Oxford Technology Park

Air Quality Assessment

On behalf of **Hill Street Holdings Ltd**

Project Ref: 23588/1009 | Rev: Issued | Date: November 2016

Office Address: 10 Queen Square, Bristol, BS1 4NT
T: +44 (0)117 332 7840 E: bristol@peterbrett.com

Document Control Sheet

Project Name: **Oxford Technology Park**

Project Ref: **23588/1009**

Report Title: **Air Quality Assessment**

Doc Ref: **Issued**

Date: **November 2016**

	Name	Position	Signature	Date
Prepared by:	Yelena Ortega	Assistant Air Quality Scientist	[redacted]	November 2016
Reviewed by:	Graham Harker	Senior Associate		November 2016
Approved by:	Anthony Russell	Partner		November 2016
For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
Draft	September 2016	Draft for client comment	YO	GH	APR
Issued	November 2016	Issued	YO	GH	APR

Contents

1 Introduction 1
1.1 Proposed Development 1
1.2 Scope of Assessment 1
1.3 Consultation 1
2 Legislation and Policy 2
2.1 The Air Quality Strategy 2
2.2 EU Limit Values 2
2.3 Planning Policy 3
3 Methodology 6
3.1 Existing Conditions 6
3.2 Construction Impacts 6
3.3 Road Traffic Impacts 9
4 Baseline Conditions 13
4.1 LAQM 13
4.2 Monitoring 13
4.3 Background Concentrations 14
4.4 Predicted Baseline Concentrations 14
5 Impact Assessment 16
5.1 Construction Impacts 16
5.2 Road Traffic Impacts 16
6 Mitigation 19
6.1 Construction 19
6.2 Operation 20
7 Low Emissions Statement 21
7.1 Introduction 21
7.2 Emissions Calculations 21
7.3 Damage Cost Calculation 21
8 Conclusions 22

Tables

Table 3.1: Criteria for Dust Emission Magnitude 6
Table 3.2: Area Sensitivity Definitions 7
Table 3.3: Risk of Dust Impacts 8
Table 3.4: Receptor Locations Description 9
Table 3.5: NO_2 and PM_{10} Objectives 10
Table 3.6: Impact Magnitude for Changes in Ambient Pollutant Concentrations 11
Table 3.7: Impact Descriptor for Changes in Concentration at a Receptor 11
Table 4.1: Measured NO_2 Concentrations, (2011-2015) 13
Table 4.2: Estimated Annual Mean Background Concentrations 14

Table 4.3: Predicted Baseline Concentrations of NO_2 and PM_{10} in 2015 and 2025 14
Table 5.1: Predicted Concentrations of NO_2 and PM_{10} at Existing Receptors 16
Table 5.2: Change in Predicted Concentrations brought about by the Development 17

Appendices

Appendix A Glossary
Appendix B References
Appendix C Model Verification
Appendix D Traffic Data
Appendix E Future Year Emissions Calculations
Appendix F Figures

1 Introduction

1.1 Proposed Development

1.1.1 Hill Street Holdings Ltd has commissioned Peter Brett Associates LLP (PBA) to undertake an air quality assessment to address the planning conditions associated with the proposed Oxford Technology Park located at Kidlington. The following planning conditions have been applied to the planning permission:

> *Planning Condition 12 - "Prior to the commencement of the development hereby permitted a detailed air quality impact assessment to identify the impact of the development on local air quality shall be submitted to and approved in writing by the Local Planning Authority. No development shall take place the Local Planning Authority has given its written approval that it is satisfied that the impact of the development on air quality has been adequately quantified. Reason – In order to safeguard the amenities of the area and to comply with Policy ENV1 of the Cherwell Local Plan 1996."*
>
> *Planning Condition 14 - "Prior to the commencement of the development hereby permitted measures to encourage the uptake of low emission transport, shall be submitted to and approved in writing, by the Local Planning Authority. No development shall take place until the Local Planning Authority has given its written approval that measures are in place which mitigate the impact of the development on local air quality and support the uptake of low emissions technologies now and in the future. Reason - In order to safeguard the amenities of the area and to comply with Policy ENV1 of the Cherwell Local Plan 1996."*

1.2 Scope of Assessment

1.2.1 This report has been prepared to answer the above planning conditions. It describes existing air quality within the study area and assesses the impact of construction and operational activities on local air quality. It includes a description of the measures that will be incorporated to encourage the uptake of low emission transport.

1.2.2 The proposed development will not include an energy centre. Therefore, an assessment of the effect of potential energy centre emissions has been scoped out.

1.2.3 The main air pollutants of concern related to construction are dust and fine Particulate Matter (PM_{10}), and road traffic are Nitrogen Dioxide (NO_2) and PM_{10}.

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

1.3 Consultation

1.3.1 Consultation has been carried out with the Environmental Health Officer (EHO) at Cherwell District Council (CDC), Sean Gregory (e-mail 4th July 2016), to obtain the latest air quality monitoring for the Council.

2 Legislation and Policy

2.1 The Air Quality Strategy

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

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

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

2.1.4 The Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16); Defra, 2016), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

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

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

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

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

2.3 Planning Policy

National Policy

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

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

2.3.2 Paragraph 124, also states that;

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

2.3.3 Paragraph 203 goes on to say;

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

Planning Practice Guidance

2.3.4 Planning Practice Guidance (PPG) (Planning Practice Guidance, 2014) was published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-001-20140306 of the PPG provides a summary as to why air quality is a consideration for planning;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*

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

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

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

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

Local Policy

2.3.10 The Cherwell Local Plan adopted in 1996 sets out the local development policies for the Council (Cherwell District Council, 1996). The Plan does not contain any specific policies relating to air quality, however, Policy ENV1 states:

"Development which is likely to cause materially detrimental levels of noise, vibration, smell, smoke fumes or other types of environmental pollution will not be permitted.

The Council will seek to ensure that the amenities of the environment, and in particular the amenities of residential properties, are not unduly affected by development proposals which may cause environmental pollution, including that caused by traffic generation."

2.3.11 The new Cherwell Local Plan (2011 – 2031) submitted in January 2014 will (upon its adoption) set out broadly the long term spatial vision for the District (Cherwell District Council, 2015). It considers Policy ESD 10 'Protection and Enhancement of Biodiversity and the Natural Environment', which states:

"Protection and enhancement of biodiversity and the natural environment will be achieved by the following: Air quality assessments will also be required for development proposals that would significantly adversely impact on biodiversity by generating an increase in air pollution"

2.3.12 A Draft Planning Obligations SPD provides guidance on the level of contribution which will be required in order to compensate for loss or damage created by a development, or to mitigate a development's impact. It sets out the range of mitigation measures which may be required, as well as the means of calculating financial contributions towards measures or monitoring, based on the cost of Air Quality Action Plan measures. CDC has resolved to declare an AQMA at Bicester Road, Kidlington. To date, Cherwell District Council has not prepared an Air Quality Action Plan for its existing AQMAs.

3 Methodology

3.1 Existing Conditions

3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by CDC. Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2016).

3.2 Construction Impacts

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

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

3.2.3 The Institute of Air Quality Management (IAQM) has issued revised guidance on the assessment of dust from demolition and construction (Holman et al, 2014). The IAQM guidance recommends that the risk of dust generation is combined with the sensitivity of the area surrounding the site to determine the risk of dust impacts from construction and demolition activities. Depending on the level of risk (high, medium, low or negligible) for each activity, appropriate mitigation is selected.

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

3.2.5 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2014 guidance (**Table 3.2**), taking into account professional judgement.

Table 3.1: Criteria for Dust Emission Magnitude

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

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

Table 3.2: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50 m 10 – 100 dwellings within 20 m	National or Internationally designated site within 20 m with dust sensitive features / species present

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

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

Table 3.3: Risk of Dust Impacts

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

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

Significance Criteria

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

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

3.3 Road Traffic Impacts

Sensitive Locations

3.3.1 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

3.3.2 Based on the above criteria, fifteen existing properties have been identified as residential receptors for the assessment. The locations of existing residential receptors were chosen to represent locations where impacts from road traffic related to the proposed development are likely to be the greatest, i.e. as a result of development traffic at junctions. These locations are described in **Table 3.4**. Receptors were modelled at a height of 1.5 m and 4.5 m representing ground and first floor exposure (shown in **Figure 1**).

3.3.3 Concentrations have also been predicted at four monitoring locations; Langford Lane 2014, Oxford Road, Bramley Close and Bicester Road (2), in order to verify the modelled results (see **Appendix C** for further details on the verification method). Diffusion tubes 'Water Eaton Lane' and 'Bicester Road South', which are also located in close proximity to the development site; are not included within the model verification, as data capture was only undertaken for the month of January in 2015, which is not sufficiently representative of the annual conditions at those locations (please refer to the Cherwell District Council Annual Status Report (ASR) 2016).

Table 3.4: Receptor Locations Description

Receptor	Location	Height (m)
R1	Campsfield Wood, Oxford Rd	1.5
R2	39 Blandon Road	1.5
R3	21 Upper Campsfield Rd	1.5
R4	1 Campsfield Cottages, Woodstock Rd	1.5
R5	89 Woodstock Rd	1.5
R6	23 Even lode Crescent	1.5
R7	1 Banbury Rd	1.5
R8	61 A4260 Oxford Road	1.5
R9	144 Oxford Road	4.5
R10	1 to 7 Mulberry Court	1.5
R11	4 Bicester Rd	1.5
R12	Gosford House, Bicester Rd	1.5
R13	121 Bicester Rd	1.5
R14	1 Water Eaton Lane	1.5
R15	368 Oxford Road	1.5

Impact Predictions

3.3.4 Predictions have been carried out using the ADMS-Roads dispersion model (v4.0.1). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2015 meteorological data from the Brize Norton meteorological station, which is considered suitable for this area.

3.3.5 AADT flows and the proportions of HDVs, for roads within 250 m of the proposed development site and air quality monitoring stations have been provided by Peter Brett Associates. Traffic data used in this assessment is summarised in **Appendix D**.

3.3.6 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v6.0.1, which is incorporated within ADMS-Roads. The traffic data were entered into ADMS-Roads, along with speed data to provide combined emission rates for each of the road links entered into the model. In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been carried out utilising 2023 emission factors and background concentrations combined with traffic data from 2025, this is considered a conservative assumption of emissions in the future. **Appendix E** provides a justification for the selection of future year vehicle emission factors.

Assessment Criteria

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

Table 3.5: NO_2 and PM_{10} Objectives

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

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

Significance

3.3.9 There is no official guidance in the UK on how to assess the significance of air quality impacts of a new development. The approach developed by the IAQM and Environmental Protection UK (EPUK) has therefore been used (Moorcroft and Barrowcliffe et al, 2015).

3.3.10 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

3.3.11 **Table 3.6** sets out the impact magnitude descriptors, whilst **Table 3.7** sets out the impact descriptors.

Table 3.6: Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (% Change in Concentration)	Annual Mean NO_2 and PM_{10} (40 µg/m³)	Annual Mean $PM_{2.5}$ (25 µg/m³)	Annual Mean of 32 µg/m³ equating to 35 days above 50 µg/m³ for PM_{10}
Large (>10%)	> 4 µg/m³	> 2.5 µg/m³	> 3.2 µg/m³
Medium (>5% - ≤10%)	>2 – ≤4 µg/m³	>1.25 – ≤2.5 µg/m³	>1.6 - ≤3.2 µg/m³
Small (>1% - ≤5%)	>0.4 – ≤2 µg/m³	>0.25 – ≤1.25 µg/m³	>0.32 - ≤1.6 µg/m³
Imperceptible (≤1%)	≤0.4 µg/m³	≤0.25 µg/m³	≤0.32 µg/m³

Table 3.7: Impact Descriptor for Changes in Concentration at a Receptor

% Changes in Concentration with development in relation to Objective / Limit Value	Emission Magnitude			
	Imperceptible	Small	Medium	Large
> 110 % (a)	Moderate	Substantial	Substantial	Substantial
>102% - ≤110% (b)	Moderate	Moderate	Substantial	Substantial
>95% - ≤102% (c)	Slight	Moderate	Moderate	Substantial
>75% - ≤95% (d)	Negligible	Slight	Moderate	Moderate
≤75% (e)	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse, and where it decreases as beneficial.
(a) NO_2 or PM_{10}: > 44µg/m³ annual mean; $PM_{2.5}$ >27.5µg/m³ annual mean; PM_{10} >35.2µg/m³ annual mean (days).
(b) NO_2 or PM_{10}: > 40.8 – ≤ 44µg/m³ annual mean; $PM_{2.5}$ > 25.5 – ≤27.5µg/m³ annual mean; PM_{10} >32.64 – ≤35.2 µg/m³ annual mean (days).
(c) NO_2 or PM_{10}: > 38 – ≤40.8µg/m³ annual mean; $PM_{2.5}$ >23.75 – ≤25.5µg/m³ of annual mean; PM_{10} >30.4 – ≤32.64µg/m³ annual mean (days).
(d) NO_2 or PM_{10}: >30 - ≤38µg/m³ annual mean; $PM_{2.5}$ >18.75 - ≤23.75µg/m³ annual mean; or <24 - ≤ 30.4µg/m³ annual mean (days).
(e) NO_2 or PM_{10}: ≤30 µg/m³ annual mean; $PM_{2.5}$ ≤18.75 µg/m³ annual mean; PM_{10} ≤24µg/m³ annual mean (days).

3.3.12 The guidance states that the assessment of significance should be based on professional judgement, taking into account factors including:

- the number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance;
- the magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 3.6** and **3.7** findings;
- whether or not an exceedance of an objective or limit value is predicted to arise in the operational study area (where there are significant changes in traffic) where none existed before or an exceedance area is substantially increased;
- the uncertainty, comprising the extent to which worst-case assumptions have been made; and
- the extent to which an objective or limit value is exceeded.

3.3.13 Where impacts can be considered in isolation at an individual receptor, moderate or substantial impacts (i.e. per **Table 3.6**) may be considered to be a significant environmental effect, whereas negligible or slight impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is significant or not.

Assumptions and Limitations

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

3.3.15 A disparity between national road transport emissions projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean nitrogen oxides and NO_2 concentrations from road traffic emissions should have fallen significantly over the past 6 – 8 years, at many monitoring sites levels have remained relatively stable, or have shown a slight increase.

3.3.16 The complete development modelling has been based on 2023 emission factors and background concentrations, whilst utilising traffic flows for 2025. The model has been verified against 2015 monitoring data. This is considered to provide an appropriately conservative assessment taking into account the uncertainties regarding future vehicle emission factors.

4 Baseline Conditions

4.1 LAQM

4.1.1 CDC has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, four AQMAs have been declared due to exceedances of the annual and hourly mean NO_2 objective. The proposed site is not located within an AQMA, the closest one to the site is the AQMA No 3 located at Bicester Road, approximately 2.6 km south east of the site.

4.2 Monitoring

Nitrogen Dioxide

4.2.1 CDC carries out automatic monitoring stations which are outside of the study area for this assessment. The Council also deploys NO_2 diffusion tubes at a number of locations (**Figure 2**). In 2015, the Council undertook passive (diffusion tube) monitoring at 42 locations. The diffusion tubes for 2015 were prepared and analysed by Environmental Scientific Group Didcot using a preparation of 50% TEA in Acetone. The national adjustment factor of 0.81 was used to bias adjust concentrations at the tubes for 2015. The closest and most representative monitoring locations are described in **Table 4.1** below.

Table 4.1: Measured NO_2 Concentrations, (2011-2015)

Site ID	Site Type	Within AQMA	Annual Mean (µg/m³)				
			2011	2012	2013	2014	2015
Langford Lane 2014*	R	N	-	-	-	20.9	21.5
Oxford Road*	R	N	34.1	32.4	31.1	29.6	28.3
Bramley Close*	R	N	-	-	29.6	29.9	29.5
Bicester Road (2)*	R	Y	**45.7**	**44.9**	**44.6**	**42.0**	**43.6**
Water Eaton Lane	R	N	-	-	-	-	30.8**
Bicester Road South	R	N	-	-	-	-	22.9**
Benmead Road	UB	N	-	-	-	-	12.4
Objective		**40**					

2011 - 2015 data taken from the Cherwell District Council, 2016
Exceedances of the objective in bold; R= Roadside; UB=Urban Background
*Used for model verification
**Insufficient data capture

4.2.2 Measured concentrations at the closest monitoring location to the development site, Langford Lane (circa 125 m), have been well below the relevant objective in 2014 and 2015. Measured concentrations at remaining monitoring locations have been below the objective, except for Bicester Road (2). Given the changes in monitoring locations and insufficient data capture there are no clear trends in monitoring results for the past five years.

PM_{10}

4.2.3 There is no PM_{10} monitoring undertaken in close proximity to the proposed development site.

4.3 Background Concentrations

4.3.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (Defra, 2016) (shown in **Table 4.2**). The background concentrations are all well below the relevant objectives.

Table 4.2: Estimated Annual Mean Background Concentrations

Year	Grid reference	Annual Mean (µg/m³)		
		NO_x	NO_2	PM_{10}
2015	445_215	15.7	15.8	18.8
	446_214	16.9	13.9	17.3
	446_215	16.4	11.4	16.8
	447_214	19.5	11.4	16.8
	448_214	21.6	11.9	16.8
	449_212	21.7	12.2	17.8
	449_213	20.7	13.9	17.3
	450_213	22.4	14.7	16.7
2023	445_215	11.9	11.7	17.9
	446_214	13.0	11.4	16.4
	446_215	12.6	8.8	15.9
	447_214	15.7	8.8	15.9
	448_214	17.6	9.3	15.9
	449_212	16.9	9.6	16.9
	449_213	16.6	11.4	16.4
	450_213	16.3	12.0	15.8
Objectives		**-**	**40**	**40**

4.4 Predicted Baseline Concentrations

4.4.1 The ADMS-Roads model has been run to predict baseline NO_2 and PM_{10} concentrations at each of the existing receptor locations identified in **Table 3.4**. The results for the baseline scenarios are presented in **Table 4.3** below.

Table 4.3: Predicted Baseline Concentrations of NO_2 and PM_{10} in 2015 and 2025

Receptor	Annual Mean (µg/m³)			
	NO_2		PM_{10}	
	2015	2025	2015	2025
R1	14.5	10.4	17.2	16.3

Receptor	Annual Mean (µg/m³)			
	NO_2		PM_{10}	
	2015	2025	2015	2025
R2	20.2	13.5	17.8	16.9
R3	30.5	19.0	18.9	17.9
R4	31.7	20.7	19.2	18.1
R5	22.3	14.8	19.2	18.3
R6	22.2	15.8	18.3	17.4
R7	30.5	20.5	18.7	17.7
R8	31.4	20.7	18.8	17.8
R9	21.3	15.4	17.6	16.6
R10	28.3	19.1	18.5	17.5
R11	24.0	16.7	18.0	17.1
R12	38.8	23.9	22.1	21.2
R13	37.5	23.3	21.6	20.6
R14	31.4	19.9	20.8	19.8
R15	24.3	16.8	18.4	17.5
Objectives	**40**		**40**	

4.4.3 The predicted annual mean NO_2 and PM_{10} objectives are not predicted to be exceeded at any of the existing receptor locations in 2015 and 2025.

5 Impact Assessment

5.1 Construction Impacts

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

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

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

5.1.3 Based on the IAQM criteria (**Table 3.1**), the dust emissions magnitude is considered to be low. The study area is considered to be of low sensitivity, as there are less than 10 dwellings within 20 m of the site boundary (**Table 3.2**). Appropriate mitigation corresponding to a low risk site is therefore required during the construction phase (**Table 3.3**). With appropriate mitigation in place the construction impacts are described as not significant.

5.2 Road Traffic Impacts

5.2.1 Predicted concentrations of NO_2 and PM_{10} at existing receptors in 2025, both without and with the proposed development in place are presented in **Table 5.1** below.

Table 5.1: Predicted Concentrations of NO_2 and PM_{10} at Existing Receptors

Receptor	Annual Mean (µg/m³)			
	2025 Without Development		2025 With Development	
	NO_2	PM_{10}	NO_2	PM_{10}
R1	10.4	16.9	10.5	16.3
R2	13.5	17.9	13.6	16.9
R3	19.0	18.1	19.1	17.9
R4	20.7	18.3	21.0	18.2
R5	14.8	17.4	14.9	18.3
R6	15.8	17.7	16.2	17.5
R7	20.5	17.8	20.8	17.8
R8	20.7	16.6	21.0	17.9
R9	15.4	17.5	15.5	16.7
R10	19.1	17.1	19.3	17.6
R11	16.7	21.2	16.9	17.1
R12	23.9	20.6	24.2	21.2
R13	23.3	19.8	23.6	20.7

Receptor	Annual Mean (µg/m³)			
	2025 Without Development		2025 With Development	
	NO_2	PM_{10}	NO_2	PM_{10}
R14	19.9	17.5	20.1	19.8
R15	16.8	16.9	16.9	17.5
Objectives	**40**		**40**	

5.2.3 The predicted NO_2 and PM_{10} concentrations in 2025 without and with the proposed development in place are below the relevant objectives at all existing receptor locations.

5.2.4 The changes in annual mean concentrations of NO_2 and PM_{10} are presented in **Table 5.2** below.

Table 5.2: Change in Predicted Concentrations brought about by the Development

Receptor	Annual Mean (µg/m³)	
	NO_2	PM_{10}
R1	0.0	0.0
R2	0.1	0.0
R3	0.2	0.0
R4	0.3	0.1
R5	0.2	0.0
R6	0.5	0.1
R7	0.3	0.1
R8	0.4	0.1
R9	0.1	0.0
R10	0.3	0.1
R11	0.2	0.0
R12	0.3	0.1
R13	0.3	0.1
R14	0.2	0.0
R15	0.1	0.0

Based on unrounded numbers

5.2.5 Based on the impact magnitude descriptors presented in **Table 3.6**, the changes in annual mean NO_2 concentrations range from imperceptible to small. Imperceptible changes occur at the majority of the receptor locations modelled with the exception of receptor R6, where the change in concentrations is described as small. The changes in PM_{10} concentrations are all imperceptible.

5.2.6 Using the criteria set out in **Table 3.7**, the impact on annual mean NO_2 concentrations is described as negligible at all receptor locations. The. impact on PM_{10} concentrations is described as negligible, and the annual mean of 32µg/m³ equating to 35 days above 50µg/m³ for PM_{10} is described as negligible at all receptor locations.

Uncertainty

5.2.7 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional

uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

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

5.2.9 The future year road traffic modelling has been based on 2023 emission factors and background concentrations, whilst utilising future traffic flows for the year 2025. The model has been verified against 2015 monitoring data. This is considered to provide conservative assessment to balance against the uncertainties regarding future vehicle emissions.

Impact Significance

5.2.10 Overall, considering the conservative nature of the assessment, and the criteria set out in **Section 3.3.13,** the air quality effects of road traffic generated by the proposed development is considered to be not significant as there are no predicted exceedances of the relevant air quality strategy objectives at any of the existing receptor locations (refer to **Table 3.5**).

6 Mitigation

6.1 Construction

6.1.1 The following standard low risk mitigation measures from the IAQM 2014 guidance are recommended. These should be included within a Construction Environmental Management Plan and agreed with the Local Authority.

Communication

- Display the name and contact details of persons accountable on the site boundary.
- Display the head or regional office information on the site boundary.

Management

- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site.
- Avoid site run off of water or mud.
- Produce a Construction Logistics Plan to manage the delivery of goods and materials.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- No on-site bonfires and burning of waste materials on site.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process.

Trackout

- Use water assisted dust sweepers on the site access and local roads.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials.
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable.
- Install hard surfaced haul routes which are regularly damped down.
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.

6.2 Operation

6.2.1 The effects of development traffic on local air quality are judged to be not significant especially regarding the conservative nature of the assessment. No additional traffic mitigation is therefore required to reduce the direct effects of the development on local air quality.

7 Low Emissions Statement

7.1 Introduction

7.1.1 In order to identify the appropriate level of air quality mitigation to employ on the site, a Damage Cost Calculation has been undertaken The methodology that has been used is common to a number of local authorities in England and Wales and places a value on the NO_x and PM_{10} emissions from road traffic associated with the development.

7.2 Emissions Calculations

7.2.1 The development is predicted to generate 2,864 movements per day with 6% f HDVs.

7.2.2 Based on the Supplementary Green Book Guidance (Defra, 2013) on 'Valuing Impacts on air quality' the annual emissions are estimated to be 2,341 kg/yr of NO_x and 278 kg/yr for PM_{10}.

7.3 Damage Cost Calculation

7.3.1 Based on the output of the Defra IGCB Air Quality Damage Cost Calculator, the present value of the damage costs is £295,598 for NO_x and £80,923 for PM_{10}. The total damage costs from the development are estimated to be £376,521[1] over a five year period in accordance with the published methodology.

Mitigation Measures Implemented

7.3.2 It being proposed to provide with a cycle lane and bus provision in conjunction with the proposed development. The bus provision will amount to approximately £50,000 a year or £250,000 for five years from the first occupation of the site. In addition, the cycle lane to be provided has a total estimated cost of approximately £468,960, which includes the cost of construction, contingency and design fees, among others.

7.3.3 The total estimated cost for the bus provision and the cycle lane is therefore approximately £718,960, which is above the estimated damage cost for the development of £376,521.

7.3.4 In addition to these measures there is a potential to provide electric vehicle charging points within the development site at 10% of the car parking spaces.

[1] The IGCB damage cost used are the IGCB Air Quality Damage Costs per Tonne, 2015 prices (Central estimate Transport Average NO_x = £25,252/tonne and PM_{10} Transport Average = £58,125/tonne. Prices available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/460398/air-quality-econanalysis-damagecost.pdf. Annual emissions have been calculated for the year 2023, and costs have been calculated for a cost value of five years.

8 Conclusions

8.1.1 An air quality impact assessment and damage cost calculation have been carried out to satisfy the planning conditions imposed on the Oxford Technology Park development.

8.1.2 To date CDC has declared four AQMAs due to exceedances of the annual and hourly mean NO_2 objective. The proposed site is not located within an AQMA, the closest AQMA to the site is the AQMA No 3 located at Bicester Road, approximately 2.6 km south east of the site.

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

8.1.4 There are no predicted exceedances of the NO_2 and PM_{10} air quality strategy objectives at any of the existing receptor locations in close proximity to the site.

8.1.5 Overall, it is concluded that there are no air quality constraints to the proposed development.

8.1.6 Mitigation measures to encourage the uptake of low emission transport have been incorporated within the proposed development. The cost of the mitigation measures exceeds the damage cost of the additional traffic emission from the development.

Appendix A Glossary

Appendix A: Glossary

AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CDC	Cherwell District Council
DfT	Department for Transport
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes Includes Heavy Gross Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides, generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
NPPF	National Planning Policy Framework
PM_{10}	Small airborne particles less than 10μm in diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
TEA	Triethanolamine

Appendix B References

Appendix B: References

Carslaw, D., Beevers, S., Westmoreland, E. and Williams, M. (2011). '*Trends in NO_x and NO_2 emissions and ambient measurements in the UK'*.
Available: http://uk-air.defra.gov.uk/library/reports?report_id=645.

Cherwell District Council (1996). Cherwell Local Plan. Available at: http://www.cherwell.gov.uk/index.cfm?articleid=9632

Cherwell District Council (2015). The Cherwell Local Plan 2011-2031. Available at: http://www.cherwell.gov.uk/index.cfm?articleid=11344

Cherwell District Council (2016). 2016 Air Quality Annual Status Report (ASR).

Department of the Environment, Food and Rural Affairs (Defra) (2013). '*Valuing Impacts on air quality: Supplementary Green Book Guidance'* HM Treasury. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197893/pu1500-air-quality-greenbook-supp2013.pdf

Department of the Environment, Food and Rural Affairs (Defra) (2015). '*2011 Based Background Maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$'.* Available: http://laqm.defra.gov.uk/maps/maps2011.html.

Department of the Environment, Food and Rural Affairs (Defra) in partnership with the Scottish Executive, The National Assembly for Wales and the Department of the Environment for Northern Ireland (2016). '*Local Air Quality Management Technical Guidance, LAQM.TG(16)'.* HMSO, London.

Department of the Environment, Transport and the Regions (DETR, 2007) in Partnership with the Welsh Office, Scottish Office and Department of the Environment for Northern Ireland (2007). '*The Air Quality Strategy for England, Scotland, Wales, Northern Ireland'* HMSO, London.

Department for Communities and Local Government (2012). '*National Planning Policy Framework'*.
Available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Environment Act 1995, Part IV.

Holman et al (2014). '*Assessment of dust from demolition and construction*', IAQM, London

Moorcroft and Barrowcliffe et al (2015). '*Land-use Planning & Development Control: Planning for Air Quality*' The Institute for Air Quality Management, London

Planning Practice Guidance (2014). '*Air Quality'*.
Available at: http//planningguidance.planningportal.gov.uk/blog/guidance/air-quality/

Statutory Instrument 2000, No 921, '*The Air Quality (England) Regulations 2000'* HMSO, London.

Statutory Instrument 2002, No 3034, '*The Air Quality (England) (Amendment) Regulations 2002'* HMSO, London.

Statutory Instrument 2010, No. 1001, '*The Air Quality Standards Regulations 2010'* HMSO, London

Appendix C Model Verification

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NO_x = NO + NO_2). The model has been run to predict the 2015 annual mean road-NO_x contribution at four monitoring locations (identified in **Table 4.1**). Concentrations have been modelled at a height of 2.5 m for Bicester Road (2), 2 m for Bramley Close and 3 m for Oxford Road and Langford Lane 2014.

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (**Figure C.1**). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (**Figure C.2**).

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Primary adjustment factor:	2.5421
Secondary adjustment factor:	0.9963

The results imply that overall, the model was under-predicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

Figure C.3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line. Bramley Close data point lies within ±10%; Oxford Road and Langford Lane lie within the ±25% on the 1:1 line.

Concentrations at Bicester Road (2) have been consistently above the relevant objective for the past 5 years. It is considered that local factors are likely to be affecting the measured concentrations at this particular point as the measured concentrations do not align with other measurements in the local area.

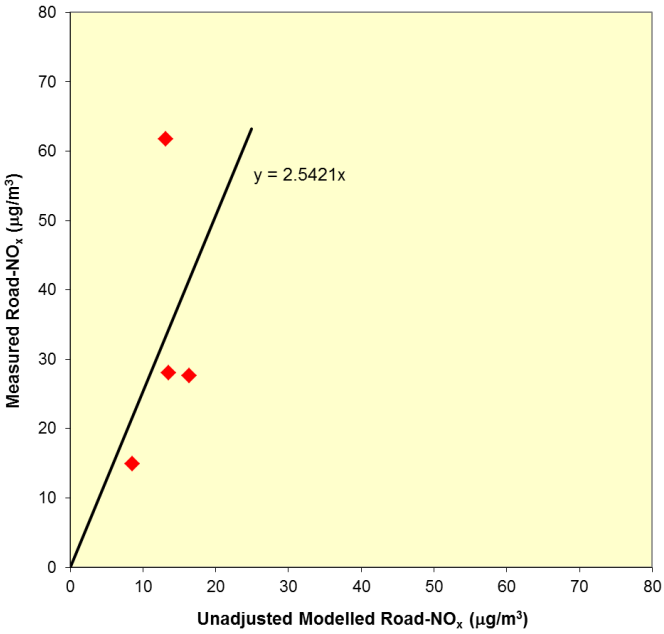


Figure C.1: Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x Concentrations

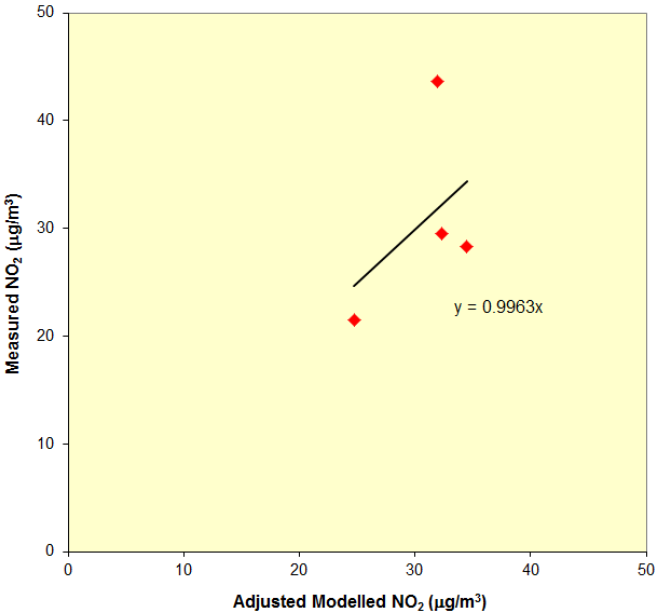


Figure C.2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO_2 Concentrations

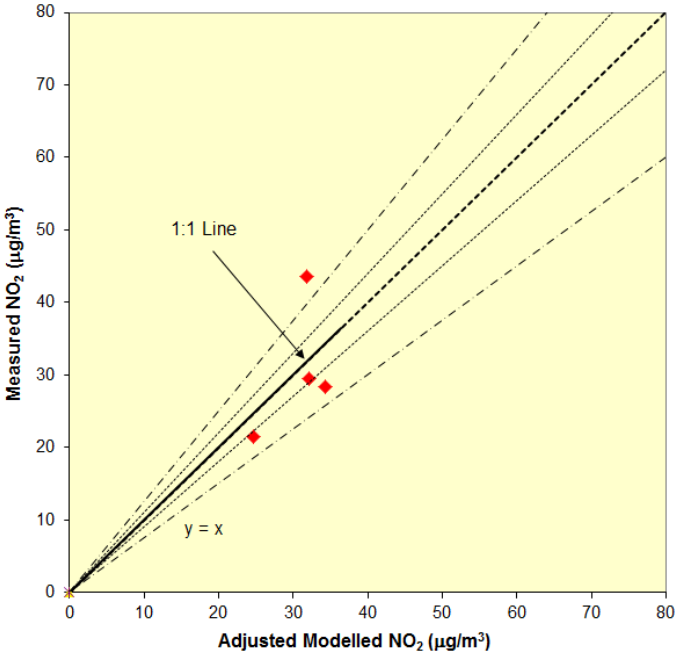


Figure C.3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO_2 Concentrations

PM_{10}

There is no PM_{10} monitoring in close proximity to the proposed development site. Therefore, the primary adjustment factor calculated for NO_2 concentrations has been applied to the modelled road-PM_{10} concentrations.

Appendix D Traffic Data

Location	2015 Baseline		2025 Without Development		2025 With Development	
	AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
A44 Oxford Road	12,329	7.2	14,343	7.2	14,683	7.1
Blandon Road	14,715	5.3	17,124	5.3	17,377	5.3
Upper Campsfield Rd	9,878	7.2	11,494	7.2	11,588	7.2
A44 Woodstock Rd (between Upper Campsfield Rd and Langford Lane)	19,870	6.3	23,110	6.3	23,798	6.3
A44 Woodstock Rd (South of Langford Lane)	19,548	6.7	22,732	6.7	23,508	6.7
Langford Lane (Between A44 and Site Access)	11,299	5.2	13,100	5.2	14,562	5.3
Langford Lane (Between Site Access and The Boulevard)	11,477	5.5	13,307	5.5	14,709	5.6
Oxford Motor Park	2,099	2.9	2,442	2.9	2,442	2.9
Langford Lane (Between The Boulevard and A4260	11,544	6.1	13,383	6.1	14,785	6.1
A4260 Banbury Road (North of Langford Lane)	10,494	4.7	12,192	4.7	12,747	4.7
Bicester Road (link to A4260)	6,157	4.5	7,157	4.5	7,395	4.6
A4260 Banbury Road (South of Langford Lane)	15,103	6.4	17,546	6.4	18,393	6.4
A4260 Oxford Road (Between Bicester Road and A4165)	15,082	7.0	17,516	7.0	18,126	7.0
Bicester Road (Between Oxford Road roundabout and Bicester Road link to A4260)	6,699	6.7	7,785	6.7	7,831	6.7
Bicester Road (North to A34)	11,500	6.7	13,510	6.7	13,748	6.9
Bicester Road	11,500	6.7	13,510	6.7	13,748	6.9
A4165 Oxford Road	14,995	7.3	17,440	7.3	17,790	7.3
A4260 Frieze Way	9,116	3.4	10,590	3.4	10,778	3.4
Oxford Road	2,978	2.5	3,466	2.5	3,491	2.5
The Boulevard	8,132	7.6	9,361	7.6	9,361	7.6
Site Access	-	-	-	-	2,864	6.0

Appendix E Future Year Emissions Calculations

Introduction

Atmospheric dispersion modelling is used to determine the effect of future development traffic on local air quality. The modelling utilises predictions of the composition and emissions profile of the vehicle fleet which are produced by Defra in the emissions factor toolkit (EFT). The composition and emissions profiles are provided on a year by year basis from 2013 to 2030, with the database being periodically updated.

The main issue with regard to the modelling of future traffic impacts is the choice of emission factors to use given that there is a degree of uncertainty as to the accuracy of the emission factors, as well as uncertainty introduced by the modelling process and the traffic data on which the predictions are based. This has become more important in recent years as it has been realised that previous versions of the EFT were likely to have significantly underestimated the real world emissions of the vehicle fleet, as well as the more recent revelations concerning the use of 'defeat devices' on VW group vehicles.

This note therefore sets out PBAs approach to the choice of vehicle emission factors for future year assessments. The note has been revised following updating of the Defra Emissions Factor Toolkit in July 2016.

Modelling Methodology

As a prelude to the discussion of emission factors, it is useful to recap on the general methodology that is used for dispersion modelling of road traffic emissions:

- Traffic data is entered into the dispersion model to represent the baseline situation and the model is used to predict how NO_x emissions are dispersed in the environment.
- The dispersion modelling predictions are compared to monitoring data to obtain a verification factor; the factor by which the predicted road traffic concentration must be multiplied by to agree with the monitored concentration.
- The modelling is repeated for the future year situation; with traffic data representing the situation without the development in place (the 'without' scheme scenario) and with the development in place ('with' scheme). In both cases, the verification factor obtained from the baseline modelling is used to multiply the model results by, in essence assuming that the model is equally as accurate in the future as it was for the baseline scenario.

The verification factor is one of the key elements in the discussion regarding vehicle emission factors. One element of uncertainty in the modelling is the degree to which the emission factors in the EFT are different to actual emissions of the vehicle fleet on the local road network. The use of the verification factor for the future year predictions essentially assumes that the difference between the EFT emission factors and real world emissions is the same in the future as it was in the baseline year. In other words, unless there is some reason to believe that the future year emission factors are less accurate than the baseline year emission factors, the degree to which the EFT emission factors and real world emission factors differ is taken into account in the modelling by the use of the verification factor. This is discussed further in the following sections.

Emission Factor Toolkit

The EFT contains estimates of the future composition of the vehicle fleet in terms of the age and type of vehicles. The composition of the vehicle fleet is primarily related to the age of the vehicles (in terms of their emissions class) and the fuel that they use (i.e. petrol or diesel). In general terms, the majority of new vehicles replace much older vehicles, and as the emissions performance of vehicles is generally taken to improve over time, both current and historical versions of the EFT predict very large reductions in NO_x emissions in the future. It is also obvious that the further one looks into the future, the more uncertain the predictions become as they depend on the rate of vehicle renewal and the size and fuel mix of the vehicles bought; which are all estimates.

The emissions performance of the vehicles is classified in terms of Euro type approval testing; Euro 1 to 6 concerning light duty vehicles and Euro I to VI heavy duty vehicles. Whilst the introduction of

each Euro class has generally seen a tightening of emission standards, the standards up until now have been based on laboratory testing of vehicles. The emissions performance of the vehicles in real world driving conditions has been higher than the laboratory testing results, especially for diesel vehicles. This factor was not recognised in earlier versions of the EFT, and combined with the fact that diesel vehicles have much higher NO_x emissions than petrol vehicles and there has been a very large increase in the number of diesel vehicles on the road, has meant that the NO_x emissions and NO_2 concentrations have not reduced as previously predicted.

The trends in NO_x emissions in the vehicle fleet, especially diesel vehicles and the accuracy of the current version of the EFT, is therefore critical in terms of the choice of emission factors in modelling.

Trends in NO_x emissions

For light duty vehicles, the latest Euro standard is Euro 6, which was introduced from September 2015 (with a derogation in the UK for the registration of new vehicles until September 2016).

The emissions standards currently relate to a laboratory test whereby the average emission rate is calculated over an idealised drive cycle. The cycle used is the New European Drive Cycle (NEDC) and there has been extensive criticism that the drive cycle does not represent real world driving conditions. It has therefore been agreed that a new drive cycle will be introduced, the World Light-duty Test Cycle (WLDTC), as well as an on-road test termed Real Driving Emissions (RDE).

Current Euro 6 vehicles are only tested in the laboratory against the NEDC, and these vehicles are termed Euro 6ab. However, from September 2017, new models will be tested against the WLDTC and will also have a RDE test. The initial introduction of the RDE test will allow vehicles to have average RDE test emissions of 2.1 times the WLDTC test; in other words, real life emissions will be allowed to be 2.1 times the laboratory emissions. The 2.1 factor is termed the conformity factor and will apply to new models from September 2017 and new vehicles from September 2019. From January 2020, the conformity factor will reduce to 1.5 for new models (January 2021 for new vehicles).

Air Quality Consultants have undertaken some research into the performance of diesel vehicles to support a methodology that they have adopted for undertaking air quality assessments[2]. As part of the analysis, they compared the real word test results of current Euro 6ab diesel vehicles and calculated an average conformity factor of 3.9 from the tests that were assessed.

Subsequently, Department for Transport have undertaken testing of Euro 5 and 6ab diesel vehicles and found that the average NO_x emissions were 1135 mg/km for Euro 5 vehicles and 500 mg/km for Euro 6ab vehicles[3]. These work out to be a conformity factor of 6.30 and 6.25 for Euro 5 and Euro 6ab respectively. Adding in the DfTr results to the AQC results gives an overall average conformity factor for Euro 6ab vehicles tested of 4.1.

A paper presented by Dr Marc Stettler at the recent Westminster Energy, Environment & Transport Forum[4] included results of RDE testing of existing Euro 6ab vehicles. Whilst there was wide range in the results, a number of the vehicles tested did already comply with the Euro 6c standard.

From the emissions testing work undertaken to date on Euro 6ab vehicles it is clear that the NO_x emissions performance of Euro 6ab vehicles is significantly better than Euro 5 vehicles, although not in line with the laboratory standards. The introduction of Euro 6 should therefore see a significant reduction in NO_x emissions in the future, as outlined in the following table.

Emission Standard	Real Driving Emissions NO_x mg/km

[2] Emissions of Nitrogen Oxides from Modern Diesel Vehicles. AQC January 2016

[3] Vehicle Emissions Testing Programme DfTr Cm 9259 April 2016

[4] Priorities for reducing air quality impacts of road vehicles. Dr Marc Stettler 17th May 2016

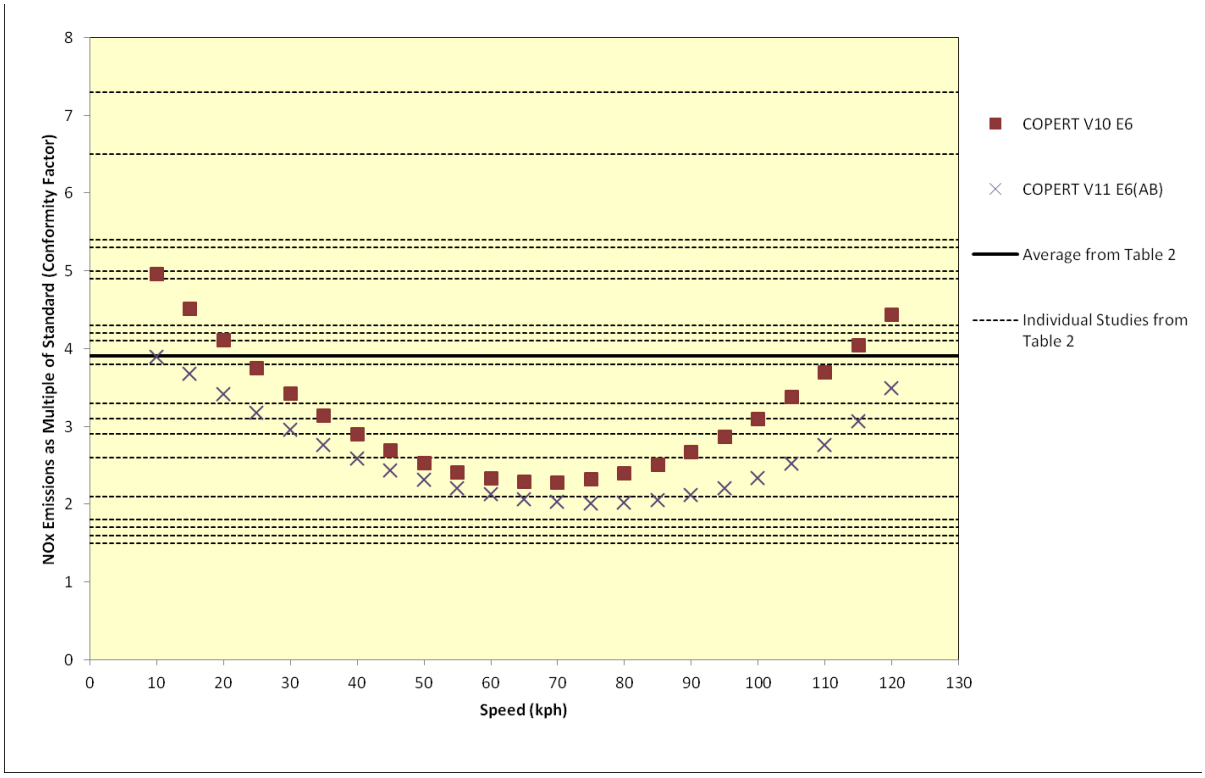
Euro 5, DfTr testing	1135
Euro 6ab, DfTr testing	500
Euro 6c, September 2017 models	168
Euro 6c, January 2020 models	120

In terms of modelling, the issue therefore becomes how well does the EFT represent the real world emissions performance of the vehicles.

Emissions in the EFT

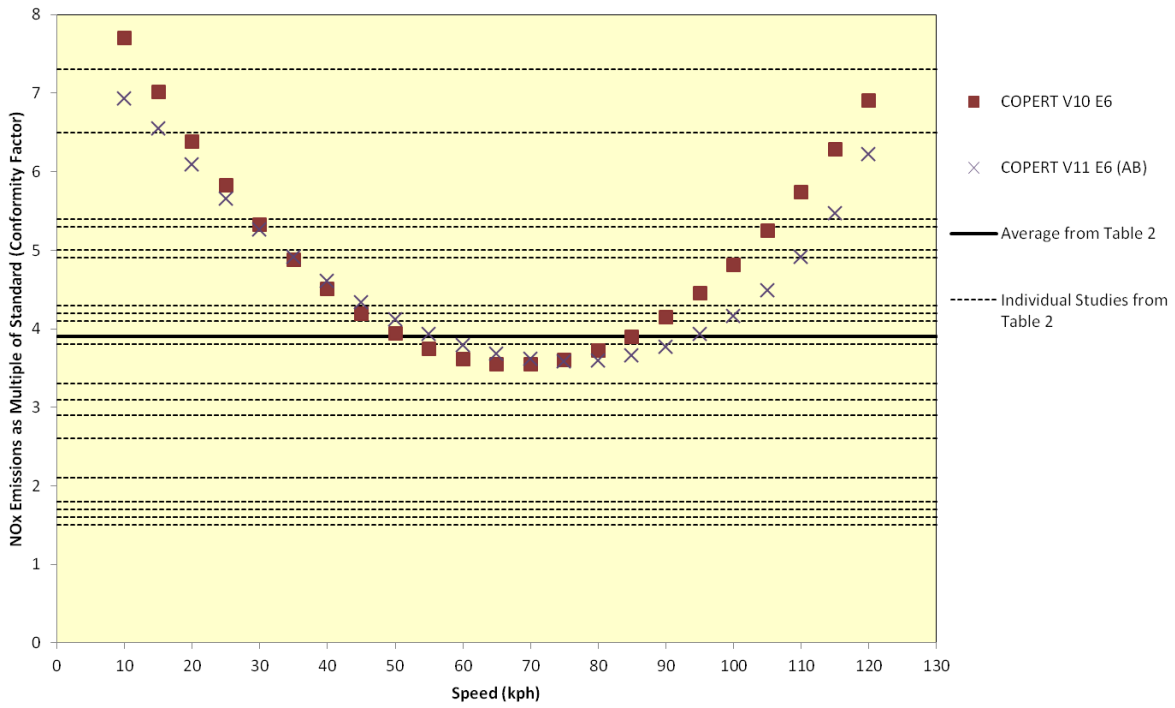
As noted in Section 3, the EFT contains estimates of vehicle emissions by Euro Class. The database has recently been updated in July 2016 from v6.02 to v7.0. It now uses NO_x emissions factors for the vehicles taken from the European Environment Agency's COPERT 4 V11 database compared to the previous version V10. In the latest submissions to the European Union for compliance against EU Limit Values, Defra used COPERT 4 V11 factors. The latest emission factors are lower than those in the previous version of the EFT.

The AQC paper provides a representation of the emissions from Euro 6 vehicles at different speeds in terms of the conformity factor. The results are shown in the following graph.



The graph shows that the EFT emissions have a conformity factor ranging from 2.3 to 5. The conformity factor is higher at low and high speeds. Overall, the average conformity factor is less than the factor determined from the testing of Euro 6ab vehicles to date, but higher than the conformity factor that will be required by the introduction of Euro 6c. The COPERT v11 factors for Euro 6ab vehicles would appear to be, on average, approximately 80% of the V10 factors.

In terms of light duty vehicles, the AQC report concluded that for future year assessments, the base case modelling should use the EFT v6.02 factors for the future year of the traffic data, i.e. unaltered. However, a sensitivity test was also recommended, whereby the average conformity factor for Euro 6 diesel vehicles is raised to 5, with the following result in terms of the EFT.



Clearly, using the sensitivity test, the average emission rate in the EFT is higher than the average from the Euro 6ab testing to date, for either COPERT v10 or v11 factors. The AQC report concluded that if the two assessments were undertaken, then the likely pollutant concentration would lie between the two estimates.

However, the AQC report also acknowledges that the EFT does not include Euro 6c vehicles which should have significantly lower NO_x emissions than current Euro 6ab vehicles, and therefore both sets of results could be conservative.

Clearly, using the sensitivity test, the average emission rate in the EFT is higher than the average from the Euro 6ab testing to date, for either COPERT v10 or v11 factors. The AQC report concluded that if the two assessments were undertaken, then the likely pollutant concentration would lie between the two estimates.

However, the AQC report also acknowledges that the EFT does not include Euro 6c vehicles which should have significantly lower NO_x emissions than current Euro 6ab vehicles, and therefore both sets of results could be conservative.

Future Year Assessment Methodology

The selection of emission factors for a future year assessment depends partly on the situation regarding the assessment to be undertaken. Where pollutant concentrations are low and are unlikely to exceed threshold levels, then one may take a conservative approach and keep emission factors at current levels. This will produce a conservative result, but as the result will be 'acceptable' in terms of leading to no exceedances of National Air Quality Strategy Objectives, then it is a reasonable approach to adopt as it avoids uncertainty as to whether there will be exceedances in the future.

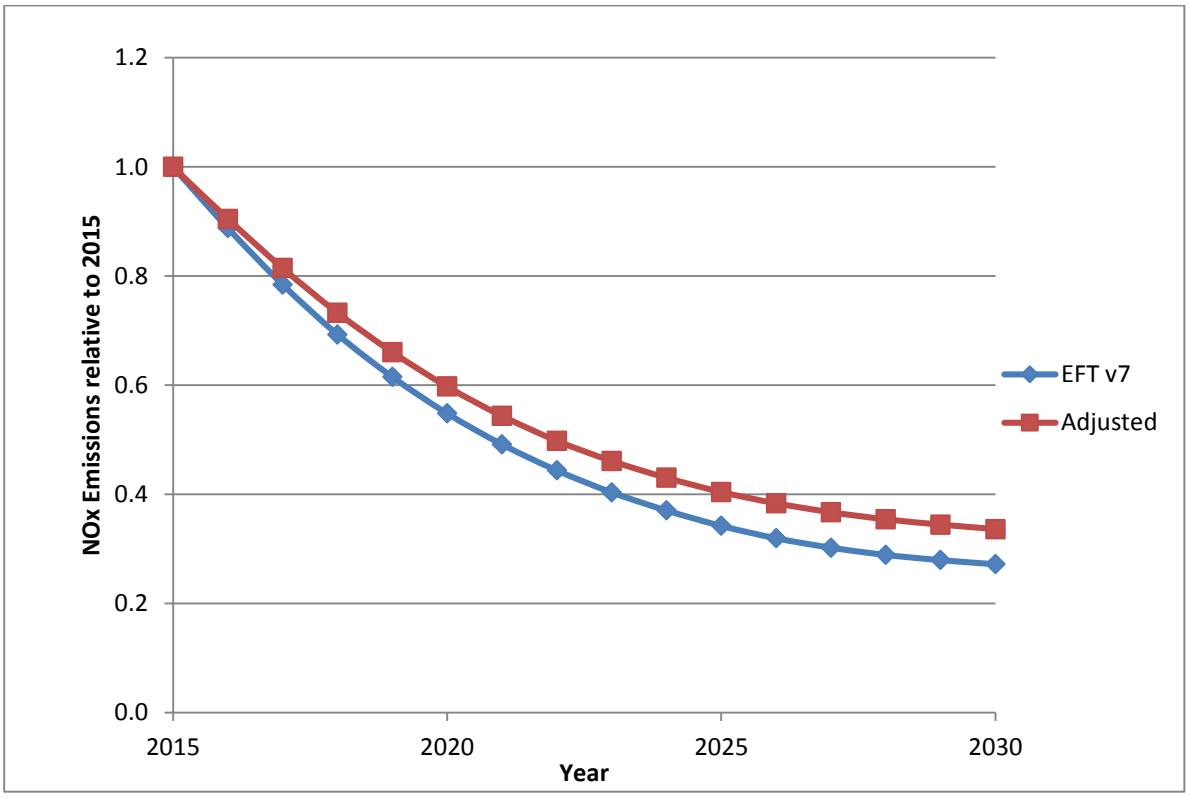
In contrast, where pollutant concentrations are high, then a different approach to uncertainty is required. In addition, for a formal Environmental Impact Assessment the legal requirement is to assess 'likely significant effects'. This is not 'worst case' significant effects, but 'likely' significant effects and therefore must allow for a degree of uncertainty in the predictions.

The approach taken to date by PBA for the assessment of future year effects when the development is completed a number of years into the future is to choose an intermediate year between the baseline model verification year and the completed development year. This approach requires revisiting in light of the latest information regarding vehicle emission factors.

As noted in Section 6, the AQC approach is to undertake two assessments; one using the EFT for the assessment year and one using higher emission factors for a sensitivity test. In addition to consideration of diesel car emissions, the AQC approach also considers taxis, light goods vehicles and heavy duty vehicles (HDVs). For taxis and light goods vehicles, a similar approach to diesel cars is proposed.

The evidence on the performance of Euro VI HDVs is more difficult to interpret; but it indicates significantly reduced NO_x emissions between Euro V and VI, although the AQC report concludes that the EFT may underestimate emissions of Euro VI HDVs. The approach proposed by AQC for HDVs for COPERT v10 emissions is to keep Euro IV and Euro V emissions the same as Euro III and make Euro VI emissions 20% of Euro V. This approach was considered to result in slightly high HDV emissions. The average COPERT v11 HDV emission factors are higher than v10 at speeds above 40 kph and lower at speeds less than 40 kph (AQC, Figure 23). Overall therefore, it would appear to be appropriate to continue the proposed AQC approach for HDV emissions for COPERT v11 emission factors.

The following graph has been prepared using the AQC approach applied to the EFT v7 for urban vehicles outside of London at 30kph with a 5% heavy duty vehicles mix. Given that both emissions estimates would need to verified against the same monitoring data, then the predictions would be the same for the same initial model verification year (i.e. 2015 in this case). The relative difference in the predicted emissions in the future is therefore the important factor.



Prior to 2025, the difference between the emission factors amounts to less than 2 years; it rises to approximately 5 years by 2030.

As noted in Section 5, the EFT does not take account of the introduction of Euro 6c vehicles, which will begin to be introduced from 2017 with a conformity factor of 2.1, and from 2020 with a conformity factor of 1.5, significantly lower than the average for v7 of the EFT. Beyond 2020 therefore, as Euro 6c vehicles become more prominent in the vehicle fleet, the EFT is likely to become more representative of real world emissions than it currently is.

As discussed in Section 2, the use of the verification factor in the modelling takes account, amongst other things, of the difference in the real world emissions performance of vehicles in the fleet. Data contained within the AQC report indicates that the EFT may have underestimated emissions of earlier classes of vehicles to a similar extent as for Euro 6ab vehicles. As such, one could be justified in using the emission factors from the year of the assessment as the uncertainty in the emission factors is taken account of by using the verification factor.

The verification factor is not the only consideration however:

- The emission factors are in terms of NO_x which is a combination of NO and NO_2. Historically, most of the NO_x emission was NO, with a small proportion of NO_2. There is some evidence that the proportion of NO_2 in the NO_x is rising, which would counteract reductions in overall NO_x emissions when one considers compliance with NO_2 National Air Quality Strategy Objectives.
- There is uncertainty in the production of the traffic data on which the air quality modelling is based, as well as uncertainty within the EFT as it is based on assumptions regarding the replacement of vehicles into the vehicle fleet (over and above assumptions on the actual emissions performance of those vehicles).
- The predicted pollutant concentration from the road traffic modelling is added to an estimate of the background concentration, which itself, is subject to uncertainty.

The above factors justify a more conservative approach to future year emissions than simply using the EFT emission factors for the year of the assessment.

Taking into account the various factors discussed above, it is proposed that for the determination of likely significant effects we will use an emissions year two years earlier for future year assessments up until 2025, and three years earlier from 2026. This is likely to be conservative given the introduction of Euro 6c vehicles into the fleet (from 2017), but recognising increasing uncertainty regarding predicting the composition of the vehicle fleet and vehicle emissions in the future.

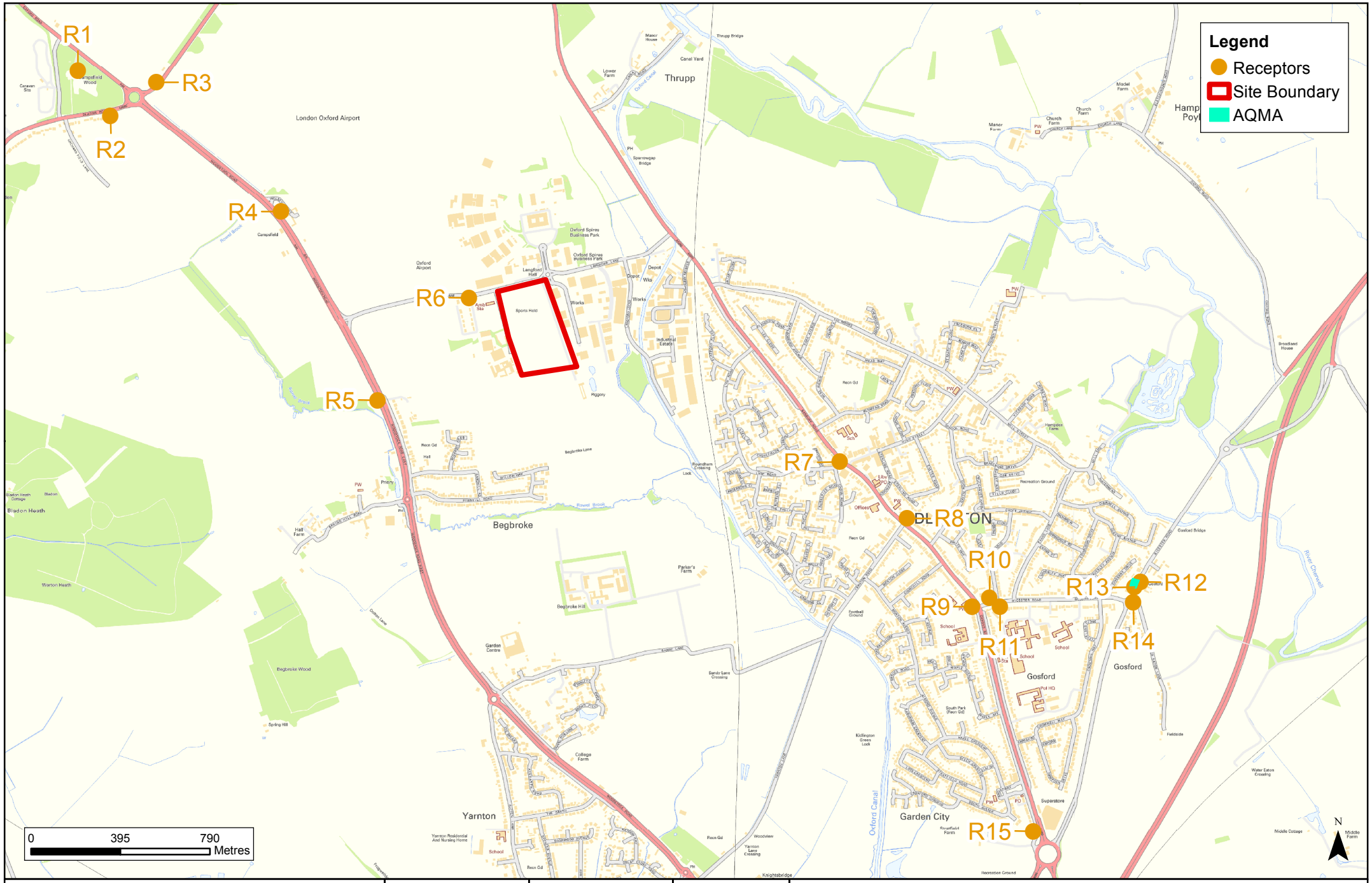
The following table shows the effect of the proposals.

Assessment Year	Emission Factor Year
2015	2015
2016	2015
2017	2015
2018	2016
2019	2017
2020	2018
2021	2019
2022	2020
2023	2021
2024	2022
2025	2023
2026	2023
2027	2024
2028	2025
2029	2026
2030	2027
2031	2028
2032	2029

Assessment Year	Emission Factor Year
2033 and beyond	2030

The choice of emission factors and background concentrations needs to take into account the specific circumstances of the assessment being undertaken, but the above approach is considered to provide a conservative basis on which to assess likely future pollutant concentrations.

Appendix F Figures



Contains Ordnance Survey Data © Crown Copyright and Database 2016

pba peterbrett

Hill Street Holdings Ltd

1:21,300 @ A4

28/07/2016

Drawn: YO

Checked: GH

Oxford Technology Park

Air Quality Receptors

Figure 1

Rev A

Document Path: J:\23588 - Oxford Technology Park\AQ\Plans and Figures\ArcGIS\Figure 1 - Receptors.mxd

Contains Ordnance Survey Data © Crown Copyright and Database 2016

pba peterbrett

Hill Street Holdings Ltd

1:12,300 @ A4

28/07/2016

Drawn: YO

Checked: GH

Oxford Technology Park

Air Quality Monitoring Locations

Figure 2 | Rev A

Document Path: J:\23588 - Oxford Technology Park\AQ\Plans and Figures\ArcGIS\Figure 2 - Monitoring Locations.mxd