DRAGONFLY

CONSULTING

Advanced Research Clusters GP Limited

ARC Oxford Plot 4200

John Smith Drive, Oxford

Air Quality Impact Assessment

DC4347-AR1v2

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1.0 INTRODUCTION

1.1 Introduction

Dragonfly Consulting has been appointed on behalf of Advanced Research Clusters GP Limited to carry out an air quality assessment in support of a full planning application at Plot 4200, ARC Oxford, John Smith Drive, Oxford (the 'Site').

An air quality assessment has been undertaken to assess impacts during the construction and operational phases of the development on air quality in the surrounding area. Oxford City Council (OCC) have identified areas of relevant exposure where the UK air quality objective limits are being exceeded and declared Air Quality Management Areas (AQMAs). The Site is within a city-wide Oxford AQMA.

Potential sources of emissions are identified and assessed in the context of existing air quality and emission sources and the nature and location of receptors. This includes air quality impacts as a result of dust emissions during the construction phase and an assessment of the impact of emissions arising from additional vehicular movements.

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

1.2 Scope of Assessment

The development would generate additional vehicle movements on the adjacent road network. The potential impacts of operational traffic have been assessed in accordance with current air quality planning guidance published by the Institute of Air Quality management (IAQM)[1] and using detailed dispersion modelling to predict the change in traffic related emissions. Air quality at the Site has also been assessed to determine the suitability of the Site for employment use.

An assessment of road traffic emissions arising from the Development has been carried out alongside an assessment of the suitability of the Site for commercial use. The assessment has concentrated on nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 µm and 2.5 µm (PM_{10} and $PM_{2.5}$), the pollutants most associated with traffic emissions and which can be harmful and cause discomfort to humans.

An assessment of air quality impacts associated with construction activities has also been undertaken to determine measures for inclusion within a Construction Management Plan (CMP).

[1] IAQM, Land-use Planning and Development Control: Planning for Air Quality, January 2017

2.0 SITE DESCRIPTION

2.1 Existing Site

The Site is located at ARC Oxford Plot 4200, John Smith Drive, Oxford, OX4 2RU.

Plot 4200 lies within the southern part of ARC Oxford to the west of John Smith Drive. It currently comprises of 7 individual office buildings organised around areas of car parking and intermittent tree planting. Residential development lies to the west and an existing private footpath runs alongside the southern side of the site.

2.2 Proposed Site

The development proposals consist of a full planning application for the demolition of existing office buildings and erection of 1no. laboratory-enabled office building for research and development with ancillary commercial space (all within use Class E). Provision of new access, enhancements to existing footpath, motor vehicle and cycle parking, landscaping and services infrastructure.

3.0 LEGISLATION, POLICY AND GUIDANCE

3.1 International Air Quality Policy

3.1.1 European Directive on Ambient Air Quality and Cleaner Air for Europe

The EU Directive 2008/50/EC[2] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for a number of pollutants and the dates by which these objectives should be met. The Air Quality Standards Regulations 2010[3] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding, and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

3.2 National Air Quality Policy

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

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[4], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

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

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

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

For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures

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

[3] Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001

[4] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

Of the pollutants included in the AQS, NO_2 and PM_{10} would be particularly relevant to this project as these are the primary pollutants associated with vehicle emissions, the main source of pollutants in the vicinity of the Site.

The current statutory standards and objectives for NO_2 and PM_{10} in relation to human health are set out in Table 3.1.

In relation to $PM_{2.5}$ the 2019 Clean Air Strategy[5] includes a commitment to set '*new, ambitious, long-term targets to reduce people's exposure to* $PM_{2.5}$' which the Environment Act 2021[6] commits the Secretary of State to setting. As discussed in Local Air Quality Management Technical Guidance 2022 (LAQM.TG(22)[7] issued by DEFRA, local authorities are expected to work towards reducing $PM_{2.5}$ in their area, setting this out as the current objectives within England for $PM_{2.5}$. Historically, limit values were established via the EU Directive with both a Stage 1 and Stage 2 limit value identified. For the purposes of this assessment the Stage 2 limit value for $PM_{2.5}$ (as provided in Table 3.1) is considered to be appropriate to use for assessing impacts of development proposals.

Table 3.1
Relevant Objectives set out in the Air Quality Strategy

Pollutant	Concentrations	Measured As	Date to be Achieved By
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times per year	1 hour mean	31 December 2005
	40 µg/m^3	Annual mean	
Particulate Matter (PM_{10})	50 µg/m^3 not to be exceeded more than 35 times per year	24-hour mean	31 December 2004
	40 µg/m^3	Annual mean	
Particulate Matter ($PM_{2.5}$)	Stage 1 – 25 µg/m^3	Annual mean	1st January 2020
	Stage 2 - 20 µg/m^3	-	-

The statutory standards and objectives apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2022 (LAQM.TG(22)) issued by DEFRA for Local Authorities on where the objectives apply, as detailed in Table 3.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

[5] Defra. (2019). Clean Air Strategy. London: HMSO

[6] Secretary of State, The Environment Act 2021 HMSO

[7] DEFRA (2022) Local Air Quality Management. Technical Guidance (LAQM.TG(22)

Table 3.2
Locations Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care home etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-Hour Mean	All locations where the annual mean objective would apply together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-Hour Mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside Sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2.2 Local Air Quality Management – The Environment Act 1995

Local authorities are seen to play a particularly important role. Section 82 of the Environment Act 1995 requires every local authority to conduct a review of the air quality from time to time within the authority's area. The DEFFA technical guidance, LAQM.TG(22), continues with the streamlined approach to the Local Air Quality Management (LAQM) regime, whereby every authority has to undertake and submit a single Annual Status Report/Annual Progress Report within its area, to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an Air Quality Management Area (section 83 of the Act) and prepare an action plan (section 84) which identifies measures that will be introduced in pursuit of the objectives.

3.2.3 National Air Quality Plan for NO_2 in the UK

The National Air Quality Plan[8] was written as a joint venture between the Defra and the Department for Transport (DfT) and aims to tackle roadside concentrations of NO_2 in the UK. It includes a number of measures such as those aimed at investing in Ultra Low Emission Vehicles (ULEVs) charging infrastructure, public transport and grants to help local authorities in improving air quality.

The plan requires all local authorities (LAs) in Wales with areas expected not to meet the Limit Values by 2020 (known as 'air quality hotspots') to develop plans to bring concentrations within these values in "the shortest time possible". These plans are to be reviewed by the government and suggestions included in the plan include actions such as utilising retrofitting technologies, changing road layout and encouraging public transport and ULEV use. Where these approaches are not considered sufficient, the LA may need to consider implementation of a Clean Air Zone (CAZ) which places restrictions on vehicle access to an area and may include charging certain (or all) vehicles or restrictions on the type of vehicle allowed to access an area.

3.2.4 Road to Zero Strategy

The Road to Zero strategy[9] sets out the government's plans to encourage zero emissions vehicles. These include the aim that by 2040 all new cars and vans will have zero tailpipe emissions and by 2050 almost every car will have zero emissions. Measures within the Strategy are aimed at encouraging the uptake of the cleanest vehicles and supporting electric charging infrastructure.

3.2.5 Clean Air Strategy

The Clean Air Strategy sets out policies to lower national emissions of pollutants in order to reduce background pollution and human exposure. It aims to create a strong framework to tackle air pollution and to reduce the number of people living in locations with $PM_{2.5}$ concentrations exceeding 10 $\mu g/m^3$ by 50% by 2025.

3.3 Planning Policy

3.3.1 National Planning Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF)[10] sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to 'protect and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'

Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 174) requires that *'planning policies and decisions should contribute to and enhance the natural local*

[8] Defra and DfT. (2017). UK plan for tackling roadside nitrogen dioxide concentrations. London: HMSO

[9] HM Government. (2018). Road to Zero Strategy. London: HMSO

[10] Ministry of Housing, Communities and Local Government: National Planning Policy Framework (September 2023)

environment by …preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as air and water quality.'

In dealing specifically with air quality the NPPF (paragraph 186) states that *'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.'*

Paragraph 188 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively'.*

3.3.2 Local Planning Policy

Oxford Local Plan

The Oxford Local Plan[11] was adopted in June 2020 and provides a vision for Development of the area up to 2036. In dealing with air quality the Plan sets out the following under Policy RE6: Air Quality:

"Planning permission will only be granted where the impact of new development on air quality is mitigated and where exposure to poor air quality is minimised or reduced.

The exposure of both current and new occupants to air pollution during the development's operational and construction phases, and the overall negative impact that proposals may cause to the city's air quality, will be considered in determining planning applications. Where additional negative air quality impacts from a new development are identified, mitigation measures will be required to ameliorate these impacts.

Sensitive uses including residential development, schools and nurseries should be located away from areas of poor air quality, with site layout designed to reduce impact and with any residual impact mitigated through air quality measures.

Planning applications for major proposals (10 or more dwellings or 1000 square metres) which would carry a risk of exposing individuals to unacceptable levels of air pollution must be accompanied by an Air Quality Assessment (AQA).

Where the Air Quality Assessment indicates that a development would cause harm to air quality, planning permission will not be granted unless specific measures are proposed and secured to mitigate those impacts.

[11] Oxford City Council, Oxford Local Plan, Adopted June 2020

Planning applications for proposals that involve significant demolition, construction or earthworks will also be required to submit a dust assessment as part of the AQA, to assess the potential impacts and health risks of dust emissions from those activities. Any appropriate site-specific dust mitigation measures will be secured as part of the Construction Management Plan (CMP).

Further guidance on meeting the requirements of the policy is set out in the Oxford City Council's Air Quality Planning Application Guidance Note and the up to date IAQM guidelines which applicants are expected to follow."

Oxford Air Quality Action Plan

The Oxford City Council Air Quality Action Plan (AQAP)[12] 2021 was adopted in January 2021 and has been produced as part of the statutory duties required of OCC under the Local Air Quality Management Framework. The AQAP outlines the actions to be taken to improve air quality within the OCC jurisdiction up to 2025.

3.4 Air Quality Guidance

3.4.1 Defra Technical Guidance, LAQM.TG(22)

LAQM.TG(22) sets out detailed guidance on how air quality should be assessed and monitored by local authorities. The document provides useful guidance on how air quality from specific sources should be screened and the approaches that should be used to undertake detailed assessment where potentially significant emissions are identified, including details on model verification and consideration of monitoring data for use in assessments.

3.4.2 IAQM Land-Use Planning and Development Control: Planning for Air Quality

The Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) have published joint guidance on the assessment of air quality impacts for planning purposes[13]. This includes information on when an air quality assessment is required, what should be included in an assessment and criteria for assessing the significance of any impacts.

3.4.3 IAQM Guidance on the Assessment of Dust from Demolition and Construction

Guidance produced by the IAQM on assessing impacts from construction and demolition activities includes a methodology for identifying the risk magnitude of potential dust sources associated with demolition, construction, earthworks and trackout. This is then used to identify the level of mitigation necessary in order for the impacts to be not significant. The London SPG 'The Control of Dust and Emissions during Construction and Demolition' is based on this guidance, however, the original document is more detailed and therefore it is used to provide additional information where necessary.

[12] Oxford City Council, Air Quality Action Plan, Adopted January 2021

[13] EPUK & IAQM (2017) Land Use Planning & Development Control: Planning for Air Quality, January 2017

4.0 METHODOLOGY

4.1 Baseline Assessment

A baseline assessment of air quality in the vicinity of the Site has been carried out through a review of monitoring data available within the OCC air quality review and assessment reports, most notably the OCC 2022 Air Quality Annual Status Report (ASR)[14]. Data has also been obtained from the UK Air Information Resource (UK-AIR) background pollution maps.

The baseline assessment has also been informed by the results of detailed modelling using the approach detailed in Section 4.3.

4.2 Construction Phase

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

Based on the development proposals it is anticipated that there would be no more than 10 additional Heavy-Duty Vehicles (HDV) generated on any one road link on any given day during the construction phase.

The IAQM air quality planning guidance sets out criteria to determine when significant effects are likely to occur, and a more detailed assessment of traffic emissions is required. The criteria indicates that significant impacts on air quality are unlikely to occur where a development results in less than 25 HDV movements per day in locations within or adjacent to an AQMA and less than 100 HDV outside of an AQMA. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment.

4.2.1 Construction/Fugitive Dust Emissions:

Construction phase activities associated with the Proposed Development may result in the generation of fugitive dust emissions (i.e. dust emissions generated by site-specific activities that disperse beyond the construction site boundaries).

If transported beyond the site boundary, dust can have an adverse impact on local air quality. The IAQM has published a guidance document for the assessment of demolition and construction phase impacts. The guidance considers the potential for dust nuisance and impacts to human health and ecosystems to occur due to activities carried out during the following stages of construction:

- Demolition (removal of existing structures);
- Earthworks (soil-stripping, ground-levelling, excavation and landscaping);
- Construction (activities involved in the provision of a new structure); and
- Trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

[14] Oxford City Council, 2022 Air Quality Annual Status Report, September 2023

A qualitative assessment of air quality impacts due to the release of fugitive dust and particulates (PM_{10}) during the construction phase was undertaken in accordance with the methodology detailed in the IAQM guidance.

The assessment takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels, thus enabling a level of risk to be assigned. Risks are described in terms of there being a low, medium, or high risk of dust impacts.

Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined.

A summary of the IAQM assessment methodology is provided in Appendix B.

4.2.2 Selection of Receptors

The IAQM assessment is undertaken where there are:

- Human receptors within 350m of the site boundary or within 50m of the route(s) used by construction vehicles on the public highway;
- Human receptors up to 500m from the site entrance(s);
- Ecological receptors within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway; and
- Ecological receptors up to 500m from the site entrance(s).

It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

4.2.3 Significance Criteria

The IAQM assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity following the application of appropriate mitigation measures. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effects will normally be negligible.

4.3 Operational Assessment

4.3.1 Introduction

The impact of traffic generation by the operational development has been predicted using the ADMS-Roads Extra dispersion model (version 5.0.1.3, released March 2020, updated in February 2022). This is a commercially available dispersion model, developed by Cambridge Environmental Research Consultants, and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from RAF Benson Meteorological Station for 2022 has been used for the assessment.

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

4.3.2 Emissions Data

The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of NO_x and PM at sensitive receptors selected by the user.

The assessment has predicted air quality during 2022 for model verification. The emission factors released by Defra in November 2021, provided in the emissions factor toolkit EFT2021_v11.0[15] have been used to predict traffic related emissions of PM and NO_x.

Emission factors and background data used in the prediction of future air quality concentrations predict a gradual decline in pollution levels over time due to improved emissions from new vehicles and the gradual renewal of the vehicle fleet. In recent years the Defra emission factors published within the Emission Factor Toolkits (EFT) have been found to predict lower NOx concentrations in future years compared to concentrations measures at roadside locations across the UK. However, research carried out by Air Quality Consultants Ltd (AQC) has now shown that emissions of NOx from vehicles within the recently released EFT are now matching concentrations recorded at roadside locations between 2013 to 2019. The report[16] concludes that *'the EFT is now unlikely to over-state the rate at which NO_x emissions decline into the future at an 'average' site in the UK. Indeed, the balance of evidence suggests that, on average, NO_x concentrations are likely to decline more quickly in the future than predicted by the EFT'*. This has removed the need for the use of any sensitivity tests for future year scenarios.

In light of the above the relevant future year EFT emissions data is considered suitable for predicting concentrations in the 2025 future year scenario and have been used for this assessment. 2022 emissions data has been used in the 2022 verification and baseline modelling scenarios.

4.3.3 Background Concentrations

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

Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been taken from the Defra background maps. To ensure a worst-case assessment 2022 background concentrations have been used for the 2025 assessment scenario assuming no decline in background concentrations between the two assessment years.

4.3.4 Traffic Data

2022 baseline, 2025 do-minimum (DM) and 2025 do-something (DS) traffic data for the adjacent road network has been provided by the Developments transport consultants Stantec.

Traffic data used in the assessment is provided in Appendix D.

[15] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

[16] https://www.aqconsultants.co.uk/news/march-2020/defra%E2%80%99s-emission-factor-toolkit-now-matching-measu

4.3.5 Model Outputs and Results Processing

The ADMS Model predicts traffic related annual mean emissions of oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$ at receptors selected by the user.

The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator (Version 8.1, released September 2020) available on the DEFRA air quality website[17].

Relevant background concentrations have subsequently been added to the model outputs to provide the total concentrations across the measured receptors.

Analysis of long-term monitoring data[18] suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment the annual mean concentration has been used to screen whether the one-hour mean objective is likely to be achieved, as recommended within LAQM.TG(22). Similar to NO_2, an annual mean PM_{10} concentrations below 32 µg/m^3 is used to screen whether the 24-hour PM_{10} mean objective is likely to be achieved, the approach also recommended within LAQM.TG(22).

4.3.6 Verification of Model Results

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

LAQM.TG(22) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

To verify the model results, the ADMS model has been used to predict NO_x concentrations at four monitoring sites (Sites DT80, DT91, TF30 & TF32). Verification was carried out against 2022 monitoring data.

The location of the monitoring sites has been adjusted within the model to ensure they are located at the correct distance from the roadside, as detailed in the ASR, although these locations have also been reviewed and confirmed through Google Earth mapping software. Further details on the verification and calculation of adjustment factors are provided in Appendix E. Following adjustment of the results all predicted concentrations were within 20% of monitored concentrations.

There is no suitable monitoring of PM_{10} or $PM_{2.5}$ data to allow verification of the PM model results. However, LAQM.TG (22) suggests applying the NO_x adjustment factor to modelled road-PM where no appropriate verification against PM data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM concentrations.

[17] http://uk-air.defra.gov.uk

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

4.4 Selection of Receptors

4.4.1 Human Receptors

As set out in Table 3.2, LAQM.TG(22) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations 'where members of the public are regularly present' should be considered. At such locations, members of the public would be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

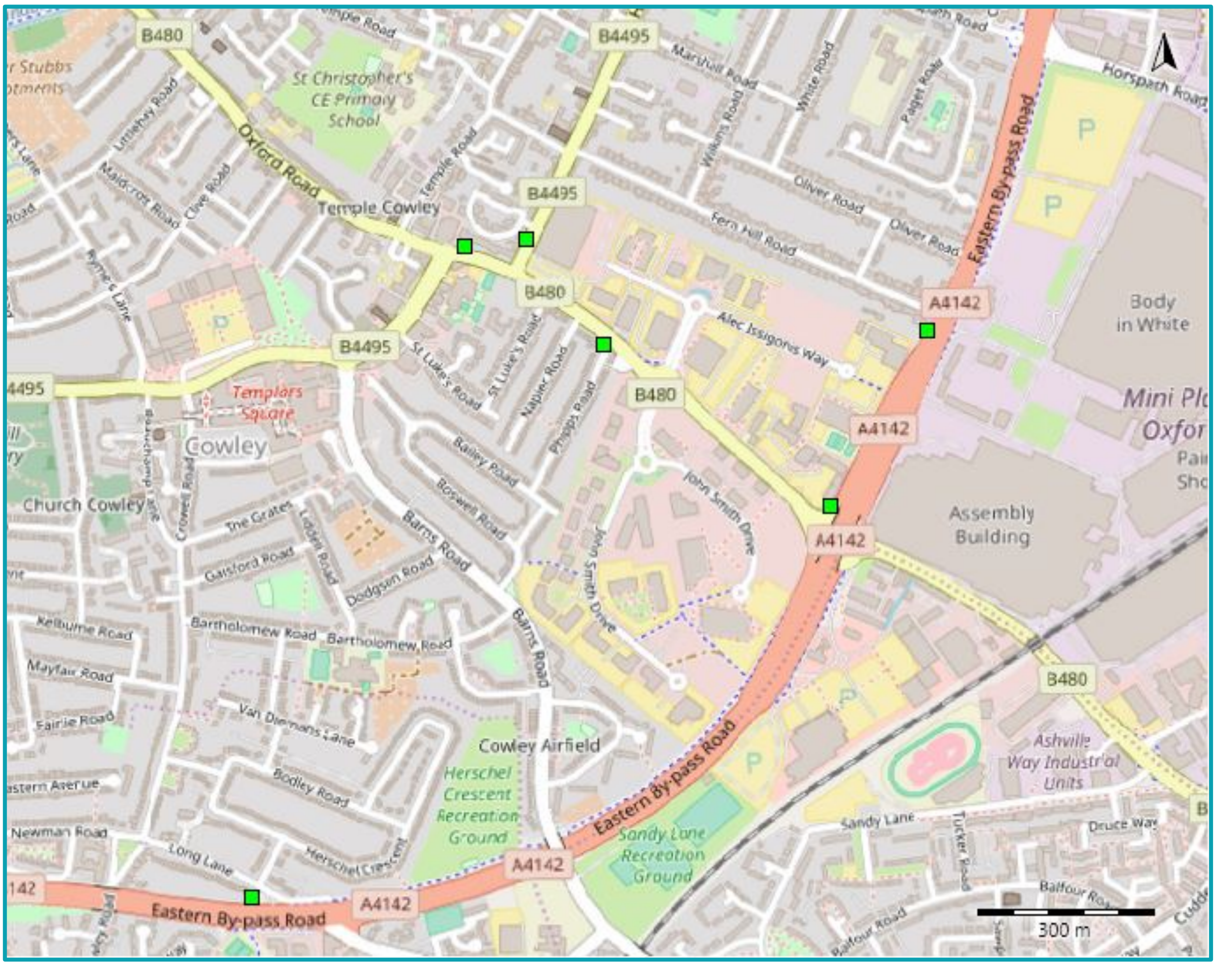
For instance, on a footpath, where exposure would be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison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

For the completion of this assessment, air quality has been predicted at selected existing sensitive receptors located adjacent to the roads included within the ADMS model, as detailed in Appendix D. The receptors have been selected to represent worst-case exposure to local traffic emissions. The location of the receptors is presented in Figure 4.1 and details are provided in Table 4.1.

Table 4.1
Details of Human Health Receptors Used in Modelling

Receptor Number	Receptor Description	OS Grid Reference	Height of Receptor (m)
R1	Garsington Road	454775, 204087	1.5
R2	Hollow Way	454643, 204265	1.5
R3	Garsington Road	454540, 204253	1.5
R4	Garsington Road	455161, 203812	1.5
R5	Fern Hill Road	455326, 204111	1.5
R6	Long Lane	454180, 203147	1.5

Figure 4.1
Location of Receptors used in Modelling Assessment



4.4.2 Ecological Receptors

Emissions arising from additional traffic as a result of the Development have the potential to cause air quality effects at designated sites within 200 m of road links at which Development AADT generation is greater than 1000. Based upon the supplied traffic data, there are no nearby ecological sites that meet the 1000 AADT threshold.

Air quality impacts on ecological receptors are therefore not considered as part of the operational phase assessment of road traffic emissions.

4.4.3 Human Health

The guidance issued by EPUK & IAQM relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

The guidance suggests expressing the magnitude of incremental change in concentrations as a proportion of an Air Quality Assessment Level (AQAL) such as the air quality objectives set out in Table 3.1.

The significance of impact is then identified based on the incremental change in the context of the new total concentrations and its relationship with the assessment criteria, noting whether the impact is adverse or beneficial based on a positive or negative change in concentrations. The criteria suggested for assigning significance is set out in Table 4.2 below.

To assess the overall significance of the predicted impact the assessment draws on the approach used for undertaking environmental impact assessments where a moderate and major impact is deemed to be significant while a minor or negligible impact would not be classed as significant.

Table 4.2
Impact Descriptors for Individual Receptors

Long-term Average Concentration at Receptor in Assessment year	% Change in Concentrations Relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% of AQAL	Moderate	Substantial	Substantial	Substantial

When assessing significance using the criteria set out in Table 4.2 the following should be taken into account:

- AQAL – Air Quality Assessment Level which in this assessment refers to the Air Quality Objectives (AQO's) set out in Table 3.1;
- The percentage change in concentration should be rounded to a whole number;
- The table should only be used with annual mean concentrations;
- The descriptors are for individual receptors only: overall significance should be based on professional judgment;
- When defining the concentrations as a percentage of the AQAL use the 'without scheme' concentration where there is a decrease in pollutant concentrations and the 'with scheme' concentrations for an increase;
- The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure, less than 75% of this value i.e. well below, the degree of harm is likely to be small. As exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL;
- It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year, it is impossible to define the new total concentrations without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

5.0 BASELINE ASSESSMENT

5.1 Oxford City Council Review and Assessment

OCC have identified areas of relevant exposure where the UK air quality objective limits are being exceeded and declared Air Quality Management Areas (AQMAs). The Site is located within the Oxford city wide AQMA.

5.2 Air Quality Monitoring

5.2.1 Nitrogen Dioxide

OCC monitors NO_2 concentrations extensively across the borough using automatic and non-automatic (passive) monitoring sites. Four of these are located within proximity to the Development. Details of the monitoring sites and data recorded since 2018 are set out in Table 5.1.

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

To allow the results to be reliably compared with the AQ Objectives, the data should be bias corrected using data collected from tubes co-located with continuous monitoring sites. The data provided in Table 5.1 below has been adjusted by KC using national bias adjustment factors obtained from the Defra LAQM website[19].

Table 5.1
Diffusion Tube Annual Average NO_2 Concentrations (µg/m^3)

Site	Classification	Year				
		2018	2019	2020	2021	2022
D80	R	-	37	31	35	34
D91	R	-	-	-	36	28
TF30	R	-	-	-	-	34
TF32	R	-	-	-	-	20

R – Roadside
Numbers in **BOLD** indicate an exceedance of the annual mean objective of 40 µg/m^3.

The data set out in Table 5.1 shows annual mean NO_2 concentrations are well below the objective limit of 40 µg/m^3 at roadside locations near the Site.

As detailed previously, where annual mean NO_2 concentrations are found to exceed 60 µg/m^3 there is a risk that the 1-hour objective is also being exceeded. Based on the data set out in Table 5.1 it is unlikely that concentrations are exceeding the 1-hour objective at the monitoring sites.

[19] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/national-bias/

5.2.2 Particulate Matter (PM_{10} and $PM_{2.5}$)

No monitoring of PM_{10} or $PM_{2.5}$ is carried out within OCC within 5 km of the site.

5.3 Predicted Baseline Concentrations

Pollutant concentrations predicted as part of the detailed modelling exercise in 2022 and the future 2025 Do Minimum scenario are set out in Table 5.2.

The data shows that predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are currently meeting the relevant objective limits set out in Table 3.1 at all existing receptor locations.

As annual mean NO_2 concentrations are predicted to be below 60 µg/m, concentrations are also predicted to be meeting the short-term objective limit for NO_2 at all the selected receptors.

Predicted annual mean PM_{10} concentrations are predicted to be less than 32 µg/m^3, concentrations are therefore meeting the short-term objective limit for PM_{10}.

The data shows no significant change in concentrations of PM_{10} and $PM_{2.5}$ between the 2022 and 2025 base years. In contrast NO_2 concentrations are predicted to decline between the two base years at all receptor locations. This is due to improvements within the emissions of fuel driven vehicles in conjunction with an increase in the number of low emissions and electric vehicles within the vehicle fleet in future years. As vehicle related emissions make up a significantly smaller proportion of total PM matter compared to NO_2, the reductions in vehicle emissions are not seen to such an extent in future PM concentrations.

Table 5.2
Predicted Annual Mean Baseline Air Quality (µg/m^3)

Receptor	2019 Baseline			2024 Do Minimum		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	18.5	16.5	11.2	17.5	16.5	11.2
R2	26.3	17.5	11.8	23.5	17.5	11.8
R3	18.9	16.6	11.3	17.8	16.7	11.3
R4	29.0	18.7	12.2	25.3	18.7	12.2
R5	33.7	19.9	13.2	30.0	20.0	13.2
R6	23.9	17.8	12.0	21.3	17.8	11.9

5.4 DEFRA Background Maps

Additional information on estimated background pollutant concentrations has been obtained from the DEFRA background maps provided on UK-AIR, the Air Quality Information Resource (http://uk-air.defra.gov.uk).

Estimated air pollution concentrations for NO_2 PM_{10} and $PM_{2.5}$ have been extracted from the 2018 based background pollution maps for the UK for 2022. These maps are available in 1 km x 1 km grid squares. Concentrations have been taken from the grid square representing the Site. In order to provide a robust assessment, background mapping data for 2022 has been used in the 2025 scenarios.

The annual mean for each pollutant is provided in Table 5.3.

Table 5.3
Annual Mean Background Air Pollution Concentrations at the Development Site

OS Grid Reference	2022		
	Nitrogen dioxide (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
425500, 204500	14.1	15.4	10.6
455500, 203500	13.4	15.1	10.1
455500, 204500	18.7	16.8	11.4
454500, 203500	13.6	15.8	10.8

The data indicates that background concentrations at the site are estimated to be below the annual mean objectives for NO_2, PM_{10} and $PM_{2.5}$.

5.5 Air Quality at the Development Site

The development site is located immediately south of the A58 in close proximity to Garsington Road and the Oxford Eastern Bypass. NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted as part of the baseline assessment indicate that the objective limits for all three pollutants are currently considerably below the relevant objective limits at receptors at receptors in equivalent locations (Table 5.2). Concentrations of all three pollutants are therefore expected to be meeting the relevant objective limits at all locations within the Site.

6.0 OPERATIONAL IMPACTS

6.1 Construction Impacts

6.1.1 Site and Surroundings

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

The total area of the Site being developed covers approximately 12,000m^2 and there are residential properties located to the west of the Site within 250m. An assessment of construction related impacts in relation to human receptors has therefore been undertaken.

Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50m from the site boundary. A review of data held on the DEFRA MAGIC website shows no sites designated as important for wildlife within 50m of the Site, therefore impacts on ecological receptors have not been considered any further within this assessment.

As discussed in Section 5, the PM_{10} concentrations, taken from the DEFRA background maps, in the vicinity of the Site are expected to be below the relevant objective limits (Table 5.2). The data indicates background concentrations in the region of 15-16 µg/m^3. Based on professional judgment, it is anticipated that PM_{10} concentrations at the Site and at adjacent properties are unlikely to be much higher than background, therefore PM_{10} concentrations are expected to be below 24µg/m^3.

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

6.1.2 Risk Assessment of Dust Impacts

Defining the Dust Emission Magnitude

With reference to the criteria detailed in Appendix B, the dust emission magnitude for each of the category's demolition, earthworks, construction and trackout have been determined. These have been summarised in Table 6.1

Table 6.1
Dust Emission Magnitude

Activity	Criteria	Dust Emission Magnitude
Demolition	Building volume to be demolished approx. 12,000 - 75000 m^3.	Medium
Earthworks	Building site area approximately approx. 12,000 m^2.	Small
Construction	Building volume approx. 50,000 m^3, main construction material brick and concrete.	Medium
Trackout	10-12 HDV (<3.5t) movements per day, no unpaved road access.	Small

Sensitivity of Surrounding Area

Using the criteria set out in Tables B2 to B4 in Appendix B, the sensitivity of the surrounding area to impacts from dust emissions has been determined and are set out in Table 6.2.

Dust Soiling

There are residential properties located immediately adjacent to the west of the Site boundary. There are medium sensitivity receptors located immediately adjacent to the Site boundary on the north and south. Given the proximity and number of sensitive residential and medium sensitivity receptors, the overall sensitivity of the surrounding area is considered to be 'high'.

It is anticipated that there will be no more than 10 HDV (>3.5t) movements per day during the construction phase which would travel along John Smith Road and Garsington Road. The sensitivity of the area to dust soiling effects from trackout is therefore considered to be 'high' as this route moves toward existing sensitive receptors.

PM_{10} Effects

As previously discussed, annual mean PM_{10} concentrations in the vicinity of the Site are expected to be below 24 µg/m^3. Based on the proximity of sensitive receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be 'low' with regards human health impacts.

Table 6.2
Sensitivity of Receptors

Potential Impact		Sensitivity at Site
Dust Soiling (demolition, earthworks and construction)	Receptor Sensitivity	High
	Number of Receptors	10-100 high sensitivity receptors within 20 m
	Sensitivity of the area	High
Dust Soiling (trackout)	Receptor Sensitivity	High
	Number of Receptors	10-100 high sensitivity receptors within 20 m
	Sensitivity of the area	High
Human Health (demolition, earthworks and construction)	Receptor Sensitivity	High
	Annual mean PM_{10} Concentrations	<24 µg/m^3
	Number of Receptors	10-100 high sensitivity receptors within 20 m
	Sensitivity of the area	Low
Human Health (trackout)	Receptor Sensitivity	High
	Annual mean PM_{10} Concentrations	<24 µg/m^3
	Number of Receptors	10-100 high sensitivity receptors within 20 m
	Sensitivity of the area	Low

Defining the Risk of Impacts

The dust emission magnitude as set out in Table 6.1 is combined with the sensitivity of the area (Table 6.2) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site. The risk of impacts associated with each activity is provided in Table 6.3 below and has been used to identify site-specific mitigation measures, which are discussed in Section 7.1 and set out in Appendix C.

Table 6.3
Summary of Effects Without Mitigation

Source	Dust Soiling	PM_{10} Effect	Ecological
Demolition	Medium Risk	Low Risk	N/A
Earthworks	Low Risk	Negligible Risk	N/A
Construction	Medium Risk	Low Risk	N/A
Trackout	Low Risk	Negligible Risk	N/A

6.2 Human Health Receptors

6.2.1 NO_2 Concentrations

Annual mean NO_2 concentrations predicted at the selected sensitive receptors are presented in Table 6.4.

The modelling is predicting annual mean concentrations well below the objective at all receptor locations during both the 2025 DM and DS scenarios.

The modelling is predicting an increase in NO_2 concentrations of 0.1 µg/m^3 as a result of the Development at receptors R2 and R4. No change in annual mean NO_2 concentrations as a result of traffic generated by the operational development is predicted at the remaining receptors. With concentrations remaining well below the objective limit, the impact is classed as being negligible based on the criteria set out in Table 4.2.

In terms of short-term NO_2 concentrations, the modelling is predicting annual mean concentrations below 60 µg/m^3 at all receptor locations. Therefore, the change in NO_2 in terms of short-term concentrations would also be negligible.

Table 6.4
Predicted Annual Mean NO_2 at Existing Receptors

Receptor	2025 DM (µg/m^3)	2025 DS (µg/m^3)	Change in NO_2 as a % of the AQAL	Significance of Impact
R1	17.5	17.5	0	Negligible
R2	23.5	23.6	0	Negligible
R3	17.8	17.8	0	Negligible
R4	25.3	25.4	0	Negligible
R5	30.0	30.0	0	Negligible
R6	21.3	21.3	0	Negligible

6.2.2 PM_{10} Concentrations

Annual mean PM_{10} concentrations predicted at the Site are set out in Table 6.5.

Annual mean PM_{10} concentrations are predicted to be well below the AQAL at all receptor locations under the 2025 DM and DS scenarios.

The modelling is predicting an increase in PM_{10} concentrations of 0.1 µg/m^3 as a result of the Development at receptors R1 and R4. No change in annual mean PM_{10} concentrations is predicted at any other receptor locations as a result of traffic emissions associated with the operational development and therefore a negligible impact.

Annual mean concentrations are predicted to be below 32 µg/m^3 at all receptors and therefore concentrations are meeting the 24-hour objective at all receptors and the impact on short-term PM_{10} is also deemed to be negligible.

Table 6.5
Predicted Annual Mean PM_{10} at Existing Receptors

Receptor	2025 DM (µg/m^3)	2025 DS (µg/m^3)	Change in NO_2 as a % of the AQAL	Significance of Impact
R1	16.5	16.6	0	Negligible
R2	17.5	17.5	0	Negligible
R3	16.7	16.7	0	Negligible
R4	18.7	18.8	0	Negligible
R5	20.0	20.0	0	Negligible
R6	17.8	17.9	0	Negligible

6.2.3 $PM_{2.5}$ Concentrations

Annual mean $PM_{2.5}$ concentrations predicted at the Site are set out in Table 6.6.

Annual mean $PM_{2.5}$ concentrations are predicted to remain well below the AQAL of 20 µg/m^3 at all receptor locations under the 2024 DM and DS scenarios.

The operational development is not predicted to result in a change in annual mean $PM_{2.5}$ concentrations at all receptor locations as a result of traffic emissions associated with the operational development and therefore a negligible impact.

Table 6.6
Predicted Annual Mean $PM_{2.5}$ at Existing Receptors

Receptor	2023 DM (µg/m^3)	2023 DS (µg/m^3)	Change in NO_2 as a % of the AQAL	Significance of Impact
R1	11.2	11.2	0	Negligible
R2	11.8	11.8	0	Negligible
R3	11.3	11.3	0	Negligible
R4	12.2	12.2	0	Negligible
R5	13.2	13.2	0	Negligible
R6	11.9	11.9	0	Negligible

6.3 Emissions from Fume Cupboards

All fume cupboards to be installed as part of the Proposed Development will be designed in line with BS EN1417520. This states that the discharge velocity from fume cupboard extracts should be at least 7 m/s but that a figure of 10 m/s is preferable to ensure the discharge will not be trapped in the aerodynamic wake of the stack.

The extract flues will also be designed in line with BS EN1417520 and will be designed appropriately to ensure sufficient dispersion of discharge. The flues will terminate at least 3 m above the highest point of the building.

The end tenant or tenants of the Proposed Development are currently unknown. However, it is likely that the laboratories will be for low-risk laboratory users.

Provided BS EN1417520 is complied with and that the end tenant or tenants are of suitably low risk, any impacts to air quality are considered to be negligible at this stage of the design process.

6.4 Emissions from Energy Generation

An energy statement has been prepared and submitted as part of the application by the project team's energy consultants, Clancy Consulting. It is confirmed in this statement that no on-site combustion i.e., Combined Heat and Power plant or Biomass Fuel Burner will be installed as part of the Development. Furthermore, it has been confirmed that the Development will be heated by electrical means and as such no gas fired boilers are to be installed.

Based upon the provided energy statement, any impacts to air quality are considered to be negligible as a result of the heating and powering of the Development.

7.0 MITIGATION

7.1 Construction Phase

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

The proposed development has been identified as a medium -risk site for dust soiling effects during demolition and construction and a low or negligible-risk site during earthworks and trackout. For human health, the Site has been identified as a negligible -risk site as set out in Table 6.3.

The developer should therefore implement appropriate dust and pollution control measures as set out within the IAQM guidance. A summary of these measures is set out in Appendix C. The proposed measures should be set out within a CMP and approved by OCC prior to commencement of any work on site.

Following implementation of the measures recommended for inclusion within the CMP the impact of emissions during construction of the proposed development would be **negligible**.

7.2 Operational Phase

The assessment has shown that the operational development would have a **negligible** impact on local air quality and as such no mitigation measures are required.

8.0 CONCLUSIONS

Dragonfly Consulting has been commissioned by Advanced Research Clusters GP Limited to prepare this air quality assessment in support of a full planning application at Plot 4200, ARC Oxford, John Smith Drive, Oxford.

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

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

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

Detailed modelling of traffic emissions has been undertaken to predict the impact of the operational development on local air quality. The assessment has taken into account the change in trips on the existing road network and the increase in traffic related emissions due to the proposed commercial Development.

The assessment has concluded a negligible impact on NO_2, PM_{10} and $PM_{2.5}$ concentrations at existing sensitive receptors as a result of the operational development.

Based on the above the proposals are meeting the requirements of both national and local planning policy and air quality does not pose a constraint to development of the Site as proposed.

Appendix A – Glossary of Terminology

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

Appendix B – IAQM Construction Dust Assessment Procedure

In order to assess the potential impacts, the activities on construction sites are divided into four categories. These are:

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

For each activity, the risk of dust annoyance, health and ecological impact is determined using three risk categories: low, medium and high risk. The risk category may be different for each of the four activities. The risk magnitude identified for each of the construction activities is then compared to the number of sensitive receptors in the near vicinity of the site in order to determine the risks posed by the construction activities to these receptors.

Step 1: Screen the Need for an Assessment

The first step is to screen the requirement for a more detailed assessment. An assessment is required where there is:

- a 'human receptor' within 250m of the boundary of the site or 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s); and/or
- an 'ecological receptor' within 50m of the boundary of the site; or 50m of the route(s) used by the construction vehicles on the public highway, up to 250m from the site entrance(s).

Step 2A: Define the Potential Dust Emission Magnitude

This is based on the scale of the anticipated works and the proximity of nearby receptors. The risk is classified as small, medium or large for each of the four categories.

Demolition: The potential dust emission classes for demolition are:

- Large: Total building volume >75,000m^3, potentially dusty construction material (e.g. Concrete), on site crushing and screening, demolition activities >20m above ground level;
- Medium: total building volume 12,000m^3 – 75,000m^3, potentially dusty construction material, demolition activities 6-12 m above ground level; and
- Small: total building volume <12,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <6m above ground, demolition during wetter months.

Earthworks: This involves excavating material, haulage, tipping and stockpiling. The potential dust emission classes for earthworks are:

- Large: Total site area >110,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;

- Medium: Total site area 18,000 m^2 – 110,000m^2, moderately dusty soil (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonnes- 100,000 tonnes; and
- Small: Total site area <18,000m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction: The important issues here when determining the potential dust emission magnitude include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. The categories are:

- Large: Total building volume >75,000m^3, on site concrete batching, sandblasting;
- Medium: Total building volume 12,000m^3 – 75,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- Small: Total building volume <12,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

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

- Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m;
- Medium: 25-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content, unpaved road length 50-100m; and
- Small: <25 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length >50m.

Step 2B: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health (PM_{10}) and ecological receptors. The sensitivity of the area takes into account the following factors:

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

Table B1 is used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Based on the sensitivities assigned to the different receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification can be defined for each. Tables B2 to B4 indicate the criteria used to determine the sensitivity of the area to dust soiling, human health and ecological impacts.

Table B1
Examples of Factors Defining Sensitivity of an Area

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
High	Users can reasonably expect enjoyment of a high level of amenity The appearance, aesthetics or value of their property would be diminished by soiling' The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. E.g. dwellings, museums and other important collections, medium and long term car parks and car showrooms.	10 – 100 dwellings within 20 m of site. Local PM_{10} concentrations close to the objective (e.g. annual mean 36-40 µg/m^3). E.g. residential properties, hospitals, schools and residential care homes.	Locations with an international or national designation and the designated features may be affected by dust soiling. Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red List for Great Britain. E.g. A Special Area of Conservation (SAC).
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. The appearance, aesthetics or value of their property could be diminished by soiling 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. E.g. parks and places of work	Less than 10 receptors within 20m. Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 µg/m^3). E.g. office and shop workers but will generally not include workers occupationally exposed to PM_{10} as protection is covered by the Health and Safety at Work legislation.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. Locations with a national designation where the features may be affected by dust deposition E.g. A Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	The enjoyment of amenity would not reasonably be expected. Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. 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. E.g. playing fields, farmland unless commercially sensitive horticultural, footpaths, short lived car parks and roads.	Locations where human exposure is transient. No receptors within 20m. Local PM_{10} concentrations well below the objectives (less than 75%). E.g. public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be affected by dust deposition. E.g. Local Nature Reserve with dust sensitive features.

Table B2
Sensitivity of the Area to Dust Soiling on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Low	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table B3
Sensitivity of the Area to Human Health

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 μg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 μg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 μg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 μg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 μg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 μg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 μg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 μg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table B4
Sensitivity of the Area to Ecological Impacts

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

Define the Risk of Impacts

The final step is to combine the dust emission magnitude determined in step 2A with the sensitivity of the area determined in step 2B to determine the risk of impacts with no mitigation applied. Tables B5 to B7 indicate the method used to assign the level of risk for each construction activity. The identified level of risk is then used to determine measures for inclusion within a site-specific Construction Management Plan (CMP) aimed at reducing dust emissions and hence reducing the impact of the construction phase on nearby receptors. The mitigation measures are drawn from detailed mitigation set out within the IAQM guidance document.

Table B5
Risk of Dust Impacts from Demolition

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table B6
Risk of Dust Impacts from Earthworks/Construction

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table B7
Risk of Dust Impacts from Trackout

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix C – Construction Mitigation Measures

It is recommended that the 'highly recommended' measures set out below are incorporated into a CMP and approved by ESC prior to commencement of any work on site:

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the CMP, record inspection results and make inspection log available to MSDC when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan 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;
- fully enclose site or specific operations where there is a high potential for dust production and the activities are being undertaken for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;
- 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;

- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials;
- 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 site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid bonfires and burning of waste materials;
- avoid scabbling where possible;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- record all inspections of haul routes and any subsequent action in a site log book;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud);
- ensure there is adequate area of hard surfaced road between the wheel wash facility and the site exit where ever site size and layout permits.

Appendix D – Traffic Data used in ADMS Roads Dispersion Model

As detailed in Section 4.3.4, the following traffic data has been used in the assessment:

AADT Traffic Data for AQ Assessment - Plot 4200 ARC Oxford

ID	Link	2022 Base Flows			2025 Opening Year			2025 Opening Year + Dev			Speed Limit PSL
		Total	HGV	HGV%	Total	HGV	HGV%	Total	HGV	HGV%	(mph)
1	John Smith Drive	3,988	9	0.2%	4,172	9	0.2%	4,612	9	0.2%	20
2	Garsington Road (West of ARC Oxford)	15,455	45	0.3%	16,167	47	0.3%	16,211	47	0.3%	30
3	Garsington Road (East of ARC Oxford)	18,851	56	0.3%	19,720	59	0.3%	20,116	59	0.3%	30
4	A4142 Eastern By Pass North	54,948	762	1.4%	57,482	797	1.4%	57,636	797	1.4%	70
5	A4142 Eastern By Pass South	43,669	612	1.4%	45,683	641	1.4%	45,837	641	1.4%	70
6	B480 Watlington Road	20,000	463	2.3%	20,922	484	2.3%	21,010	484	2.3%	30

Appendix E – Verification and Adjustment of Modelling Concentrations

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions.

Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(22).

Verification of the model results has been carried out against data recorded at monitoring sites DT80, DT91, TF30 and TF32 (as detailed in Table 5.1). Verification has been carried out against 2022 monitoring data.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NOx (Figure E1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the DEFRA NOx from NO_2 calculator available on the UK-AIR website.

Figure E1
Comparison of Modelled Road NOx with Measured Road NOx

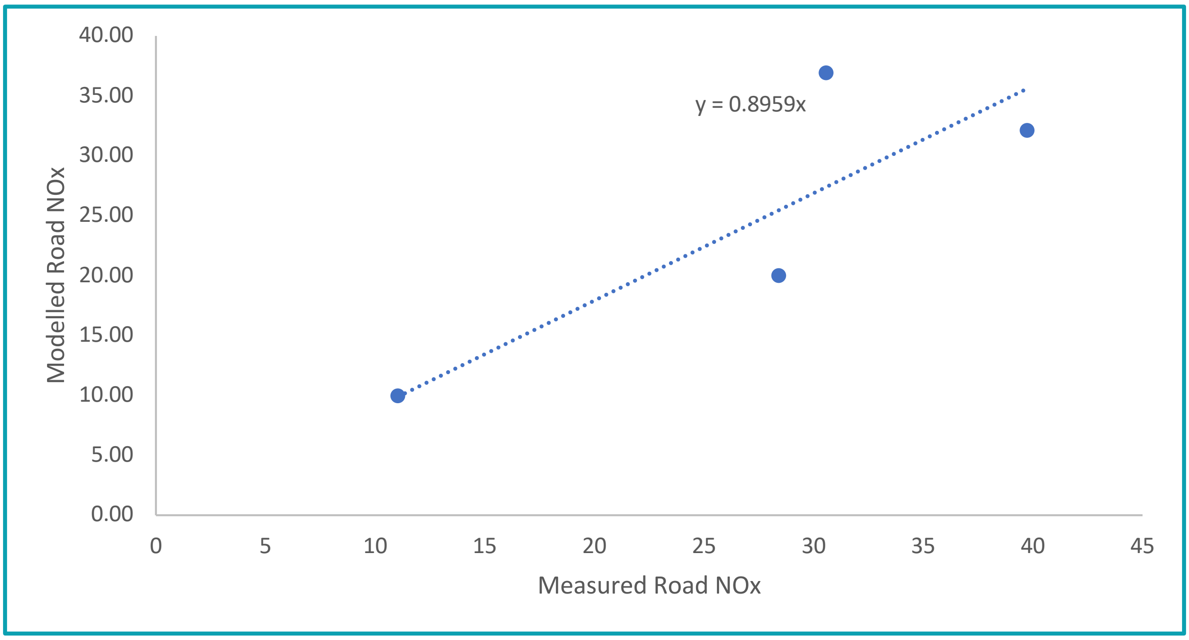
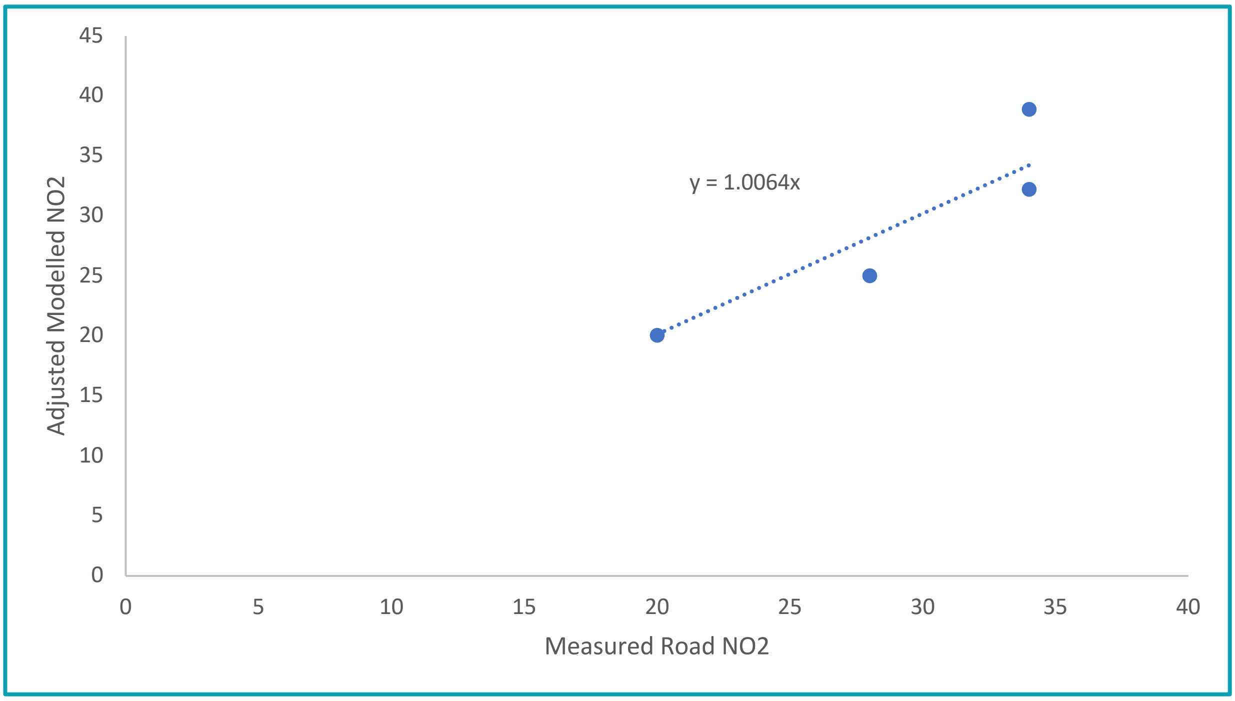


Figure E1 shows that the ADMS model is under-predicting the road-NO_x concentrations at the monitoring sites. An adjustment factor has therefore been determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.8959 = 1.1161). This factor has been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

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

Figure E2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO_2, was calculated (1/1.0064=0.9936).

Figure E2
Comparison of Modelled NO_2 with Measured NO_2



After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO_2.

The adjustment factor of 1.1161 has been applied to the modelled NOx-road concentrations predicted at all receptor locations. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 concentrations and adjusted by 0.9936 to provide the final predicted annual mean NO_2 concentrations at each receptor.

The RMSE of the unadjusted results was calculated as 6.5 µg/m^3. However, following adjustment using both the primary and secondary adjustment factors set out above the RMSE was reduced to 2.9 µg/m^3, below the preferred 4 µg/m^3.

The above factors have also been applied to the predicted PM_{10} and $PM_{2.5}$ concentrations**.**