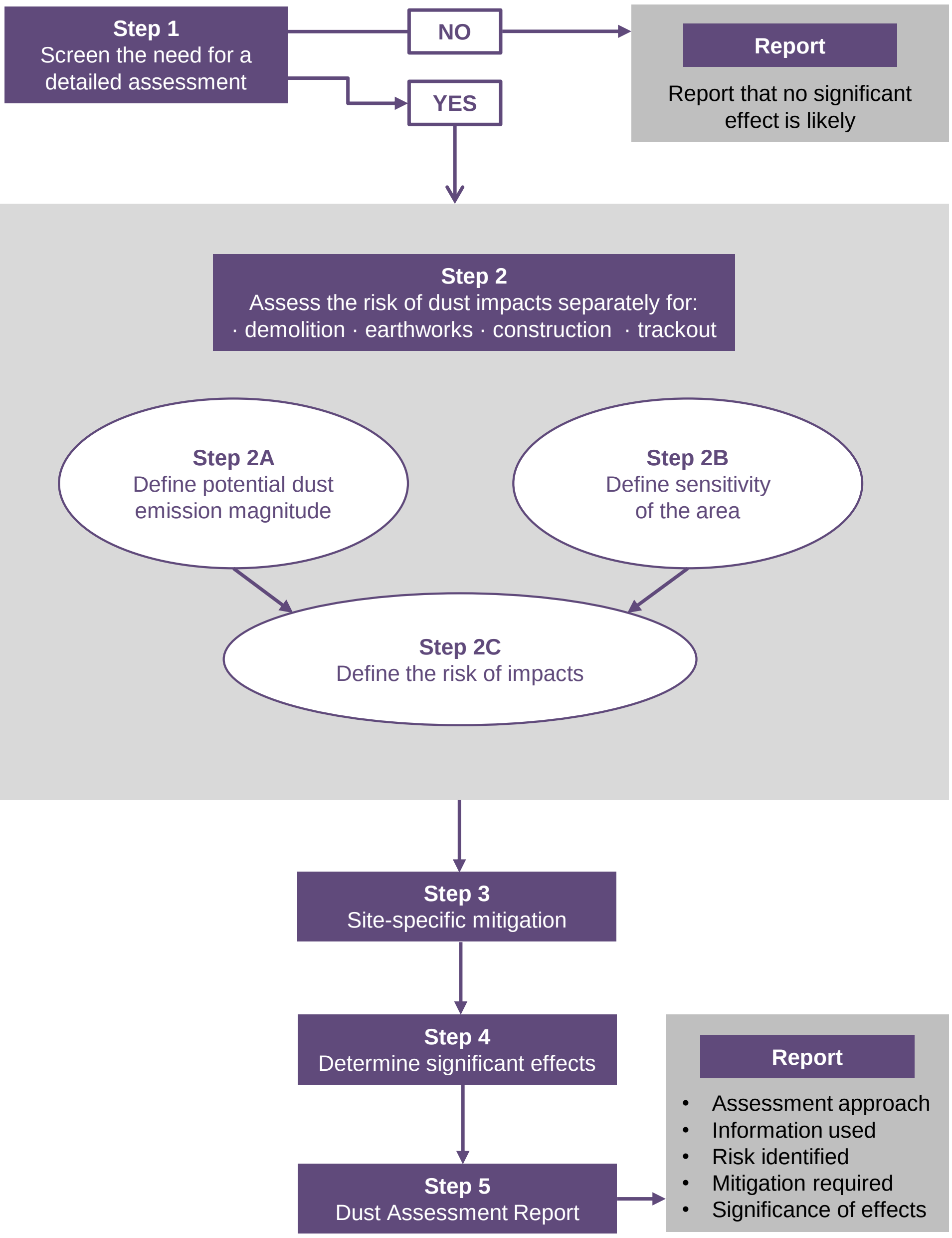
Introduction

This section sets out the methodology of the demolition and construction dust emissions assessment associated with the Proposed Development.

Outline of Method

The methodology for the assessment of the construction impacts is based on a five step approach laid out below.

Diagram 1 Structure of construction dust assessment



Step 1 - Screen the need for a detailed assessment

Based on the IAQM guidance, the need for an assessment is based on simple distance based criteria as follows:

> *"An assessment will normally be required where there are:*
>
> *human receptors within 350 m of the Site boundary and / or within 50 m of the access route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s); and / or*
>
> *ecological receptors within 50 m of the Site boundary and / or within 50 m of the access route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s)."*

If the proposal is screened out, it can be concluded that the level of risk is "negligible" and any effects will not be significant. If the Proposed Development cannot be screened out, based on the above criteria, Step 2 - Step 4 will need to be carried out. In this case, as there are receptors within the distances specified above (see more detailed description in Step 2), the assessment is required to proceed to Step 2 - Step 4 and the methodology and information used in each of the Steps is set out below.

Step 2 - Assess the risk of dust impacts

Step 2A Define potential dust emission magnitude

Demolition

The following are descriptors for the different dust emission classes for demolition.

Large: Total building volume >50,000 m3, potentially dusty construction material (e.g. concrete), on-Site crushing and screening, demolition activities >20 m above ground level;

Medium: Total building volume 20,000 m3 – 50,000 m3, potentially dusty construction material, demolition activities 10-20 m above ground level; and;

Small: Total building volume <20,000 m3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks

The following are descriptors for the different dust emission classes for earthworks.

Large: Total Site area >10,000 m2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;

Medium: Total Site area 2,500 m2 – 10,000 m2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and

Small: Total Site area <2,500 m2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months.

Construction

The following are descriptors for the different dust emission classes for construction.

Large: Total building volume >100,000 m3, piling, on Site concrete batching; sandblasting;

Medium: Total building volume 25,000 m3 – 100,000 m3, potentially dusty construction material (e.g. concrete), piling, on Site concrete batching; and;

Small: Total building volume <25,000 m3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

Trackout is used to describe construction traffic accessing the Proposed Development and is the transport of dust and dirt from the Site onto the public road network, where it may be deposited and re-suspended by other vehicles using the road network. Only receptors within 50 m of the route(s) used by vehicles on the public highway up to 500 m from the Site entrance(s) are considered to be at risk.

The following are descriptors for the different dust emission classes for Trackout.

Large: >50 HDV (Heavy Duty Vehicle) (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;

Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100 m; and

Small <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Step 2B Define the sensitivity of the area

The sensitivity of the area takes account of a number of factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- The local background PM_{10} concentrations; and
- Site-specific factors.

For this assessment of sensitivities of people to dust soiling effects and health effects of PM_{10} the receptors are residential properties that can reasonably expect an enjoyment of a high level of amenity and may be exposed for eight hours or more in a day. Therefore, the sensitivity of receptors to dust soiling effects and health effects of PM_{10} is “high”.

There are no local, national or European designated habitat Sites within 50 m of the Site boundary which would be sensitive to dust deposition.

Table A3.1 and Table A3.2 set out the selection criteria for the sensitivity of the area to dust soiling effects on people and property and the selection criteria for the sensitivity of the area to human health impacts, respectively.

Table A3.1 Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A3.2 Sensitivity of the area to human health

Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	350
High	> 32 µg/m^3	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	28 - 32 µg/m^3	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	24 - 28 µg/m^3	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	< 24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Medium	n/a	>10	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
Low	n/a	>1	Low	Low	Low	Low	Low

The background PM_{10} concentration representing the Site is 24.2 µg/m3.

Step 2C Define the Risk of Impacts

The dust emission magnitude is then combined with the sensitivity of the area to determine the overall risk of impacts with no mitigation measures applied. Matrices in Table 3 provide a method of assigning the level of risk for each activity. This can then be used to determine level of mitigation that is required.

Table A3.1 Risk of dust impacts

Sensitivity	Dust emission magnitude		
	Large	Medium	Small
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

Step 3 – Site Specific Mitigation

During the construction phase of the development it will be important to control dust levels for high, medium and low risk sources. In order to avoid significant impacts from dust during the construction phase, suitable mitigation measures should be adopted. Following the identification of the risk category for the demolition, earthworks, construction and trackout activities based on the tables set out in Step 2, appropriate mitigation measures can be identified. Activities identified as a “High risk Site” will require a greater level of mitigation than those identified as “Low risk Site”.

A selection of these measures have been specified for low risk to high risk sites in the the IAQM guidance as measures suitable to mitigate dust emissions for sites such as the Proposed Development. The considerations and controls set out in the guidance would be applicable to most developments of this nature in an urban setting.

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Step 4 – Determine Significant Effects

In Step 2 of the assessment the Site and the surroundings are defined and the risk of dust effects occurring for each activity will also be identified. Step 3 identifies the appropriate Site-specific mitigation. Once these steps have been completed, the significance of the potential dust effects can be determined. The recommended mitigation measures should normally be sufficient to reduce construction dust nuisance to a minor or negligible impact.