



GEM Air Quality Ltd

The Apex
2 Sheriffs Orchard
Coventry
CV1 3PP

Tel: 0121 288 0434
www.gemairquality.co.uk

Waldeck Street, Reading: Air Quality Assessment

**Prepared for
Lainston Woodley Arms LLP**

**Report Ref: AQ0457
Date: January 2014**



DOCUMENT CONTROL & DISCLAIMER

Title:

Waldeck Street, Reading:
Air Quality Assessment

Report Ref:

AQ0457

Date Issued:

January 2014

Client Details:

Lainston Woodley Arms LLP
21 Southampton Street
Southampton
SO15 2ED

Produced By:

GEM Air Quality Ltd
The Apex
2 Sheriffs Orchard
Coventry
CV1 3PP

Tel: 0121 288 0434

Email: info@gemairquality.co.uk
www.gemairquality.co.uk

Disclaimer:

GEM Air Quality Ltd completed this Report on the basis of a defined programme of work and terms and conditions agreed with the Client. All reasonable skill and care has been used in producing this report, taking into account the project objectives, the agreed scope of work, prevailing site conditions and the degree of manpower and resources allocated to the project.

GEM Air Quality Ltd accepts no responsibility to any parties whatsoever, following the issue of the Report, for any matters arising outside the agreed scope of the work.

This Report is issued in confidence to the Client and **GEM Air Quality Ltd** has no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the report solely at their own risk.

CONTENTS

1	INTRODUCTION	1
1.1	Scope	1
2	POLLUTANTS & LEGISLATION	2
2.1	Pollutant Overview	2
2.2	Air Quality Strategy	2
2.3	Local Air Quality Management	3
2.3.1	Reading Borough Council	3
3	PLANNING POLICY & GUIDANCE.....	4
3.1	National Planning Policy & Guidance.....	4
3.1.1	National Planning Policy Framework	4
3.1.2	Environmental Protection UK	4
3.1.3	The Air Quality Expert Group	5
3.2	Local Planning Policy & Guidance	5
3.2.1	Reading Borough Council	5
4	ASSESSMENT METHODOLOGY.....	6
4.1	Construction Phase	6
4.2	Operational Phase (Traffic Emissions)	9
4.2.1	Modelled Scenarios.....	9
4.2.2	ADMS-Roads	9
4.2.3	Emission Factors.....	9
4.2.4	Traffic Data.....	9
4.2.5	Street Canyons	10
4.3	Background Concentrations.....	10
4.4	Surface Roughness	11
4.5	Meteorological Data	11
4.6	Model Output	12
4.6.1	NO _x /NO ₂ Relationship.....	12
4.6.2	Predicted Short Term Concentrations	12
4.6.3	Model Verification	12

4.6.4	Receptor Locations.....	12
4.7	Significance Criteria	14
4.7.1	Construction Phase	14
4.7.2	Operational Phase.....	17
5	AIR QUALITY ASSESSMENT	18
5.1	Impact from Construction Activities	18
5.2	Impact of Vehicle Emissions.....	19
5.2.1	Model Verification	19
5.2.2	Model Adjustment	20
5.2.3	Nitrogen Dioxide	21
5.2.4	Particulate Matter.....	21
6	CONCLUSIONS AND RECOMMENDATIONS	23
6.1	Impact from Construction Activities	23
6.2	Impact of Vehicle Emissions.....	24
6.2.1	Building Mitigation.....	24
6.3	Overall Conclusion	24

LIST OF TABLES

Table 1 – Overview of NO ₂ and PM ₁₀	2
Table 2 – UK Air Quality Objectives for Nitrogen Dioxide and Particulate Matter	3
Table 3 – Annual Average Daily Traffic Flows and Percentage HDV for Selected Roads, Baseline 2012 and Projected 2016	10
Table 4 – Background NO _x , NO ₂ and PM ₁₀ Concentrations	11
Table 5 – Modelled Receptor Locations	13
Table 6 – Dust Emission Classifications Applicable to the Construction Site	14
Table 7 – Risk Categories for each Construction Activity	15
Table 8 – Factors Defining Sensitivity of an Area.....	16
Table 9 – Significance of Effects for each Activity with No Mitigation	16
Table 10 – Significance of Effects for each Activity with Mitigation.....	16
Table 11 – Overall Risk of Site based on each Construction Activity.....	18
Table 12 – Summary of Significance for Construction Activities	18
Table 13 – Comparison of Modelled and Monitored NO ₂ Concentrations (µg/m ³), 2012	19
Table 14 – Monitored NO _x and NO ₂ concentrations, 2011	20
Table 15 – Adjustment of Modelled NO _x Contributions, 2011	20
Table 16 – Predicted NO ₂ Concentrations, Annual Mean (µg/m ³)	21



Table 17 – Predicted PM ₁₀ Concentrations, Annual Mean (µg/m ³)	21
--	----

LIST OF FIGURES

Figure 1 – Dust Assessment Procedure	8
Figure 2 – Wind Speed and Direction Data, Heathrow Airport (2012)	11
Figure 3 – Modelled Receptor Locations	13
Figure 4 – Assessing the Significance of Air Quality Impacts of a Development Proposal	17

1 INTRODUCTION

1.1 Scope

GEM Air Quality Ltd has been commissioned to undertake a detailed air quality assessment based on the potential impacts of existing and future traffic levels on a proposed residential development located on the site of the Woodley Arms pub along Waldeck Street in Reading, Berkshire. The air quality assessment examines the impact on both design proposals, which include the conversion of the existing pub into four flats or the construction 44-unit residential block for students.

The pollutants modelled as part of this assessment are nitrogen dioxide (NO₂) and particulate matter (PM₁₀). The impacts of vehicle emissions have been assessed using the techniques detailed within Volume 11, Section 3 of the Design Manual for Roads and Bridges (DMRB)¹ and the Local Air Quality Management Technical Guidance (LAQM.TG09)². The impact of road traffic emissions will be assessed using the latest version of the ADMS-Roads air dispersion model. This model has been devised by Cambridge Environmental Research Consultants (CERC) and is described as a comprehensive tool for investigating air pollution problems due to small networks of roads.

It should be noted that the short term impacts of NO₂ and PM₁₀ emissions have not been modelled as dispersion models are inevitably poor at predicting short-term peaks in pollutant concentrations, which are highly variable from year to year, and from site to site. Notwithstanding this, general assumptions have been made about short term concentrations based on the modelled annual mean concentrations.

Any increase in traffic flows on the local road network has not been assessed. This is due to the fact that the proposed development will only generate fewer vehicle movements compared to the sites current use as a pub. As such, there will be a net decrease in vehicle flows on the local road network as a result of the proposed development.

In addition to this, the assessment has also discussed ways of minimising the impacts of potential poor air quality on existing and proposed receptors by way of mitigation measures (if relevant), as well as assessing the potential impact on local air quality from construction activities at the site.

¹ Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 – HA207/07, Highways Agency, May 2007

² Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance (TG09), Defra, February 2009

2 POLLUTANTS & LEGISLATION

2.1 Pollutant Overview

In most urban areas of the UK, traffic generated pollutants have become the most common pollutants. These are nitrogen dioxide (NO₂), fine particulates (PM₁₀), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO₂). This air quality assessment focuses on NO₂ and PM₁₀, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO₂ and PM₁₀.

Table 1 – Overview of NO₂ and PM₁₀

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM₁₀)	Tiny particulates of solid or liquid nature suspended in the air	Road transport; Power generation plants; Production processes e.g. windblown dust	Soil erosion; Volcanoes; Forest fires; Sea salt crystals	Asthma; Lung cancer; Cardiovascular problems
Nitrogen Dioxide (NO₂)	Reddish-brown coloured gas with a distinct odour	Road transport; Power generation plants; Fossil fuels – extraction & distribution; Petroleum refining	No natural sources, although nitric oxide (NO) can form in soils	Pulmonary edema; Various environmental impacts e.g. acid rain

2.2 Air Quality Strategy

The UK Government and the devolved administrations published the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland on 17 July 2007³. The Strategy provides an over-arching strategic framework for air quality management in the UK by way of the following:

- setting out a way forward for work and planning on air quality issues;
- setting out the air quality standards and objectives to be achieved;
- introducing a new policy framework for tackling fine particles; and
- identifying potential new national policy measures which modelling indicates could give further health benefits and move closer towards meeting the Strategy's objectives.

With regards to this assessment, the Air Quality Strategy contains national air quality standards and objectives established by the Government to protect human health. The objectives for nitrogen dioxide and particulates (PM₁₀ and PM_{2.5}) have been set, along with

³ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007

seven other pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, PAHs, sulphur dioxide and ozone). Those which are limit values required by EU Daughter Directives on Air Quality have been transposed into UK law through the Air Quality Standards Regulations 2007 which came into force on 15th February 2007. Table 2 provides the UK Air Quality Objectives for NO₂ and PM₁₀.

Table 2 – UK Air Quality Objectives for Nitrogen Dioxide and Particulate Matter

Pollutant	Objective	Concentration measured as	Date to be achieved by and maintained thereafter
Particles (PM₁₀)	50µg/m ³ not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	40µg/m ³	Annual mean	31 December 2004
Nitrogen Dioxide (NO₂)	200µg/m ³ not to be exceeded more than 18 times a year	1 hour mean	31 December 2005
	40µg/m ³	Annual mean	31 December 2005

Objectives for PM_{2.5} have also been introduced by the UK Government and the Devolved Administrations, but these are not included in Regulations. As such, this assessment has not considered the impact on PM_{2.5}.

2.3 Local Air Quality Management

Part IV of the Environment Act 1995 requires local authorities to review and assess existing air quality within their boundaries, as well as predict future air quality as part of an ongoing Review and Assessment process. The current timetable for Review and Assessment (rounds 4, 5 and 6) requires every local authority to report to Defra up to and including 2017, with the different elements repeated over a three year cycle.

2.3.1 Reading Borough Council

The Council has declared a single Air Quality Management Area (AQMA), which covers the majority of main roads within the Borough including Southampton Street to the east of the proposed development.

The Council completed its latest Air Quality Progress Report in April 2013. The report concluded that the majority of air quality objectives for all pollutants were achieved in 2012, although the NO₂ annual objective continued to be exceeded within the declared AQMA.

3 PLANNING POLICY & GUIDANCE

3.1 National Planning Policy & Guidance

3.1.1 National Planning Policy Framework

On a national level, air quality can be a material consideration in planning decisions. The National Planning Policy Framework (NPPF) for England, released on 27th March 2012, is considered a key part of the Governments reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. The NPPF replaces the Planning Policy Statement 23 (PPS23) *Planning and Pollution Control*⁴.

The NPPF 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”.

It goes on to state 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”.

3.1.2 Environmental Protection UK

In 2006, the National Society for Clean Air and Environmental Protection (NSCA) issued a guidance document with regards to assisting both developers and planning authorities on air quality issues⁵. In April 2010, this guidance was updated by Environmental Protection UK (formerly known as the National Society for Clean Air and Environmental Protection)⁶.

The updated guidance provides a set of criteria used to determine whether a development will have a significant impact on air quality. If the Proposed development results in a significant change in air quality or results in a change of relevant exposure to air quality then it is reasonable to expect an air quality assessment to be undertaken. The report describes how, in all cases, professional judgement is required when deciding if an air quality assessment is necessary, as it is not possible to apply an exact and precise set of criteria to all development proposal situations.

⁴ Planning Policy Statement 23: Planning and Pollution Control, Office of the Deputy Prime Minister (ODPM), November 2004

⁵ Development Control: Planning for Air Quality, An Updated guidance from NSCA on dealing with air quality concerns within the development control process, NSCA, 2006

⁶ Development Control: Planning For Air Quality (2010 Update), Updated guidance from Environmental Protection UK on dealing with air quality concerns within the development control process, Environmental Protection UK, April 2010

3.1.3 The Air Quality Expert Group

The Air Quality Expert Group (AQEG) is an advisory group that provides independent scientific advice on air quality. AQEG published *Air Quality and Climate Change: A UK Perspective*⁷ in 2007. The report recognises the potential for both local and global air quality improvements. Local authorities will be looking towards reductions in both and developers should take this into account throughout the design, construction and operational phases of a development, bearing in mind any potential trade-offs between global and local air quality improvements.

3.2 Local Planning Policy & Guidance

3.2.1 Reading Borough Council

Reading Borough Council adopted its Core Strategy in January 2008 and recently adopted a Sites and Detailed Policy Document (SDPD). The SDPD contains a specific air quality policy:

DM21: AIR QUALITY

“Development should have regard to the need to improve air quality and reduce the effects of poor air quality.

- 1. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:*
 - Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly reduce air quality;*
 - Whether the development is within, or accessed via, an Air Quality Management Area; and*
 - Whether it can be demonstrated that a local reduction in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.*
- 2. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application.*
- 3. Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring”.*

⁷ Air Quality Expert Group (AQEG) report – Air quality and climate change: a UK perspective, published for the Department for Environment, Food and Rural Affairs, Scottish Executive, Welsh Assembly Government and Department of the Environment in Northern Ireland, 2007

4 ASSESSMENT METHODOLOGY

4.1 Construction Phase

Dust is a major environmental concern associated with construction activities. Residents living in proximity to such a site can potentially be affected by site dust up to 1 km from the source, although continual or severe concerns about dust sources are most likely to be experienced near to dust sources, generally within 100 metres. In general, large dust particles (greater than 30 μm) make up the greatest proportion of dust emitted from construction sites and will largely deposit within 100 m of sources. Intermediate sized particles (10-30 μm) are likely to travel up to 250-500 m. Smaller particles (less than 10 μm), which make up a small proportion of the dust emitted, can travel up to 1km from sources⁸.

In November 2006, the Greater London Authority (GLA)⁹ released best practice guidance relating to the control of dust and emissions from construction and demolition sites. This guidance is widely referred to in assessments of construction impacts, even in areas outside London. However, the assessment methodology and significance criteria of potential impacts were outside the scope of the guidance document at the time of publication. As such, the Institute of Air Quality Management (IAQM) published guidance on the potential impacts of construction activities in collaboration with the GLA and the Building Research Establishment (BRE)¹⁰.

Based on this guidance, the main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment on site.

In relation to the most likely impacts, the guidance states the following:

“The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of particulate matter in all size fractions, but will be associated mostly with particulate matter greater than 10 μm . Experience of assessing the exhaust emissions from on-site plant and

⁸ Minerals Policy Statement (MPS) 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Office of the Deputy Prime Minister, 2005

⁹ The control of dust and emissions from construction and demolition – Best Practice Guidance, produced in partnership by London Councils and the Greater London Authority, November 2006

¹⁰ Guidance of the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, IAQM, January 2012



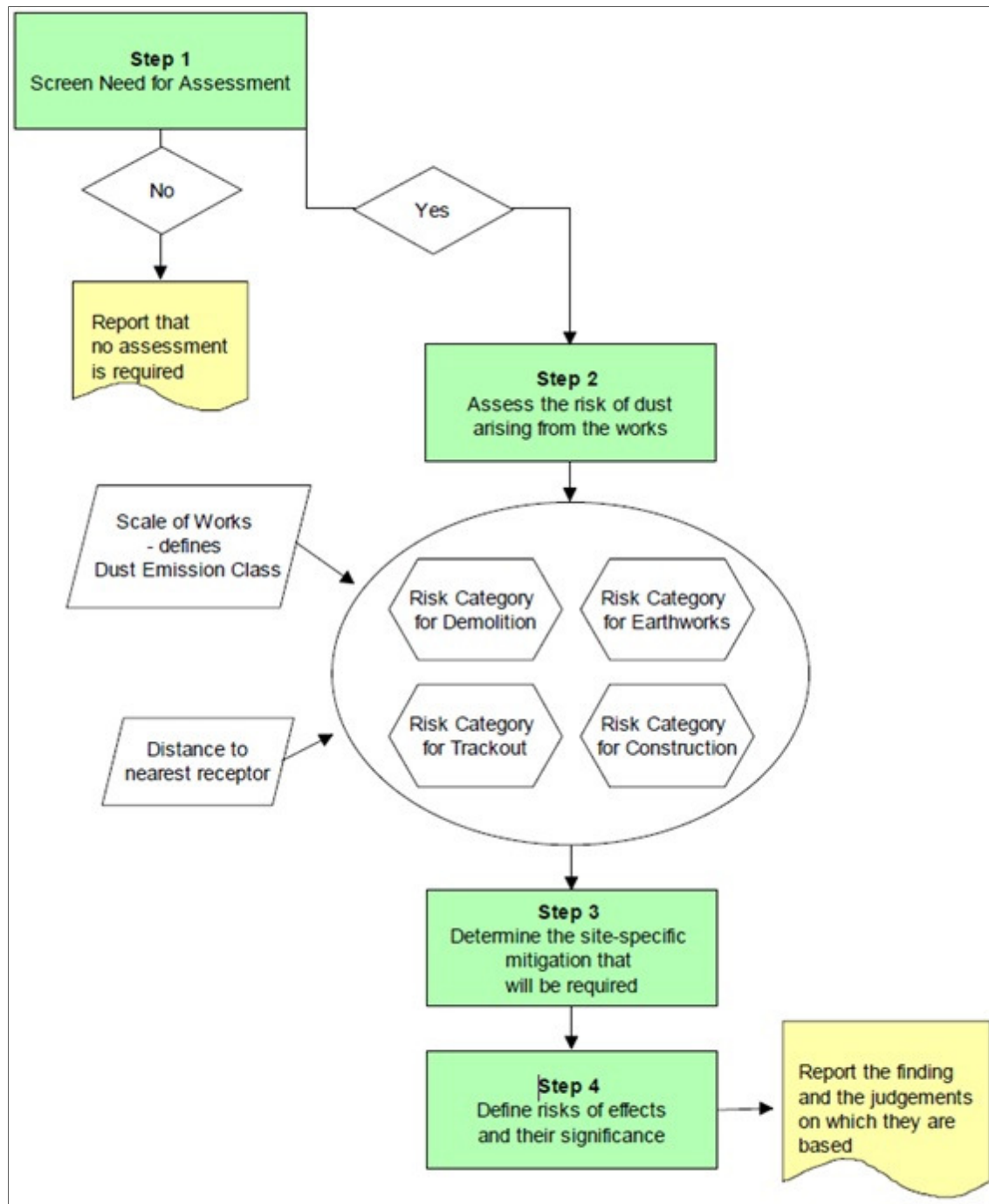
site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed”.

The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- Demolition;
- Earthworks;
- Construction; and
- Track out.

With regards to the proposed development site the potential for dust emissions is assessed for each activity that is likely to take place. The assessment procedure assumes no mitigation measures are applied. The conditions with no mitigation thus form the baseline or “do-nothing” situation for a construction site. The assessment procedure uses the steps provided in the guidance and summarised in Figure 1.

Figure 1 – Dust Assessment Procedure



4.2 Operational Phase (Traffic Emissions)

4.2.1 Modelled Scenarios

A future year has been chosen (2016) for the assessment, along with the baseline year (2012). Overall, two scenarios have been adopted as part of the assessment. These are as follows:

- **Scenario 1** – existing levels of air quality (2012); and
- **Scenario 2** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure (2016).

Predicted concentrations will be compared to the Air Quality Strategy objectives. The future year (2016) has been modelled in order to account for the increase in traffic flows along the modelled road network and represents the first full year of occupation following completion. However, in order to undertake a worst case assessment emission rates for 2012 have been used for all modelled scenarios.

4.2.2 ADMS-Roads

Modelling the impact of traffic emissions on the proposed development will be undertaken using the latest version of the ADMS-Roads model¹¹. ADMS-Roads is significantly more advanced than that of most other air dispersion models in that it incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

4.2.3 Emission Factors

Defra and the Devolved Administrations have provided an updated Emission Factors Toolkit (Version 5.2) which incorporates updated NO_x emissions factors and vehicle fleet information¹². These emission factors have been integrated into the latest ADMS-Roads modelling software. However, in order to undertake a worst case assessment emission factors for 2012 have been used for all modelled years.

4.2.4 Traffic Data

Traffic flow data for the A327 Southampton Street has been downloaded from the Department for Transport (DfT)¹³ for 2012. This data is provided in Table 3. Baseline data from the DfT (2012) has been projected to 2016 and is provided in Table 4. Projection of traffic data has been undertaken using growth factors specific to the Reading Borough

¹¹ Model Version: 3.2.4.0, Interface Version: 3.2.0 (18/10/2013)

¹² <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft>, January 2013

¹³ <http://www.dft.gov.uk/traffic-counts/index.php>

Council, obtained from TEMPro¹⁴ and National Road Traffic Forecasts (NRTF)¹⁵. The A4 Pell Street and A4 Crown Street have also been modelled for the purposes of model verification.

Modelled vehicle speeds have also been provided in Table 3. These speeds are based on local speed limit data. However, where a link approaches a junction a speed of 5 kph has been modelled in order to represent slow moving and queuing traffic.

Table 3 – Annual Average Daily Traffic Flows and Percentage HDV for Selected Roads, Baseline 2012 and Projected 2016

Road / Link	AADT (2012)	AADT (2016)	%HDV	Speed (kph)
A327 Southampton St (south of A4)	8,136	8,898	1.8%	48
A4 Pell Street	8,077	8,833	2.2%	48
A4 Crown Street	13,489	14,752	2.1%	48
A327 Southampton St (north of A4)	18,345	20,062	1.8%	48

Peter Brett Associates have advised that the current site generates 156 two-way vehicle movements per day. By comparison, the proposed four flat conversion will generate 7 two-way vehicle movements per day. The proposed student accommodation is expected to generate fewer vehicle movements than the flat conversion. As such, both proposed developments will have a positive impact on traffic flows along the local road network and their impact on local air quality as a result of changes to local traffic flows has not been assessed.

4.2.5 Street Canyons

A street canyon may be defined as a relatively narrow street with buildings on both sides. Street canyons may result in elevated pollutant concentrations from road traffic emissions due to a reduced likelihood of the pollutants becoming dispersed in the atmosphere. Street canyons have not been considered as part of this assessment.

4.3 Background Concentrations

Background NO₂ concentrations have been obtained from the National Air Quality Archive UK Background Air Pollution Maps¹⁶. These 1 km x 1 km grid resolution maps are derived from a base year of 2010 (for NO_x, NO₂, PM₁₀ and PM_{2.5} only), which are then projected to future years (2012). The background concentrations for 2012 are provided in Table 4 and have been used for all modelled scenarios.

¹⁴ Tempro (Trip End Model Presentation Program) version 6 , dataset v5.4 Department for Transport

¹⁵ National Road Traffic Forecasts (Great Britain) 1997, Department for Transport

¹⁶ UK Air Quality Archive, <http://laqm.defra.gov.uk/maps/maps2010.html>

Table 4 – Background NO_x, NO₂ and PM₁₀ Concentrations

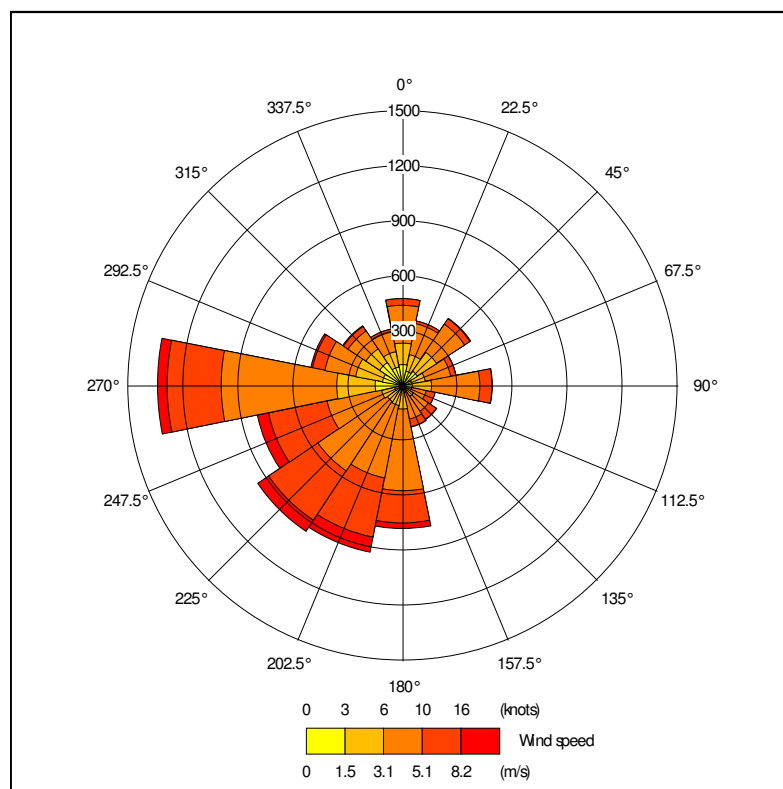
Pollutant	X	Y	2012
NO ₂	471500	172500	24.0
NO _x			39.4
PM ₁₀			18.0

4.4 Surface Roughness

A surface roughness of 1.0 metres has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for cities. This value has been used across the modelled domain.

4.5 Meteorological Data

Hourly sequential meteorological data from the Heathrow Airport meteorological station has been used. Wind speed and direction data from the Heathrow Airport meteorological station has been plotted as a wind rose in Figure 2.

Figure 2 – Wind Speed and Direction Data, Heathrow Airport (2012)

4.6 Model Output

4.6.1 NO_x/NO₂ Relationship

Following recent evidence that shows the proportion of primary NO₂ in vehicle exhaust has increased¹⁷. As such, a new NO_x to NO₂ calculator has been devised¹⁸. This new calculator has been used to determine NO₂ concentrations for this assessment, based on predicted NO_x concentrations using ADMS-Roads. Converted NO₂ concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NO_x concentrations are adjusted before conversion to NO₂.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short term impacts of NO₂ and PM₁₀. Research undertaken in 2003¹⁹ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³.

For PM₁₀, a relationship between the annual mean and the number of 24-hour mean exceedences has been devised and is as follows:

- No. 24-hour mean exceedences = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

This relationship has been applied to the modelled annual mean concentrations in order to estimate the number of 24-hourly exceedences.

4.6.3 Model Verification

The Council undertakes diffusion tube monitoring (NO₂) at a number of roadside locations. The diffusion tube located at the Red Cow pub along Southampton Street has been used for the purposes of model verification. The location of this verification site is provided in Table 5.

4.6.4 Receptor Locations

In order to assess the potential impact of the traffic emissions from the modelled network a number of receptors have been identified representing the boundaries of the proposed development at ground floor level. A description of these receptors is provided in Table 5 and their location is provided in Figure 3.

¹⁷ Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007

¹⁸ <http://laqm.defra.gov.uk/documents/NOx-NO2-Calculator-v3.2.xls>

¹⁹ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

Table 5 – Modelled Receptor Locations

Receptor ID	Coordinate Location		Height (m)	Receptor Description
	X	Y		
V1	471685	172853	2.0	Red Cow Pub diffusion tube, used for model verification
R1	471857	172432	1.5	Eastern boundary
R2	471845	172449	1.5	Northern boundary
R3	471837	172429	1.5	Western boundary
R4	471853	172408	1.5	Southern boundary

Figure 3 – Modelled Receptor Locations



4.7 Significance Criteria

4.7.1 Construction Phase

Assessing the risk of dust arising from the construction site (see Step 2, Figure 1) has used the emission classifications provided in Table 6. The overall risk is then defined (Table 7) based on the distance of relevant receptors to the construction activity.

Table 6 – Dust Emission Classifications Applicable to the Construction Site

Activity	Dust Emission Class		
	Large	Medium	Small
Demolition	Total building volume >50,000 m ³ , potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level	Total building volume 20,000 – 50 000m ³ , potentially dusty construction material, demolition activities 10-20 m above ground level	Total building volume <20,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months
Earthworks	Total site area >10,000 m 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	Total site area 2,500 – 10,000 m ² , moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes	Total site area <2,500 m ² , soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	Total building volume >100,000 m ³ , piling, on site concrete batching; sandblasting	Total building volume 25,000 m ³ – 100,000 m ³ , potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m	25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100 m;	<25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Table 7 – Risk Categories for each Construction Activity

Construction Activity	Distance to Nearest Receptor (m)		Dust Emission Class		
	Dust Soiling & PM ₁₀	Ecological	Large	Medium	Small
Demolition	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 100	<20	High Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Low Risk Site
	200 – 350	40 – 100	Medium Risk Site	Low Risk Site	Negligible
Earthworks	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 50	--	High Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
	200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible
Construction	<20	--	High Risk Site	High Risk Site	Medium Risk Site
	20 – 50	--	High Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
	200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible
Track out	<20	--	High Risk Site	Medium Risk Site	Medium Risk Site
	20 – 50	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
	50 – 100	20 – 100	Low Risk Site	Low Risk Site	Negligible

In order to undertake Step 4 (Figure 1) and determine the significance of potential dust effects professional judgement must be used, taking into account the factors that define the sensitivity of the surround area and overall pattern of potential risks derived from Table 7. Based on the IAQM guidance, the sensitivity of the surrounding area may be defined using the criteria provided in Table 8.

Table 8 – Factors Defining Sensitivity of an Area

Sensitivity of Surrounding Area	Human Receptors	Ecological Receptors
Very High	Very densely populated area. More than 100 dwellings within 20 m. Local PM ₁₀ concentrations exceed the objective. Contaminated buildings present. Very sensitive receptors (e.g. oncology units). Works continuing in one area of the site for more than one year.	European Designated site
High	Densely populated area. 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). Commercially sensitive horticultural land within 20m.	Nationally Designated site
Medium	Suburban or edge of town area. Less than 10 dwellings within 20 m. Local PM ₁₀ concentrations below the objective (e.g. annual mean 30-36 µg/m ³).	Locally designated site
Low	Rural area; industrial area No dwellings within 20 m Local PM ₁₀ concentrations well below the objectives (less than 75%) Wooded area between site and receptors	No designations

The sensitivity of the area surrounding the construction site is combined with the risk of the site giving rise to dust effects to define the significance of the effects for each of the four activities (demolition, earthworks, construction and track out). The significance of effects may be defined with and without mitigation for each activity, as detailed in the following tables.

Table 9 – Significance of Effects for each Activity with No Mitigation

Sensitivity of Surrounding Area	Risk of Site Giving Rise to Dust Effects		
	High Risk Site	Medium Risk Site	Low Risk Site
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight adverse	Negligible	Negligible

Table 10 – Significance of Effects for each Activity with Mitigation

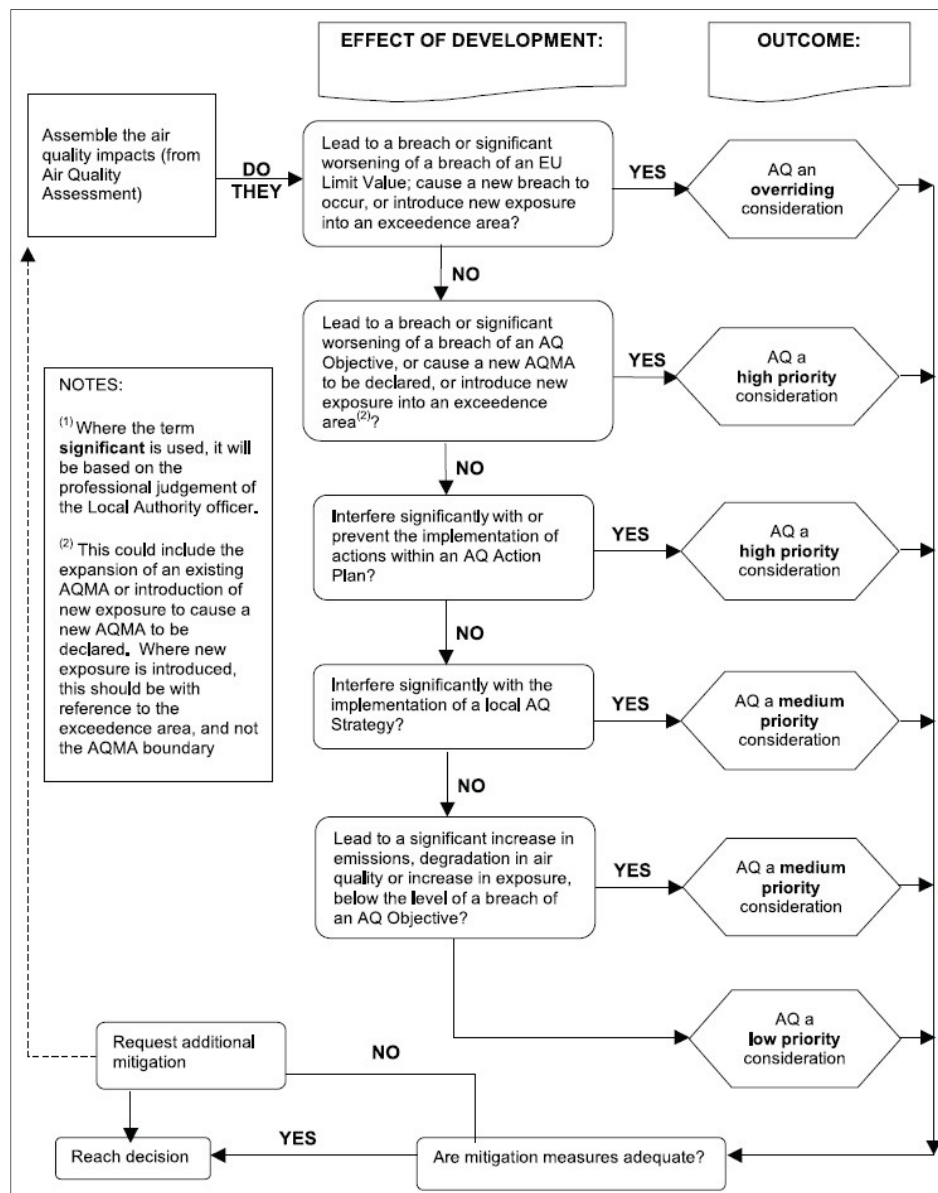
Sensitivity of Surrounding Area	Risk of Site Giving Rise to Dust Effects		
	High Risk Site	Medium Risk Site	Low Risk Site
Very High	Slight adverse	Slight adverse	Negligible
High	Slight adverse	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

The final step is to determine the overall significance of the effects arising from the construction phase of a proposed development. An overall summary table has been produced illustrating the potential effects with and without mitigation.

4.7.2 Operational Phase

The guidance released by Environmental Protection UK also provides steps for a Local Authority to follow in order to assess the significance of air quality impacts of a development proposal. This procedure, shown in Figure 4, has also been applied to the modelled results.

Figure 4 – Assessing the Significance of Air Quality Impacts of a Development Proposal



5 AIR QUALITY ASSESSMENT

5.1 Impact from Construction Activities

The assessment of construction activities has focused on the proposed student accommodation only. Using the criteria provided in Table 8 the dust emission class for each activity is as follows:

- Demolition = Small;
- Earthworks = Small;
- Construction = Small; and
- Track out = Small.

Based on the risk categories for each activity in relation to the surrounding sensitive receptors (Table 7) the site is considered to have a medium to high risk depending on the construction activity. This is summarised in Table 11.

Table 11 – Overall Risk of Site based on each Construction Activity

Construction Activity	Distance to Nearest Receptor (m)		Dust Emission Class		
	Dust Soiling & PM ₁₀	Ecological	Large	Medium	Small
Demolition	<20	N/A	N/A	N/A	Medium risk site
Earthworks	<20	N/A	N/A	N/A	Medium risk site
Construction	<20	N/A	N/A	N/A	Medium risk site
Track out	<20	N/A	N/A	N/A	Medium risk site

Based on Table 8, the sensitivity of the surrounding area is considered medium. As such, the significance of effects from demolition, earthworks, construction and track out activities with no mitigation is, at worst, slight adverse (see Table 9). With mitigation, the significance of effects from demolition, earthworks, construction and track out activities is negligible (see Table 9). This is summarised in the following table.

Table 12 – Summary of Significance for Construction Activities

Source	Dust Soiling and PM ₁₀ Effects	
	With no Mitigation	With Mitigation
Demolition	Slight Adverse	Negligible
Earthworks	Slight Adverse	Negligible
Construction	Slight Adverse	Negligible
Track Out	Slight Adverse	Negligible

It should also be noted that the likelihood of an adverse impact occurring is correlated to wind speed and wind direction. As such, unfavourable wind speeds and wind directions must occur at the same time as a dust generating activity in order to generate an adverse

impact. The overall impacts also assume that the dust generating activities are occurring over the entirety of the site meaning that as an activity moves further away from a potential receptor the magnitude and significance of the impact will be further reduced. This is particularly relevant to the existing receptor immediately to the east of the proposed development.

The impact of exhaust emissions (PM₁₀) from construction vehicles has not been assessed. Based on the air quality planning guidance issued by EPUK, an assessment of construction exhaust emissions on the local road network should be undertaken for developments with HDV flows of greater than 200 movements per day. Furthermore, modelling of exhaust emissions from construction traffic is problematic due to the temporary nature of construction activities and the irregular movements associated with the different phases of a particular development. As such, any modelling of these emissions would be worst case and not representative of the actual emissions from construction related traffic.

5.2 Impact of Vehicle Emissions

5.2.1 Model Verification

Using the guidance provided in Box A3.6 within the Local Air Quality Management Technical Guidance TG(09)²⁰, the modelled output has been verified against the monitoring data obtained from the diffusion tube located at the Red Cow pub along Southampton Street. The following table provides a summary of the model verification process for NO_x/NO₂. It has not been possible to verify modelled PM₁₀ concentrations.

Table 13 – Comparison of Modelled and Monitored NO₂ Concentrations (µg/m³), 2012

Verification Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/monitored] x100
V1	32.2	43.0	-25.1%

As described in the Technical Guidance (LAQM.TG09), in order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within ±25% (ideally ±10%) of the monitored concentrations. Since the modelled concentration is under-predicting by more than 25% the predicted modelled concentrations will require adjustment in order to improve the confidence in modelled concentrations across the modelled domain.

²⁰ Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance (TG09), Defra, February 2009

5.2.2 Model Adjustment

In order to undertake model adjustment, it is first necessary to derive the monitored and modelled road contributions of NO_x (excluding background). The modelled road contribution NO_x is taken directly from the ADMS-Roads output before it has been converted to NO₂ using the NO_x to NO₂ calculator described in Section 4.6.1. The NO_x to NO₂ calculator can also be used to derive monitored road contributions of NO_x from NO₂ diffusion tube results. A summary of these calculations is provided in Table 14.

Once the monitored and modelled road contributions of NO_x (excluding background) have been derived the contributions of NO_x are compared and a ratio derived. In this case the ratio is 2.49 and this factor has been used to adjust the modelled road contribution of NO_x. This is shown in Table 15.

Table 14 – Monitored NO_x and NO₂ concentrations, 2011

AQA ID	Monitored Total NO ₂	Defra Background NO ₂	Monitored road contribution NO ₂ (total – background)	Monitored road contribution NO _x (total – background)	Modelled road contribution NO _x (excludes background)	Ratio of monitored road contribution NO _x / modelled road contribution NO _x
V1	43	24	19	43.9	17.6	2.49

Table 15 – Adjustment of Modelled NO_x Contributions, 2011

AQA ID	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NO _x	Modelled total NO ₂ (based on empirical NO _x /NO ₂ relationship)	Monitored total NO ₂	% Difference [(modelled – monitored) / monitored] x 100
V1	2.49	43.9	43.0	43	0.0%

Following adjustment of the modelled NO_x concentrations by a factor of 2.49 the total NO₂ concentration at the model verification location has been calculated using the method described in Section 4.6.1. The revised NO₂ concentration, shown in Table 20, indicates a more acceptable model performance when compared against the monitored NO₂ concentrations. As such, an adjustment factor of 2.6 has been applied to all modelled NO_x concentrations across the model domain before conversion to NO₂.

5.2.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO₂ in 2012 and 2016 are provided in Table 16. As mentioned in Section 4.6.1, NO₂ concentrations have been calculated from the predicted NO_x concentrations using the latest NO_x-NO₂ conversion spreadsheet available from the Air Quality Archive.

Table 16 – Predicted NO₂ Concentrations, Annual Mean (µg/m³)

Receptor ID	2012	2016
R1	24.7	24.8
R2	24.8	24.8
R3	24.6	24.7
R4	24.6	24.6

The predicted concentrations of NO₂ in 2012 and 2016 are below the annual mean objective at all the modelled receptor locations.

Nitrogen dioxide also has an hourly objective of 200 µg/m³ not to be exceeded more than 18 times in one year. However, the hourly mean concentration is not calculated directly by the ADMS Roads model. This is as a result of an evaluation of continuous monitoring data from across the UK that revealed that the relationship between the annual mean and hourly mean NO₂ concentrations was very weak. Nonetheless, research undertaken in 2003²¹ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³. Given that predicted NO₂ concentrations in 2012 are well below 60 µg/m³ at all the modelled receptors, the short term objective for NO₂ is unlikely to be exceeded.

5.2.4 Particulate Matter

Predicted annual mean concentrations for PM₁₀ in 2012 and 2016 are provided in Table 17. The number of 24-hour exceedences is also provided.

Table 17 – Predicted PM₁₀ Concentrations, Annual Mean (µg/m³)

Receptor	Annual Mean, 2012	24-hour Mean Exceedences, 2012	Annual Mean, 2016	24-hour Mean Exceedences, 2016
R1	18.1	1	18.1	1
R2	18.1	1	18.1	1
R3	18.0	1	18.1	1
R4	18.0	1	18.1	1

²¹ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003



The ADMS predictions for annual mean PM₁₀ concentrations for 2012 and 2016 indicate that the annual mean objective (40 µg/m³) would be achieved at all the modelled receptor locations. In addition, the maximum number of days when PM₁₀ concentrations are more than 50 µg/m³ is 1, less than the 35 exceedences allowed in the regulations. Using the flow chart presented in Figure 4, air quality (PM₁₀) is a low priority consideration based on the predicted concentrations provided above.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Impact from Construction Activities

A qualitative assessment of dust levels associated with the proposed student accommodation has been carried out. The qualitative assessment shows that with no mitigation the significance of dust soiling and PM₁₀ is, at worst, slight adverse. However, this can be reduced to negligible through appropriate mitigation measures. Implementation of the following Best Practice Measures based on a low risk site²² will help reduce the impact of the construction activities to an acceptable level:

Site Planning:

- Erect effective barriers around dusty activities or the site boundary;
- No bonfires; and
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors.

Construction Traffic:

- All vehicles to switch off engines – no idling vehicles;
- Effective vehicle cleaning and specific wheel-washing on leaving site;
- All loads entering and leaving site to be covered;
- No site runoff of water or mud; and
- All non road mobile machinery (NRMM) to use ultra low sulphur tax-exempt diesel (ULSD) where available.

Site Activities:

- Use water as dust suppressant;
- Cutting equipment to use water as suppressant or suitable local exhaust ventilation systems; and
- Securely cover skips and minimise drop heights.

With the above mitigation measures enforced, the likelihood of nuisance dust episodes occurring at those receptors adjacent to the development is reduced. Notwithstanding this, the developer should take into account the potential impact of air quality and dust on occupational exposure standards (in order to minimise worker exposure) and breaches of air quality objectives that may occur outside the site boundary. Monitoring is not recommended at this stage, however, continuous visual assessment of the site should be undertaken and a complaints log maintained in order to determine the origin of a particular dust nuisance. Keeping an accurate and up to date complaints log will isolate particular site activities to a nuisance dust episode and help prevent it from reoccurring in the future.

²² The control of dust and emissions from construction and demolition – Best Practice Guidance, produced in partnership by London Councils and the Greater London Authority, November 2006

6.2 Impact of Vehicle Emissions

Predicted PM₁₀ and NO₂ concentrations do not exceed the relevant air quality objectives in 2012 or 2016 at any of the modelled locations. Using the flow chart presented in Figure 4, air quality (PM₁₀ and NO₂) is a low priority consideration based on the predicted concentrations at the modelled receptors.

6.2.1 Building Mitigation

Based on the results and discussion above there is no need to consider building mitigation.

6.3 Overall Conclusion

Based on the outcome of this assessment the current proposals are considered acceptable in terms of the potential air quality impacts across the development.