Air Quality Assessment:
Assessment Update, The Italian Hospital, Camden

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Experts in air quality management & assessment

Document Control

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Executive Summary

The air quality impacts associated with the construction and operation of the proposed redevelopment of the Italian Hospital in Camden have been assessed. As a result of changes to the energy strategy, on-site boiler plant are now proposed. This update to the air quality assessment therefore considers the impact of this boiler plant, in addition to the previously assessed impacts.

Existing conditions within the study area show poor air quality, with concentrations of nitrogen dioxide exceeding the annual mean objective in the local area. Concentrations of PM_{10} and $PM_{2.5}$ are below the objective. The site lies within an Air Quality Management Area.

The construction works will give rise to a *Low* Risk of dust impacts. It is nevertheless still necessary to apply basic best practice measures to minimise dust emissions. With these mitigation measures in place, the overall impacts during construction will be 'not significant'.

The proposed development will not contribute significant road traffic to the local area, and as such will not have a significant impact on air pollution from road sources. The location of the site away from significant road sources means that the site will not experience significant increases in pollution due to local road traffic and thus the pollutant levels at the site will be predominantly determined by the background concentrations in the area. As such, impacts of road traffic on the development, and the impacts of the development on traffic emissions, are both considered to be 'not significant'.

Existing background concentrations are elevated and currently exceed the objective for nitrogen dioxide, whilst PM_{10} and $PM_{2.5}$ concentrations are below the objective. Predicted trends for nitrogen dioxide background concentrations, based on Defra's background maps, show background levels to be below the objective in 2020 when the development is expected to be completed and in use.

An assessment of the emissions from the boiler plant has demonstrated that off-site impacts will be negligible. On-site, the emissions from the plant will not lead to any exceedance of the objectives, thus air quality will be acceptable.

The proposed redevelopment has also been shown to meet the London Plan's requirement that new developments are at least 'air quality neutral'.

Overall, the construction and operational air quality effects of the proposed redevelopment are judged to be 'not significant'.

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed redevelopment of the Italian Hospital in Camden. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Great Ormond Street Hospital (GOSH). It provides an update to the air quality assessment completed in July 2017 (J290A/1/F4), to include consideration of the impacts of on-site energy plant.

1.2 The proposed redevelopment will return the Italian Hospital back into clinical use, as an outpatient care facility. The building was historically used as a hospital, but has more recently been ancillary to the clinical facilities provided at the main GOSH site. These ancillary uses include a staff nursery, offices and parent accommodation. Renovations are due to commence in 2018, with outpatient operations starting in 2020.

1.3 The development lies within an Air Quality Management Area (AQMA) declared by the London Borough (LB) of Camden for exceedances of the annual mean nitrogen dioxide objective and the 24-hour mean particulate matter (PM_{10}) objective.

1.4 The redevelopment is not expected to lead to a significant increase in vehicle flows on the local roads, with traffic numbers generated by the redevelopment estimated by the transport consultant to be fewer than 50 vehicles per day. Furthermore, the majority of those trips will be made by existing traffic associated with nearby hospital facilities.

1.5 The revised redevelopment plans include on-site boiler plant ("energy plant"), the emissions from which could impact upon air quality at existing residential properties, as well as at existing sensitive receptors within the development itself. The main air pollutant of concern related to boiler plant is nitrogen dioxide (NO_2).

1.6 The outpatient clinic will be subject to the impacts of existing sources of air pollution in the area. The main air pollutants of concern related to the proposed redevelopment are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.7 The Greater London Authority's (GLA's) London Plan (GLA, 2016a) requires new developments to be air quality neutral. The air quality neutrality of the proposed redevelopment has, therefore, been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

1.8 The GLA has also released Supplementary Planning Guidance on the Control of Dust and Emissions from Construction and Demolition (GLA, 2014b). The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will

need to be applied. A construction dust assessment has been undertaken and the appropriate mitigation has been set out.

1.9 This report describes existing local air quality conditions in 2016, and discusses the predicted air quality in 2020, when the development is anticipated to become operational. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.10 This report has been prepared taking into account all relevant local and national guidance and regulations.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Clean Air Act 1993 & Environmental Protection Act

2.2 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993 (1993). This requires the local authority to approve the chimney height. Plant which are smaller than 366 kW have no such requirement. The local authority's approval will, therefore, be required for the plant to be installed in the proposed development.

2.3 Measures to ensure adequate dispersion of emissions from discharging stacks and vents are included in Technical Guidance Note D1 (Dispersion) (1993), issued in support of the Environmental Protection Act (1990).

Planning Policy

National Policies

2.4 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should *"contribute to…reducing pollution"*. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that 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"*.

2.5 More specifically the NPPF makes clear that:

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

2.6 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2018), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*". In addition, the PPG makes clear that *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

2.7 The PPG states that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation".

2.8 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality"*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".*

London-Specific Policies

The London Plan

2.9 The London Plan (GLA, 2016a) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to air quality.

2.10 Policy 7.14, 'Improving Air Quality', addresses the spatial implications of the Mayor's Air Quality Strategy and how development and land use can help achieve its objectives. It recognises that Boroughs should have policies in place to reduce pollutant concentrations, having regard to the Mayor's Air Quality Strategy.

2.11 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

2.12 Consultation on a draft new London Plan (GLA, 2017) is now complete, with an examination in public scheduled for autumn 2018. The current timescale is that the new London Plan will be adopted in Autumn 2019. However, the draft London Plan is a material consideration in planning decisions, which will gain more weight as it moves through the process to adoption. Policy SI1 on 'Improving Air Quality' states that "*London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced*". It goes on to detail that development proposals should not:

- *"lead to further deterioration of existing poor air quality*
- *create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits*
- *reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality*
- *create unacceptable risk of high levels of exposure to poor air quality".*

2.13 It also states that "*the development of large-scale redevelopment areas, such as Opportunity Areas and those subject to an Environmental Impact Assessment should propose methods of achieving an Air Quality Positive approach through the new development. All other developments should be at least Air Quality Neutral*".

The Mayor's Air Quality Strategy

2.14 The revised Mayor's Air Quality Strategy (MAQS) was published in December 2010 (GLA, 2010). The overarching aim of the Strategy is to reduce pollution concentrations in London to achieve compliance with the EU limit values as soon as possible. The Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures. These additional measures and the role of Low Emission Zones are described in Appendix A1.

GLA SPG: Sustainable Design and Construction

2.15 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a) provides details on delivering some of the priorities in the London Plan. Section 4.3 covers Air Pollution. It defines when developers will be required to submit an air quality assessment, explains how location and transport measures can minimise emissions to air, and provides emission standards for gas-fired boilers, Combined Heat and Power (CHP) and biomass plant. It also sets out, for the first time, guidance on how Policy 7.14B(c) of the London Plan relating to 'air quality neutral' (see Paragraph 2.11, above) should be implemented.

GLA SPG: The Control of Dust and Emissions During Construction and Demolition

2.16 The GLA's SPG on The Control of Dust and Emissions During Construction and Demolition (GLA, 2014b) outlines a risk assessment based approach to considering the potential for dust generation from a construction site, and sets out what mitigation measures should be implemented to minimise the risk of construction dust impacts, dependent on the outcomes of the risk assessment. This guidance is largely based on the Institute of Air Quality Management's (IAQM's) guidance (IAQM, 2016), and it states that "*the latest version of the IAQM Guidance should be used*".

Air Quality Focus Areas

2.17 The GLA has identified 187 air quality Focus Areas in London. These are locations that not only exceed the EU annual mean limit value for nitrogen dioxide, but also have high levels of human exposure. They do not represent an exhaustive list of London's air quality hotspot locations, but locations where the GLA believes the problem to be most acute. They are also areas where the GLA considers there to be the most potential for air quality improvements and are, therefore, where the GLA and Transport for London (TfL) will focus actions to improve air quality. The proposed development is located close to a number of air quality focus areas, given its central London location.

Local Transport Plan

2.18 One of the main objectives of the Camden Transport Strategy (Camden Council, 2011a) is to "*reduce motor traffic and vehicle emissions to improve air quality, mitigate climate change and contribute to making Camden a 'low carbon and low waste borough".* To support this objective there are a number of policies related to air quality including:

"Policy 1.4 Camden will continue to promote low emission vehicles and support the staged introduction of the Low Emission Zone in London. The Council would also like to see further development of national policy to support local level efforts to improve air quality and tackle climate change;

Policy 1.5 For essential car journeys, Camden will encourage more residents and businesses to change to electric vehicles…to help reduce air and noise pollution…"

Local Policies

2.19 Camden Council's new Local Plan was adopted by the Council in July 2017 (Camden Council, 2017). Included within this is Policy CC4 on Air Quality which states that:

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

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

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

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

2.20 The new Local Plan also includes Policy T2 which requires "*all new developments in the borough to be car-free*".

2.21 Camden Council has also produced the Supplementary Planning Document Camden Planning Guidance 6 Amenity (Camden Council, 2011b) which provides further guidance on air quality and outlines the requirements for an air quality assessment. The Planning Guidance states that:

"The Council's overarching aim is for new development is [sic] *to be 'air quality neutral' and not lead to further deterioration of existing poor air quality.*

You will be required to include mitigation and offsetting measures to deal with any negative air quality impacts associated with your development proposals. At the same time your development should be designed to minimise exposure of occupants to existing poor air quality.

To manage and prevent further deterioration of air quality in Camden, we will require an air quality assessment with planning applications for development that could have a significant negative impact in [sic] *air quality. This impact can arise during both the construction and operational stages of a development as a result of increased NO_x and PM_{10} emissions".*

2.22 Camden Council has also produced Camden's Environmental Sustainability Plan (Camden Council, 2011c) which states the Council is "*committed to improving air quality, reducing, reusing and recycling waste, and enhancing our local biodiversity and green spaces".*

Air Quality Action Plans

National Air Quality Plan

2.23 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017a). Alongside a package of national measures, the Plan requires those Local Authorities that are predicted to have exceedances of the limit values beyond 2020 to produce local action plans by March 2018. These plans must have measures to achieve the statutory limit values within the shortest possible time. There is currently no practical way to take account of the effects of the national Plan in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.24 Camden Council has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough, and has developed an Air Quality Action Plan (Camden Council, 2016). This identifies actions and mitigation measures necessary to improve air quality in the borough. The overarching aims of the Plan are to:

1. *"Continue to meet the EU objectives for Carbon Monoxide, Benzene, 1,3-Butadiene, Lead and PM_{10}.*
2. *Continue to reduce concentrations of PM_{10} and $PM_{2.5}$, and to meet the EU Objective for NO_2."*

2.25 In addition, the key objectives of the Plan are to:

- *"Encourage reduction in fossil fuel use, the adoption of clean fuels and low emission technology and promote energy efficiency.*
- *Raise awareness about air quality in Camden and promote lifestyle changes which can help reduce levels of air pollution and minimise exposure to air pollution.*
- *Improve the health and well-being of the local population, including those that work and visit Camden.*
- *Work in partnership with national and regional bodies, and with local public and private organisations, to foster and drive improvements in air quality.*

- *Lead by example and reduce NO_2 and PM_{10} emissions associated with the Council's own buildings and transport services.*
- *Ensure actions which serve to reduce NO_2 and PM_{10} emissions complement actions to mitigate CO_2 emissions."*

Assessment Criteria

2.26 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

2.27 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m^3 (Defra, 2016). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m^3 (Defra, 2016). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 µg/m^3 it is unlikely that the 24-hour mean objective will be exceeded.

2.28 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2016). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

2.29 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$ (The European Parliament and the Council of the European Union, 2008). The limit values for nitrogen dioxide are

the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.

2.30 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2016).

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Construction Dust Criteria

2.31 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (IAQM)[1] (2016) has been used (the GLA's SPG (GLA, 2014b) recommends that the assessment be based on the latest version of the IAQM guidance). Full details of this approach are provided in Appendix A2.

Screening Criteria for Point Source Assessments

2.32 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have developed an approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from point sources, such as energy plant, have the potential for significant air quality impacts. The first step of the approach, as described in Appendix A3, is to screen the emissions and the emissions parameters to determine whether an assessment is necessary:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion.

[1] The IAQM is the professional body for air quality practitioners in the UK.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

2.33 This screening approach requires professional judgement, and the experience of the consultants preparing the assessment is set out in Appendix A4.

2.34 If it is determined that an assessment of the point source emissions is required then there is a further stage of screening that can be applied to the model outputs. The approach is that any change in concentration smaller than 0.5% of the long-term environmental standard will be *negligible*, regardless of the existing air quality conditions. Any change smaller than 1.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 94% of the standard and any change smaller than 5.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 75% of the standard. The guidance also explains that:

"Where peak short term concentrations (those averaged over periods of an hour or less) from an elevated source are in the range 11-20% of the relevant Air Quality Assessment Level (AQAL), then their magnitude can be described as small, those in the range 21-50% medium and those above 51% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. In most cases, the assessment of impact severity for a proposed development will be governed by the long-term exposure experienced by receptors and it will not be a necessity to define the significance of effects by reference to short-term impacts. The severity of the impact will be substantial when there is a risk that the relevant AQAL for short-term concentrations is approached through the presence of the new source, taking into account the contribution of other local sources".

2.35 As a first step, the assessment of the emissions from the energy plant within the proposed development has considered the predicted process contributions using the following criteria:

- is the long-term (annual mean) process contribution less than 0.5% of the long-term environmental standard?; and
- is the short-term (24-hour mean or shorter) process contribution less than 10% of the short-term environmental standard?

2.36 Where both of these criteria are met, then the impacts are *negligible* and thus 'not significant'. Where these criteria are breached then a more detailed assessment, considering total concentrations (incorporating local baseline conditions), has been provided.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

2.37 Guidance from IAQM (2016) is that, with appropriate mitigation in place, the effects of construction dust will be 'not significant'. This is the latest version of the guidance upon which the assessment methodology set out in the GLA guidance (GLA, 2014b) is based (the GLA guidance advises that the latest version of the IAQM guidance should always be used). The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be 'not significant'.

Operational Significance

2.38 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A3. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A4.

3 Assessment Approach

Existing Conditions

3.1 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2018a). Local sources have also been identified through examination of the Council's Air Quality Review and Assessment reports.

3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the national pollution maps published by Defra (2018b) and verified against local monitoring data. These cover the whole country on a 1x1 km grid.

3.3 Exceedances of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra (2017b) as part of its 2017 Air Quality Plan for the baseline year 2015 and for the future years 2017 to 2030, as well as from any nearby Automatic Urban and Rural Network (AURN) monitoring sites (which operate to EU data quality standards). These maps are used by the UK Government, together with the AURN results, to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2018c), which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

Construction Impacts

3.4 The construction dust assessment considers the potential for impacts within 350 m of the site boundary; or within 50 m of roads used by construction vehicles. The assessment methodology follows the GLA's SPG on the Control of Dust and Emissions During Construction and Demolition (GLA, 2014b), which is based on that provided by IAQM (2016). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A2 explains the approach in more detail.

Impacts of the Proposed Energy Plant

3.5 The proposed development will be provided with heat and hot water using four 250 kW condensing natural gas-fired boilers (referred to as “energy plant”) to be located in the lower ground floor plantroom within the development building. The assumed specifications for this plant, upon which the assessment is based, are set out in Appendices A5 and A6.

Screening

3.6 The first step in considering the energy plant impacts has been to screen the pollutant emissions against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraphs A3.11 and A3.12 in Appendix A3. Where plant impacts cannot be screened out against these criteria, a further stage of screening is required, whereby the modelled contributions of the plant are compared to further screening criteria, as described in Paragraphs 2.32 to 2.36. Where impacts can be screened out there is no need to progress to a more detailed assessment. The following sections describe the approach to dispersion modelling of the plant emissions, which has been required for this project.

Sensitive Locations

3.7 In terms of the potential impacts from the proposed energy plant, concentrations have been modelled for a gridded area which covers both on-site and off-site receptors for the year 2020. Two separate grids have been modelled, at heights of 1.5 m and 14.6 m, to represent the ground floor and roof levels respectively.

Assessment Scenarios

3.8 Predictions of nitrogen dioxide concentrations have been carried out assuming that the plant is installed and fully operational in 2020.

Modelling Methodology

3.9 The impacts of emissions from the proposed energy plant have been modelled using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. Entrainment of the plume into the wake of the building has been simulated within the model. The model input parameters are set out in Appendix A5. The air quality modelling has been carried out based on a number of necessary assumptions, detailed further in Appendix A5. Where possible a realistic worst-case approach has been adopted.

Emissions Data

3.10 The emissions data input into the model for the energy plant have been provided by Sonnemann Toon Architects and KJ Tait Engineers. Further details of the emissions data used in this assessment are provided in Appendix A5.

3.11 For consideration of concentrations in relation to the short-term objective, the worst-case assumption has been made that the boilers will run continuously and at full (100%) load. This will have led to an over-prediction in modelled concentrations. For consideration of concentrations in relation to the annual mean objective, a realistic utilisation of 23%, provided by Sonnemann Toon Architects and KJ Tait Engineers, has been used. Modelled annual mean outputs based on continuous operation have therefore been scaled to reflect this anticipated level of utilisation.

Uncertainty

3.12 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which in reality are variable as the plant will operate at different loads at different times. The actual plant to be installed within the redevelopment will also not be confirmed until the contractor has selected the preferred supplier/manufacturer, and thus could be different to that assumed for this assessment. The assessment has, however, addressed this by applying worst-case assumptions where necessary, and provided that the actual plant installed adheres to the restrictions set out in Appendix A6, the conclusions of this assessment will remain valid.

3.13 There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. Where parameters have been estimated the approach has been to use reasonable worst-case assumptions.

'Air Quality Neutral'

3.14 The guidance relating to air quality neutral follows a tiered approach, such that all developments are expected to comply with minimum standards for gas and biomass boilers and for CHP plant (GLA, 2014a). Compliance with 'air quality neutral' is then founded on emissions benchmarks that have been derived for both building (energy) use and road transport in different areas of London. Developments that exceed the benchmarks are required to implement on-site or off-site mitigation to offset the excess emissions (GLA, 2014a).

3.15 Appendix A7 sets out the emissions benchmarks. The approach has been to calculate the emissions from the development and to compare them with these benchmarks.

4 Site Description and Baseline Conditions

4.1 The proposed redevelopment site is located near Russell Square, in the centre of Camden. The site is adjacent to Boswell Street, and is in close proximity to the Great Ormond Street Hospital. It currently consists of office, nursery and parent accommodation supporting the main hospital, however its previous use was as a hospital, and the redevelopment plans are to convert the building to an outpatient clinic.

4.2 The nearby area consists of numerous hospital facilities, as well as commercial offices.

Industrial sources

4.3 A search of the UK Pollutant Release and Transfer Register (Defra, 2018a) has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality.

Air Quality Management Areas

4.4 Camden Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. In 2000 an AQMA was declared across the whole borough for exceedances of the annual mean nitrogen dioxide objective, and annual and 24-hour mean PM_{10} objectives (Camden Council, 2016).

Air Quality Focus Areas

4.5 The proposed development is located close to a number of air quality focus areas, being in a central London location. There are 187 air quality Focus Areas in London, these being locations that not only exceed the EU annual mean limit value for nitrogen dioxide but also locations with high levels of human exposure. Whilst the site itself is set back from any major roads, and is not likely to experience the same impacts as within the focus areas, the overall background pollutant concentrations in the local area are high.

Local Air Quality Monitoring

4.6 Camden Council operates a number of automatic monitoring stations within its area. One of which, the Bloomsbury Automatic Urban Rural Network (AURN) site, is located 300 m to the northwest of the proposed development site. Air quality conditions at the Italian Hospital site are likely to be similar to those at Bloomsbury, although the urban setting of these two locations somewhat differs. The Bloomsbury monitoring site is in an open space (Russell Square), but is surrounded by the busy roads around Russell Square. The Italian Hospital is in a more built-up setting with buildings adjacent to the site in all directions, but is some considerable distance from the nearest busy road and is only bordered by very minor roads (e.g. Boswell Street). Overall it is

considered that the background concentrations measured at the Bloomsbury monitoring site will be broadly representative of baseline concentrations at the Italian Hospital.

4.7 Results for the years 2012 to 2017 are summarised in Table 2 and the monitoring location with respect to the site is shown in Figure 1.

Table 2: Summary of Nitrogen Dioxide (NO_2) Monitoring (2012-2017) [a,b]

Site No.	Site Type	Location	2012	2013	2014	2015	2016	2017
Automatic Monitor - Annual Mean (µg/m^3)								
LB	Urban Background	Bloomsbury AURN Site	**55**	**51**	ND	**48**	**42**	40
Objective			**40**					
Automatic Monitor - No. of Hours > 200 µg/m^3								
LB	Urban Background	Bloomsbury AURN Site	0	0	ND	0	0	0
Objective			**18 (200)**					

ND = No Data

[a] Exceedances of the objectives are shown in bold.

[b] Data downloaded from the London Air website (King's College London, 2018).

4.8 There is a clear downward trend in nitrogen dioxide concentrations in recent years. This trend is expected to continue as vehicle emission standards are continually tightened, and with the introduction of the Ultra-Low Emission Zone (ULEZ) in this part of London (aimed for launch in 2019).

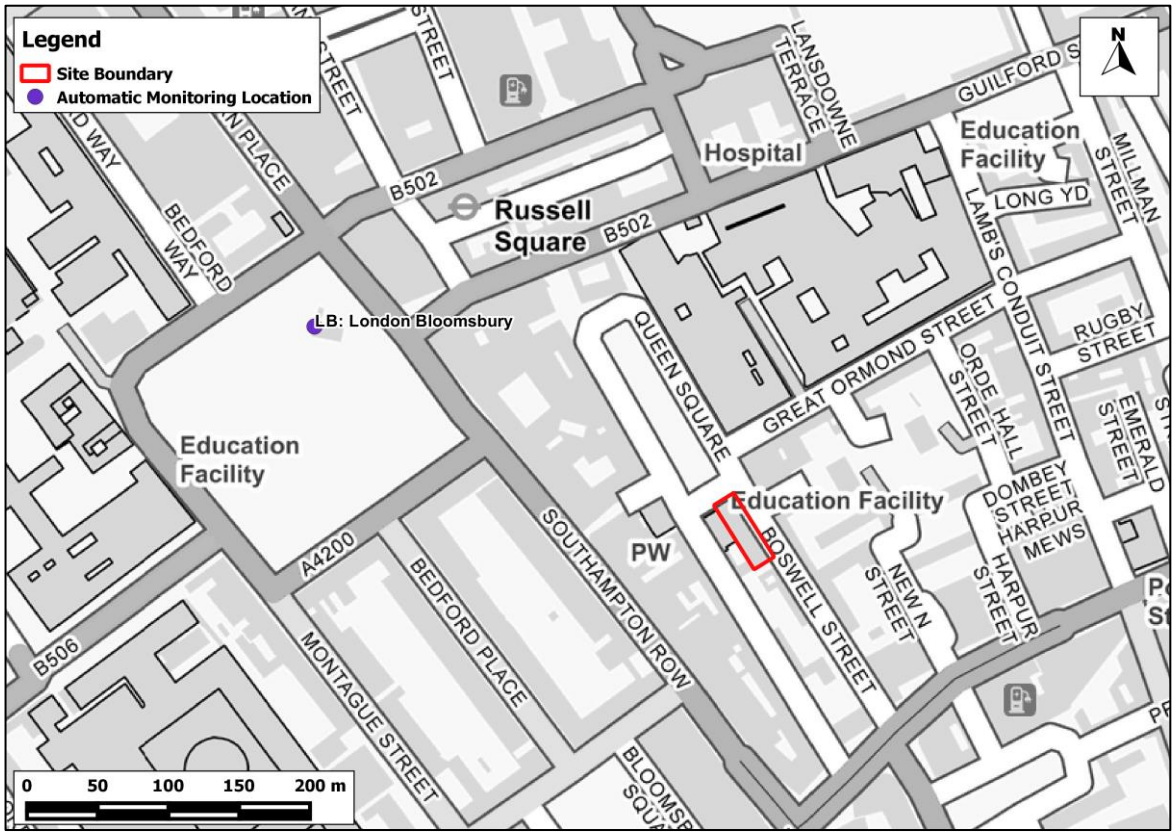

Figure 1: Monitoring Location

4.9 The Bloomsbury automatic monitoring station, located 300 m northwest of the proposed development site, also measures PM_{10} and $PM_{2.5}$ concentrations. Results for the years 2012 to 2017 are summarised in Table 3. PM_{10} and $PM_{2.5}$ concentrations are well below the relevant objectives.

Table 3: Summary of PM_{10} and $PM_{2.5}$ Automatic Monitoring (2012-2017)

Site No.	Site Type	Location	2012	2013	2014	2015	2016	2017
PM_{10} Annual Mean (µg/m^3) [a]								
LB	Urban Background	Bloomsbury AURN Site	19	18	20	ND	20	19
Objective			**40**					
PM_{10} No. Days >50 µg/m^3 [a]								
LB	Urban Background	Bloomsbury AURN Site	10	3	10	6	9	6
Objective			**35 (50)**					
$PM_{2.5}$ Annual Mean (µg/m^3) [b,c]								
LB	Urban Background	Bloomsbury AURN Site	16	12	15	11	ND	14[a]
Objective			**25**					

ND = No Data

[a] PM_{10} data (including $PM_{2.5}$ data for 2017) downloaded from the London Air website (King's College London, 2018).

[b] $PM_{2.5}$ data (excluding data for 2017) have been taken from the Annual Status Report for 2015 (London Borough of Camden, 2016).

[c] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Exceedances of EU Limit Value

4.10 There are several AURN monitoring sites within the Greater London Urban Area that have measured exceedances of the annual mean nitrogen dioxide limit value. Furthermore, Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2017b), which are used to report exceedances of the limit value to the EU, and which have been updated to support the 2017 Air Quality Plan, identify exceedances of this limit value in 2015 along many roads in London, including Southampton Row approximately 85 m to the east of the proposed development. The Greater London Urban Area has thus been reported to the EU as exceeding the limit value for annual mean nitrogen dioxide concentrations. Defra's predicted concentrations for 2020, presented for three scenarios ('baseline', 'with Clean Air Zones' and 'with Clean Air Zones and additional actions' – the latter two taking account of the measures contained in its 2017 Air Quality Plan (Defra, 2017a)), also identify continued exceedances of the limit value along Southampton Row. However, the development site is situated away from Southampton Row by approximately 85 m and the roadside concentrations predicted in Defra's model are thus not representative of conditions at the proposed development.

4.11 The GLA has already implemented a Low Emission Zone and an Ultra-Low Emission Zone. Thus, the authority has effectively already implemented the Clean Air Zone that is required to deliver compliance.

Background Concentrations

4.12 Estimated background concentrations within the study area have been determined for 2016 and a future opening year of 2020 using Defra's background maps (Defra, 2018b). The background concentrations are set out in Table 4 and have been derived as described in Appendix A5.

Table 4: Estimated Annual Mean Background Pollutant Concentrations in 2016 and 2020 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2016	47.3	20.1	12.9
2020 [a]	35.1	19.0	11.7
Objectives	**40**	**40**	**25** [b]

[a] In line with Defra's forecasts.

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

4.13 The background concentrations for PM_{10} and $PM_{2.5}$ are well below the objectives in both 2016 and 2020. The background concentration of nitrogen dioxide, however, exceeds the objective in 2016. Background concentrations are expected to decrease in progressive years through increasingly stringent vehicle emission standards and the introduction of the Ultra-Low Emission Zone (ULEZ) in this part of London, aimed for launch in 2019. It is therefore anticipated that concentrations in 2020 will be below the objective.

5 Construction Phase Impact Assessment

5.1 The construction works will give rise to a risk of dust impacts construction, as well as from trackout of dust and dirt by vehicles onto the public roads. Step 1 of the assessment procedure is to screen the need for a detailed assessment. There are receptors within the distances set out in the guidance (see Appendix A2), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

Demolition

5.2 There is no requirement for demolition on site.

Earthworks

5.3 There is no requirement for earthworks on site.

Construction

5.4 Construction will involve the renovation of the 3,460 m^2 building. Dust will arise from the handling and storage of dusty materials, from the cutting of concrete, and from other various construction activities. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for construction is considered to be *small*.

Trackout

5.5 The number of heavy vehicles accessing the site, which may track out dust and dirt, is currently unknown, but given the scope of the renovation activities, it is likely that there will be a maximum of 10 outward heavy vehicle movements per day. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for trackout is considered to be *small*.

5.6 Table 5 summarises the dust emission magnitude for the proposed development.

Table 5: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	Not applicable
Earthworks	Not applicable
Construction	Small
Trackout	Small

Sensitivity of the Area

5.7 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

5.8 The IAQM guidance, upon which the GLA's guidance is based, explains that residential properties are 'high' sensitivity receptors to dust soiling, while commercial / offices are a 'medium' sensitivity receptor (Table A2.2 in Appendix A2). There are numerous residential properties within close proximity to the development site. Using the matrix set out in Table A2.3 in Appendix A2, the area surrounding the onsite works is of 'high' sensitivity to dust soiling.

Figure 2: 20 m Distance Band around Site Boundary

5.9 Table 5 shows that the dust emission magnitude for trackout is *small* and Table A2.3 in Appendix A2 thus explains that there is a risk of material being tracked 50 m from the site exit. Since it is not known which roads construction vehicles will use, it has been assumed that all possible routes could be affected as shown in Figure 3. There are numerous residential properties within close proximity to the development site; Table A2.3 in Appendix A2 thus indicates that the area is of 'high' sensitivity to dust soiling due to trackout.

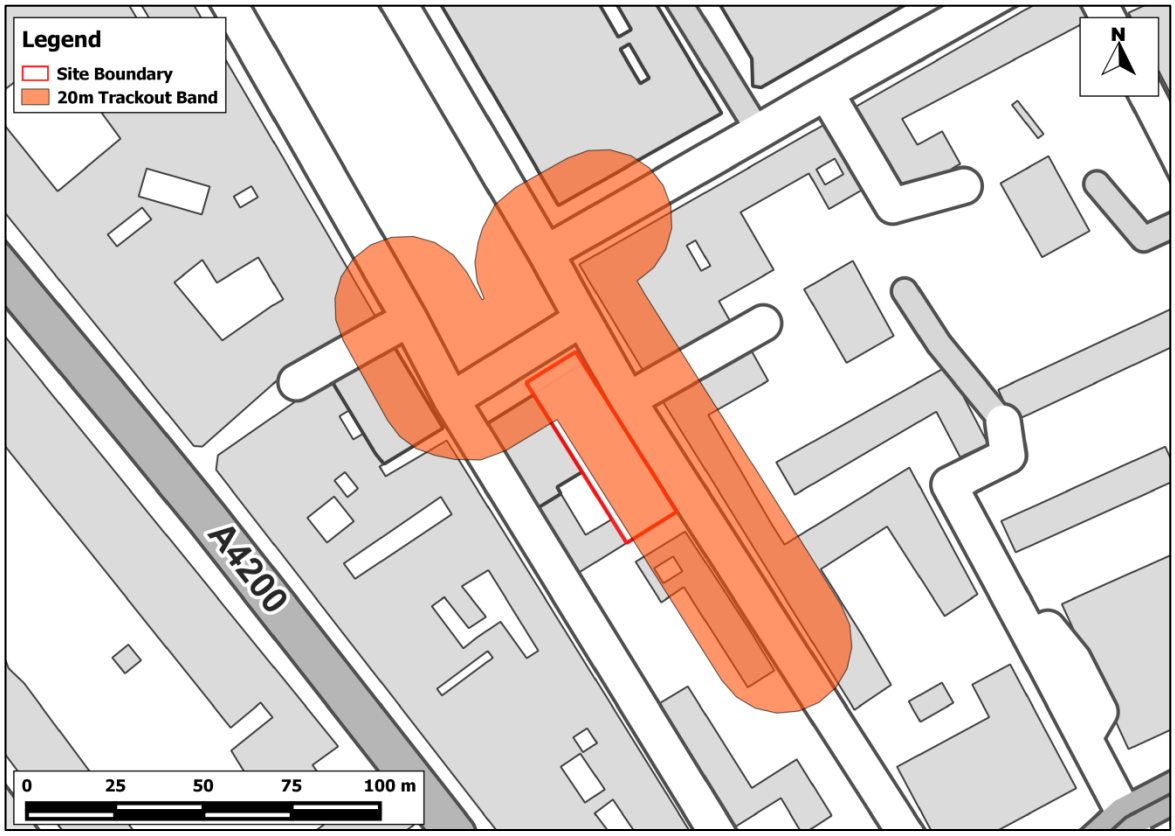

Figure 3: 20 m Distance Band around Roads Used by Construction Traffic Within 50 m of the Site Boundary

Sensitivity of the Area to any Human Health Effects

5.10 Hospitals are classified as being 'high' sensitivity to human health effects, while places of work are classified as being of 'medium' sensitivity. The matrix in Table A2.4 in Appendix A2 requires information on the baseline annual mean PM_{10} concentration in the area. The existing annual mean PM_{10} concentration is best described by the background concentration from Table 4, namely 20.1 µg/m^3. Using the matrix in Table A2.4 in Appendix A2, the area surrounding the onsite works and the area surrounding roads along which material may be tracked from the site, are both of 'medium' sensitivity due to the nature of the receptors and the scale of the renovations.

Sensitivity of the Area to any Ecological Effects

5.11 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of the site boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

Summary of the Area Sensitivity

5.12 Table 6 summarises the sensitivity of the area around the proposed construction works.

Table 6: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	High Sensitivity	High Sensitivity
Human Health	Medium Sensitivity	Medium Sensitivity

Risk and Significance

5.13 The dust emission magnitudes in Table 5 have been combined with the sensitivities of the area in Table 6 using the matrix in Table A2.6 in Appendix A2, in order to assign a risk category to each activity. The resulting risk categories for the two relevant construction activities, without mitigation, are set out in Table 7. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 8 (step 3 of the assessment procedure).

Table 7: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition	Not Applicable	Not Applicable
Earthworks	Not Applicable	Not Applicable
Construction	Low Risk	Low Risk
Trackout	Low Risk	Negligible

5.14 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (IAQM, 2016).

6 Operational Phase Impact Assessment

Impacts at Off-Site Receptors

6.1 The calculated total NOx emission rate from the energy plant (11.7 mg/s of NOx in total) exceeds the screening thresholds set out in the EPUK/IAQM guidance (see Paragraph A3.11 in Appendix A3). As such, dispersion modelling has been undertaken. Further details of the energy plant emissions are provided in Appendices A5 and A6.

6.2 In order to determine the potential impacts of the proposed energy plant, receptor grids at off-site locations have been modelled separately at ground floor level (1.5 m) and roof level (14.6 m) heights. The predicted process contributions of nitrogen dioxide for both receptor grids have been compared with the screening criterion described in Paragraph 2.34. In terms of the annual mean objective, any change smaller than 0.5% of the objective will be classified as *negligible* (i.e. where the predicted process contribution is <0.2 µg/m^3). In terms of the 1-hour mean objective, any change smaller than 10% of the objective will be classified as *negligible* (i.e. where the predicted process contribution is <20 µg/m^3).

6.3 At ground floor level, the maximum predicted nitrogen dioxide concentrations, from any of the three meteorological years considered, were below the screening criteria for both the annual mean and 1-hour mean objective; therefore no further assessment is required as impacts of the energy plant will be *negligible*.

6.4 The maximum predicted nitrogen dioxide concentrations associated with emissions from the energy plant at roof level are shown in Table 8. The concentrations shown are from any of the three meteorological years considered.

Table 8: Predicted Maximum Pollutant Concentrations at Roof-Level associated with Energy Plant Emissions (µg/m^3)

Averaging Period	Maximum Grid Area Process Contribution		Objective
	µg/m^3	% of Objective	
Annual Mean NO_2	0.34	0.9	**40**
99.79th %ile of 1-hour NO_2	12.36	6.2	**200**

6.5 These predicted maximum concentrations can be compared with the EPUK/IAQM screening criteria (see Paragraph 2.34) and the following conclusions can be drawn:

- the predicted maximum annual mean nitrogen dioxide concentration (0.9% of the objective) is above the screening criterion (0.5%); and
- the predicted maximum 99.79th percentile of 1-hour mean nitrogen dioxide concentrations (6.2% of the objective) is below the screening criterion (10%).

6.6 The predicted impacts exceed the screening criterion for annual mean nitrogen dioxide concentrations, and thus require further detailed assessment. No further assessment is required for 1-hour mean nitrogen dioxide concentrations. A contour plot for the annual mean process contributions at roof level (14.6 m) has been generated and is shown in Figure 4 below.

Figure 4: Nitrogen Dioxide Annual Mean Process Contribution Contour at Roof-Level (14.6 m)

Imagery ©2018 Google, Map data ©2018 Google.

6.7 As explained in Paragraph 2.34, any change smaller than 1.5% of the annual mean objective will be classified as *negligible* provided the total concentration is less than 94% of the objective (i.e. below 37.6 µg/m^3). At elevated roof-level locations, the baseline nitrogen dioxide concentration will be similar to background levels; which is estimated to be 35.1 µg/m^3 in 2020 (Table 4). Combining this baseline concentration with the maximum predicted process contribution concentration from the energy plant (Table 8) gives a maximum total nitrogen dioxide concentration of less than 94% of the objective (i.e. 35.1 µg/m^3 + 0.34 µg/m^3 = 35.44 µg/m^3). The impacts can therefore be classified as *negligible*.

Impacts at On-Site Receptors

6.8 The maximum predicted process contributions of nitrogen dioxide from the proposed energy plant at on-site receptors are outlined in Table 9. Receptor grids have been modelled separately at ground floor level (1.5 m) and roof level (14.6 m) heights, and the reported values represent the worst-case concentrations, taken from any of the three meteorological years considered. All of the worst-case concentrations were found to occur at roof level.

Table 9: Predicted Concentrations of Nitrogen Dioxide in 2020 for On-Site Locations

Averaging Period	Objective	Baseline Concentration ($\mu g/m^3$) [a]	Max. Process Contribution ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
Annual Mean NO_2	40	35.1	0.7	35.8
99.79th %ile of 1-hour NO_2	200	70.2	12.4	82.6

[a] The annual mean baseline concentration has been taken as the 'mapped' background concentrations outlined in Table 4. For consideration of the 1-hour objective the baseline concentration has assumed to be twice the annual mean.

6.9 The maximum process contributions for both annual mean and 1-hour mean nitrogen dioxide have been added to the estimated baseline concentrations, equivalent to the 'mapped' background concentrations (see Table 4). The predicted total concentrations for both annual mean and 1-hour mean nitrogen dioxide are below the objectives thus air quality for future on-site receptors will be acceptable.

Significance of Operational Air Quality Effects

6.10 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A3.

6.11 More specifically, the judgement that the air quality effects will be 'not significant' without mitigation takes account of the assessment that:

- impacts at off-site receptors, as a result of emissions from the energy plant, are all predicted to be *negligible*; and
- concentrations are predicted to be below the air quality objectives for all on-site receptors.

7 'Air Quality Neutral'

7.1 The purpose of the London Plan's requirement that development proposals be 'air quality neutral' is to prevent the gradual deterioration of air quality throughout Greater London. The 'air quality neutrality' of a proposed development, as assessed in this section, does not directly indicate the potential of the proposed development to have significant impacts on human health (this has been assessed separately in the previous section).

Building Emissions

7.2 Sonnemann Toon Architects and KJ Tait Engineers have advised that the boiler plant will meet the NOx emissions standards set out in the Sustainable Design and Construction SPG (GLA, 2014a); gas-fired boiler plant must achieve an emission rate of <40 mg/kWh.

7.3 Sonnemann Toon Architects and KJ Tait Engineers have also confirmed that the total annual energy demand (thermal) of the development is anticipated to be around 2,121,216 kWh. This corresponds to an annual boiler usage of approximately 23% with a total annual NOx emission of 84.8 kg.

7.4 Appendix A7 shows the Building Emissions Benchmarks (BEBs) for each land use category. Table 10 shows the calculation of the BEBs for this development.

Table 10: Calculation of Building Emissions Benchmark for the Development

	Description	Value	Reference
A	**Gross Internal Floor Area of D1 Medical or Health Services Premises (m^2)**	3,175	Sonnemann Toon Architects
B	**NOx BEB for D1 Medical or Health Services Premises (g/m^2/annum)**	43.0	Table A7.1
Total BEB NOx Emissions (kg/annum)		136.5	(A x B) / 1000

7.5 The Total Building NOx Emission of 84.2 kg/annum is less than Total BEB NOx Emission of 136.5 kg/annum. The proposed development is thus better than air quality neutral in terms of building emissions.

Road Transport Emissions

7.6 The proposed outpatient clinic is considered to be an extension of the overall Great Ormond Street Hospital facilities, and there is not expected to be any increase in traffic numbers on local roads as a result of the development, based on information provided by the transport consultants (Steer Davies Gleave, 2017).

7.7 Based on this, the proposed development will not increase traffic volumes, and hence will be air quality neutral in terms of traffic emissions.

8 Mitigation

Mitigation Included by Design

8.1 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:

- good daylight levels assisted by narrow plan nature, thus reducing electricity usage;
- minimising overheating through modifications to existing façade openings to maximize high level opening with restricted low level opening and use of free cooling methods, such as using night ventilation to minimise use of mechanical cooling to consulting rooms;
- existing building facades will be retained but the addition of additional insulation will be reviewed with ongoing design;
- secondary glazing to existing windows;
- locating service-intensive departments at basement and ground floor allowing support rooms with potential for natural ventilation to be located at upper levels;
- running of boiler flue to 3 m above roof level to ensure the best possible dispersion environment;
- effective metering and monitoring of building energy use;
- LED lighting throughout the facility including effective controls, zoning and metering; and
- mixed mode ventilation of consulting rooms and support accommodation maximising natural ventilation use to the building.

Recommended Mitigation

Construction Impacts

8.2 Measures to mitigate dust emissions will be required during the construction phase of the development in order to minimise effects upon nearby sensitive receptors.

8.3 The site has been identified as a *Low* Risk site during construction and trackout, as set out in Table 7. The GLA's SPG on *The Control of Dust and Emissions During Construction and Demolition* (GLA, 2014b) describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on what monitoring should be undertaken during the construction phase. This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of

the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A8.

8.4 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

8.5 In addition to the measures provided in Appendix A8, it is recommended that discussions are held with oncology departments at the hospital before works are carried out. This will allow these departments to take necessary measures to reduce the exposure of immune-suppressed patients to any potential biological contaminants that may occasionally arise from any renovation works to historic buildings.

Energy Plant Impacts

8.6 The energy plant flue will conform with the specifications to minimise air quality impacts set out in the GLA's Sustainable Design and Construction SPG (GLA, 2014a), which includes the requirement that all stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g. rain cowls). It is also generally considered best practice for plant to have a flue terminating at least 1 m above the roof level, which is the case for this proposed development.

8.7 Further requirements from the SPG are set out in Appendix A6, which also details the specifications of the energy plant used to assess the boiler impacts. If the installed plant does not conform to these specifications, additional assessment and/or mitigation may be required. Appendix A6 also sets out measures included in Technical Guidance Note D1 (Dispersion) (Technical Guidance Note D1 (Dispersion), 1993) to ensure adequate dispersion of emissions from discharging stacks and vents, which the proposed development will meet.

Air Quality Neutral

8.8 The development is considered to be air quality neutral and no additional mitigation is thus required.

9 Residual Impacts and Effects

Construction

9.1 The IAQM guidance, on which the GLA's guidance is based, is clear that, with appropriate mitigation in place, the residual effects will normally be 'not significant'. The mitigation measures set out in Section 8 and Appendix A8 are based on the GLA guidance. With these measures in place and effectively implemented the residual effects are judged to be 'not significant'.

9.2 The IAQM guidance does, however, recognise that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be 'not significant'.

Energy Plant Impacts

9.3 The residual impacts will be the same as those identified in Section 6. The overall effects of the proposed development will be 'not significant'.

10 Conclusions

10.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emissions. With these measures in place, it is expected that any residual effects will be 'not significant'.

10.2 The proposed development will not contribute significant road traffic to the local area, and as such will not have a significant impact on air pollution from road traffic. The location of the site with respect to significant road sources means that the site will not experience significant increases in pollution due to local road traffic. The pollutant levels which will be experienced at the site will be predominantly determined by the background concentrations in the area.

10.3 Existing background concentrations are elevated and currently exceed the objective for nitrogen dioxide, whilst PM_{10} and $PM_{2.5}$ concentrations are below the objective. Predicted trends for nitrogen dioxide background concentrations, based on Defra's background maps, show background levels to be below the objective in 2020 when the development is due to have finished renovations and begin operations.

10.4 Emissions from the proposed energy plant at both on-site and off-site receptor locations have been considered. The impacts at off-site receptors have shown to be *negligible* and thus effects will be 'not significant'. The emissions from the boiler plant also have the potential to impact on future on-site receptors, particularly those located closest to the stack. Concentrations of nitrogen dioxide are predicted to be below the objectives, thus future on-site receptors will experience acceptable air quality.

10.5 The building and transport related emissions associated with the proposed redevelopment are both judged to be below the relevant benchmarks. The proposed development therefore complies with Policy 7.14 of the London Plan, which requires all new developments in London to be at least air quality neutral.

11 References

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12 Glossary

AADT	Annual Average Daily Traffic
ADMS-5	Atmospheric Dispersion Modelling System model for point sources
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
BEB	Building Emissions Benchmark
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
EV	Electric Vehicle
Focus Area	Location that not only exceeds the EU annual mean limit value for NO_2 but also has a high level of human exposure
GIA	Gross Internal Floor Area
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LB	London Borough
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
LGV	Light Goods Vehicle

µg/m^3	Microgrammes per cubic metre
MAQS	Mayor's Air Quality Strategy
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
NRMM	Non-road Mobile Machinery
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PC	Process Contribution
PHV	Private Hire Vehicle
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
SCR	Selective Catalytic Reduction
SPG	Supplementary Planning Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
T-Charge	Toxicity Charge
TEB	Transport Emissions Benchmark
TfL	Transport for London
TRAVL	Trip Rate Assessment Valid for London
ULEZ	Ultra Low Emission Zone
ZEC	Zero Emission Capable

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A1 London-Specific Policies and Measures

London Plan

A1.1 The London Plan sets out the following points in relation to planning decisions:

"Development proposals should:

a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs or where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3);

b) promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils "The control, of dust and emissions form construction and demolition";

c) be at least "air quality neutral" and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs));

d) ensure that where provision needs to made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches;

e) where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."

The Mayor's Air Quality Strategy

A1.2 The Mayor's Air Quality Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures, including:

Policy 1 – Encouraging smarter choices and sustainable travel;

- *Measures to reduce emissions from idling vehicles focusing on buses, taxis, coaches, taxis, PHVs and delivery vehicles;*
- *Using spatial planning powers to support a shift to public transport;*

- *Supporting car free developments.*

Policy 2 – Promoting technological change and cleaner vehicles:

- *Supporting the uptake of cleaner vehicles.*

Policy 4 – Reducing emissions from public transport:

- *Introducing age limits for taxis and PHVs.*

Policy 5 – Schemes that control emissions to air:

- *Implementing Phases 3 and 4 of the LEZ from January 2012*
- *Introducing a NOx emissions standard (Euro IV) into the LEZ for Heavy Goods Vehicles (HGVs), buses and coaches, from 2015.*

Policy 7 – Using the planning process to improve air quality:

- *Minimising increased exposure to poor air quality, particularly within AQMAs or where a development is likely to be used by a large number of people who are particularly vulnerable to air quality;*
- *Ensuring air quality benefits are realised through planning conditions and section 106 agreements and Community Infrastructure Levy.*

Policy 8 – Creating opportunities between low to zero carbon energy supply for London and air quality impacts:

- *Applying emissions limits for biomass boilers across London;*
- *Requiring an emissions assessment to be included at the planning application stage.*

Low Emission Zone (LEZ)

A1.3 A key measure to improve air quality in Greater London is the Low Emission Zone (LEZ). This entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects older, diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. The LEZ was introduced on 4th February 2008, and was phased in through to January 2012. From January 2012 a standard of Euro IV was implemented for lorries and other specialist diesel vehicles over 3.5 tonnes, and buses and coaches over 5 tonnes. Cars and lighter Light Goods Vehicles (LGVs) are excluded. The third phase of the LEZ, which applies to larger vans, minibuses and other specialist diesel vehicles, was also implemented in January 2012. As set out in the 2010 MAQS, a NOx emissions standard (Euro IV) is included in the LEZ for HGVs, buses and coaches, from 2015.

Ultra Low Emission Zone (ULEZ)

A1.4 An Ultra Low Emission Zone (ULEZ) is to be introduced in London on 8 April 2019. The ULEZ will operate 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches. The Mayor is also proposing to expand the ULEZ beyond central London, potentially covering the whole of Greater London for heavy diesel vehicles from 2020 and the entire area within the North and South Circular roads for all vehicles from 2021.

Other Measures

A1.5 The Mayor introduced an Emissions Surcharge (also known as the Toxicity Charge, or T-Charge) in October 2017, which added an extra £10 charge for vehicles using the congestion charge zone that do not meet the Euro 4/IV emission standards. The Emissions Surcharge aims to discourage the use of older, more polluting vehicles driving into and within central London. It is the first step towards the introduction of the ULEZ.

A1.6 From 2018 all taxis presented for licencing for the first time must be zero emission capable (ZEC). This means they must be able to travel a certain distance in a mode which produces no air pollutants. From 2018 all private hire vehicles (PHVs) presented for licensing for the first time must meet Euro 6 emissions standards. From 1 January 2020, all newly manufactured PHVs presented for licensing for the first time must be ZEC (with a minimum zero emission range of 10 miles). The Mayor's aim is that the entire taxi and PHV fleet will be made up of ZEC vehicles by 2033.

A1.7 The Mayor has also proposed to make sure that TfL leads by example by cleaning up its bus fleet, implementing the following measures:

- TfL will procure only hybrid or zero emission double-decker buses from 2018;
- a commitment to providing 3,100 double decker hybrid buses by 2019 and 300 zero emission single-deck buses in central London by 2020;
- introducing 12 Low Emission Bus Zones by 2020;
- investing £50m in Bus Priority Schemes across London to reduce engine idling; and
- retrofitting older buses to reduce emissions (selective catalytic reduction (SCR) technology has already been fitted to 1,800 buses, cutting their NOx emissions by around 88%).

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM (2016), upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>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 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix A8.

STEP 4: Determine Significant Effects

A2.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant'.

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [2]

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

[2] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.4: Sensitivity of the Area to Human Health Effects [2]

Receptor Sensitivity	Annual Mean PM_{10}	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	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A2.5: Sensitivity of the Area to Ecological Effects [2]

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	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

A3 EPUK & IAQM Planning for Air Quality Guidance

A3.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A3.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;

- Wherever possible, new developments should not create a new “street canyon”, as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

“It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the “damage cost approach” used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential”.

A3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to

offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A3.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or

- the development will have a centralised energy facility or other centralised combustion process.

A3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor; and

A3.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A3.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent

buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

A3.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A3.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

A3.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Impact Descriptors and Assessment of Significance

A3.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

Impact Descriptors

A3.16 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A3.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A3.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[a] Values are rounded to the nearest whole number.

[b] This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A3.17 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*'

impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and

- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A3.18 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A3.19 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A4 Professional Experience

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is a Technical Director with AQC and has twenty years' experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has been an expert witness at several public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to the UK Government's air quality review and assessment helpdesk, Transport Scotland, Transport for London, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. Dr Marner is a member of Defra's Network of Evidence Experts and a member of Defra's Air Quality Expert Group.

Penny Wilson, BSc (Hons) CSci MIEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than seventeen years' relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is Member of the Institute of Air Quality Management and a Chartered Scientist.

Dr Aidan Farrow, BSc (Hons) PhD

Dr Farrow is a Consultant with AQC, having joined the company in 2016. He previously worked for four years as a research scientist at the University of Hertfordshire's Centre for Atmospheric and Instrumentation Research. There he was responsible for the National Centre for Atmospheric Science Air Quality Forecast, as well as working on research projects with a variety of Climate, Weather and Air Quality models. He is now gaining experience in the field of air quality assessment.

Samantha Barber, MChem

Miss Barber is an Assistant Consultant with AQC, having joined the company in November 2017. She is gaining experience of air quality assessments for a range of developments using air quality monitoring and modelling techniques. Prior to joining AQC she completed her MChem in Chemistry and has also worked for a year as a Technical Services Officer at BOC Gases Ltd.

Full CVs are available at www.aqconsultants.co.uk.

A5 Modelling Methodology

Model Inputs

A5.1 The impacts of emissions from the proposed energy plant have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model has been run to predict the contribution of the proposed energy plant emissions to annual mean concentrations of nitrogen oxides and the 99.79th percentile of 1-hour mean nitrogen oxides concentrations.

A5.2 The gas-fired boiler plant that will be installed into the development will have an assumed net fuel input of 952 kW (calculated gross input of 1054.4 kW). The boiler plant will conform to the Sustainable Design and Construction SPG (GLA, 2014a) requiring NOx emissions to be <40 mg/kWh[3]. Emissions will rise to roof level in a single dedicated flue. A fan assisted flue may be required to aid this. The boiler plant will operate for 23% of the year (23% of the maximum annual load), with the modelling assuming that it is at full load when operational. The exhaust volume flow rate for the natural-gas fired plant has been calculated based on the complete combustion of the assumed natural gas composition in Table A5.1 and the following typical values for boilers of this size:

- 100% load;
- 105 ˚C exit temperature;
- 31% excess air in; and
- Condensing plant removing 50% of the water from the exhaust.

[3] Maximum NOx emission rate permitted within the Sustainable Design and Construction SPG (GLA, 2014a).

Table A5.1: Typical Gas Fuel Composition

Component	Natural Gas
Methane	90.76%
Ethane	4.64%
Propane	1.22%
Carbon Monoxide	-
Hydrogen	-
Carbon Dioxide	1.07%
Nitrogen	2.32%
Net Calorific Value (LHV) (MJ/kg)	46.5
Gross Calorific Value (HHV) (MJ/kg)	51.5
HHV/LHV	1.11
Molecular Mass (g/mol)	17.61

A5.3 Further details of the energy plant parameters are provided in Appendix A6.

Table A5.2: Plant Specifications and Modelled Emissions and Release Conditions

Parameter	Value
Gas Boilers (4 x Ideal Evomod 250kW Boilers)	
Specified Flue Internal Diameter (m) [a]	0.4
Calculated Normalised Exhaust Volume Flow (Nm^3/s) [b]	0.228
Calculated Actual Exhaust Volume Flow (m^3/s) [c]	0.463
Calculated Exit Velocity (m/s)	3.68
Specified NOx Emission Rate (mg/kWh)	39.7
Modelled NOx Emission Rate (mg/kWh)	40.0
Calculated Gross Fuel Input (kW)	1054.4
Calculated NOx Emission Rate (g/s)	0.01172
Specified Exhaust Temperature (°C)	105

[a] This is the internal flue diameter required to achieve an efflux velocity of 10 m/s, as required by the GLA's Sustainable Design and Construction SPG (GLA, 2014a).

[b] 'Normal' here refers to 0% O_2, 0˚C, 101.325 kPa and 0% H_2O.

[c] Not normalised.

A5.4 Entrainment of the plume into the wake of the buildings (the so-called building downwash effect) has been taken into account in the model. The building dimensions and flue location have been obtained from drawings provided by Sonnemann Toon Architects. The location of the flue is shown in Figure A5.1 along with the modelled buildings and their heights. The flue has been modelled at a height of 17.6 m (1.5 m above the screened plant area; 3 m above roof level). Three scenarios were modelled for the energy centre; no buildings using a high surface roughness (1.5), all onsite site buildings using a high surface roughness (1.5) and all onsite buildings using a low

surface roughness (0.5). The maximum concentrations were taken from the three different modelled scenarios to allow for a more conservative assessment.

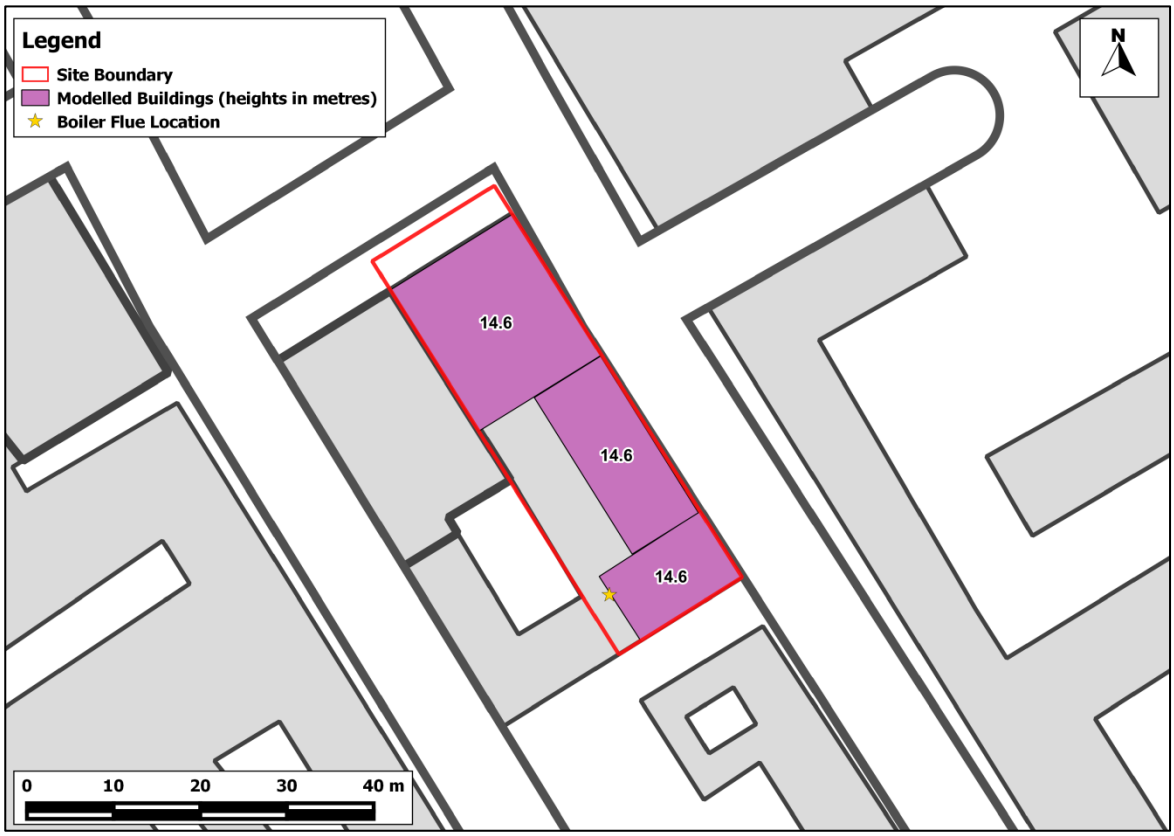

Figure A5.1: Flue Location & Modelled Buildings

A5.5 Hourly sequential meteorological data from Heathrow for 2014, 2015 and 2016 have been used in the model. The Heathrow meteorological monitoring station is located at Heathrow Airport, approximately 24 km to the west of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed development site; both the development site and the Heathrow meteorological monitoring station are located in London where they will be influenced by the effects of inland meteorology over urban topography.

Background Concentrations

A5.6 The nitrogen dioxide and PM_{10} background maps for 2016 have been calibrated against local measurements made at the London Bloomsbury urban background automatic monitoring site. The measured nitrogen dioxide concentration at this site in 2016 was 42.0 µg/m^3, while the mapped background for the grid square within which it lies was 45.0 µg/m^3. All mapped background

nitrogen dioxide concentrations have therefore been calibrated by applying a factor of 0.93. The measured PM_{10} concentration at the London Bloomsbury site in 2016 was 20 µg/m^3, while the mapped background was 21.2 µg/m^3. All mapped background PM_{10} and $PM_{2.5}$ concentrations have therefore calibrated by applying a factor of 0.94.

Model Post-processing

A5.7 Emissions from the energy plant will be predominantly in the form of nitrogen oxides (NOx) and PM_{10}. ADMS-5 has been run to predict the contribution of the proposed energy plant emissions to annual mean concentrations of nitrogen oxides and to the 99.79th percentile of 1-hour mean nitrogen oxides concentrations. For the initial screening of the process contributions, the approach recommended by the Environment Agency (2005) has been used to predict nitrogen dioxide concentrations, assuming that:

- annual mean NO_2 concentration = annual mean NOx concentration multiplied by 0.7; and
- 99.79th percentile of 1-hour mean NO_2 concentrations = 99.79th percentile of 1-hour mean NOx concentrations multiplied by 0.35.

A6 Energy Plant Specification

A6.1 The proposed development will be provided with heat and hot water using four 250kW condensing natural gas-fired boilers, to be located in the lower ground floor plantroom within the development. Specification for this plant, upon which the assessment has been based, is shown in Table A6.1.

Table A6.1: Energy Plant Specifications

Parameter	Value	Restriction
Boiler		
Gross Peak Fuel Input (kW)	1054.4	Max
Hours of Use per Annum	2015	Max
Annual Fuel Input (kWh/annum)	2,121,216	Max
Exhaust Temperature (°C)	105	Min
Flue Internal Diameter (m)	0.4	Max
Efflux Velocity (m/s)	3.68	Min
NOx Emission Rate (mg/kWh)	40	Max
Condensing	Yes	-

A6.2 The restrictions set out in Table A6.1 should be adhered in order to ensure that the final plant design does not lead to impacts greater than those modelled. To further emphasise these, the final design should adhere to the following minimum specifications:

- a boiler system to be comprised of units totalling a maximum of 1054.4 kW fuel input must share a common flue outlet with a maximum internal diameter of 0.4 m at the exit point, terminating at least 3 m above the roof level;
- all stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls or 'Chinaman's Hats');
- the system must be designed to conform to the requirements of the GLA's guidance on sustainable design and construction (GLA, 2014a). The gas boilers must conform to a maximum NOx emission of <40 mg/kWh. The SPG makes clear that the emission standards are 'end-of-pipe' concentrations expressed at specific reference conditions for temperature, pressure, oxygen and moisture content. Compliance with these standards will be confirmed prior to occupation, based on:
    - monitoring undertaken on the actual installed plant; or
    - manufacturer guaranteed performance levels supported by type approval monitoring undertaken by the equipment supplier.
- in order to attain these values, relevant catalyst or alternative abatement will be required.

A6.3 If the design of the energy centre deviates significantly from the modelled specification, additional future modelling may be required in order to ensure that there are no significant adverse air quality impacts.

A6.4 The GLA's Sustainable Design and Construction SPG (GLA, 2014a) also states that the set out in Technical Guidance Note D1 (Dispersion) (1993) should also be adhered to in order to ensure adequate dispersion of emissions from discharging stacks and vents. These include the following, all of which are complied with for the proposed development:

- Discharges should be vertically upwards and unimpeded by cowls or any other fixtures on top of the stack. However, the use of coning or of flame traps at the tops of stacks is acceptable. In the case of discharge stacks (whether single or multiple stack) with shrouds or casings around the stack(s), the stack(s) alone should extend above the shroud or casing. This extension should be at least 50% of the shroud or casing's greatest lateral dimension;
- Irrespective of the pollutant discharge, there are minimum discharge stack heights based on the heat release and the discharge momentum. These can be calculated following calculations set out in the guidance note, but the absolute minimum value is 1 m; and
- No discharge stack should be less than 3 m above the ground or any adjacent area to which there is general access. For example, roof areas and elevated walkways.

A7 'Air Quality Neutral'

A7.1 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a), and its accompanying Air Quality Neutral methodology report (AQC, 2014), provide an approach to assessing whether a development is air quality neutral. The approach is to compare the expected emissions from the building energy use and the car use associated with the proposed development against defined emissions benchmarks for buildings and transport in London.

A7.2 The benchmarks for heating and energy plant (termed 'Building Emissions Benchmarks' or 'BEBs') are set out in Table A7.1, while the 'Transport Emissions Benchmarks' ('TEBs') are set out in Table A7.2. In order to assess against the TEBs, it is necessary to combine the expected trip generation from the development with estimates of average trip length and average emission per vehicle. So as to ensure a consistent methodology, the report which accompanies the SPG (AQC, 2014) recommends that the information in Table A7.3 and Table A7.4 (upon which the TEBs are based) is used. Similarly, the information in Table A7.5 may be used if site-specific information are not available (AQC, 2014). For use classes other than A1, B1 and B3, trip lengths and average emissions per vehicle are not provided, thus the trip rates in Table A7.6 alone may be used to consider the air quality neutrality of a development. These have been derived from the Trip Rate Assessment Valid for London (TRAVL) database.

Table A7.1: Building Emissions Benchmarks (g/m^2 of Gross Internal Floor Area)

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

Table A7.2: Transport Emissions Benchmarks

Land use	CAZ [a]	Inner [b]	Outer [b]
NOx (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

[a] Central Activity Zone.

[b] Inner London and Outer London as defined in the LAEI (GLA, 2016b).

Table A7.3: Average Distance Travelled by Car per Trip

Land use	Distance (km)		
	CAZ	Inner	Outer
Retail (A1)	9.3	5.9	5.4
Office (B1)	3.0	7.7	10.8
Residential (C3)	4.3	3.7	11.4

Table A7.4: Average Road Traffic Emission Factors in London in 2010

Pollutant	g/vehicle-km		
	CAZ	Inner	Outer
NOx	0.4224	0.370	0.353
PM_{10}	0.0733	0.0665	0.0606

Table A7.5: Average Emissions from Heating and Cooling Plant in Buildings in London in 2010

	Gas (kg/kWh)		Oil (kg/kWh)	
	NOx	PM_{10}	NOx	PM_{10}
Domestic	0.0000785	0.00000181	0.000369	0.000080
Industrial/Commercial	0.000194	0.00000314	0.000369	0.000080

Table A7.6: Average Number of Light Vehicle Trips per Annum for Different Development Categories

Land use	Number of Trips (trips/m^2/annum)		
	CAZ	Inner	Outer
A1	43	100	131
A3	153	137	170
A4	2.0	8.0	-
A5	-	32.4	590
B1	1	4	18
B2	-	15.6	18.3
B8	-	5.5	6.5
C1	1.9	5.0	6.9
C2	-	3.8	19.5
D1	0.07	65.1	46.1
D2	5.0	22.5	49.0
Number of Trips (trips/dwelling/annum)			
C3	129	407	386

A8 Construction Mitigation

A8.1 The following is a set of best-practice measures from the GLA guidance (GLA, 2014b) that should be incorporated into the specification for the works. These measures should be written into a Dust Management Plan. Some of the measures may only be necessary during specific phases of work, or during activities with a high potential to produce dust, and the list should be refined and expanded upon in liaison with the construction contractor when producing the Dust Management Plan.

Site Management

- Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary;
- display the head or regional office contact information;
- record and respond to all dust and air quality pollutant emissions complaints;
- make a complaints log available to the local authority when asked;
- carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions are being carried out and during prolonged dry or windy conditions; and
- record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and ensure that the action taken to resolve the situation is recorded in the log book.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods; and

- 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.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone;
- ensure all Non-road Mobile Machinery (NRMM) comply with the standards set within the GLA's Control of Dust and Emissions During Construction and Demolition SPG. This outlines that, from 1st September 2015, all NRMM of net power 37 kW to 560 kW used on the site of a major development in Greater London must meet Stage IIIA of EU Directive 97/68/EC (The European Parliament and the Council of the European Union, 1997) and its subsequent amendments as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum. From 1st September 2020 NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum, while NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum;
- ensure all vehicles switch off engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
- impose and signpost a maximum-speed-limit of 10 mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where appropriate); and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using recycled water where possible and appropriate;
- use enclosed chutes, conveyors and covered skips; and
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- avoid bonfires and burning of waste materials.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible; and
- 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.

Measures Specific to Trackout

- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site;
- avoid dry sweeping of large areas; and
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.