12.0 AIR QUALITY

12.1 INTRODUCTION

The following chapter, completed by Bureau Veritas, outlines the assessment of the impacts of the development with respect to air quality. The air quality impacts have been assessed against objectives set out by the UK Government.

12.2 POTENTIAL EFFECTS

In respect of air quality, there are two key potential effects which may result from the development of the Brickkiln scheme:

- Changes to air quality as a result of development;
- Introduction of new exposure relevant to air quality.

Changes to air quality as a result of development may arise due to the generation of additional emissions, principally from road traffic. This assessment aims to identify where changes in air quality may occur as a result of emissions from road traffic generated by the Brickkiln scheme. The assessment will also assess the potential impact of dust generation from the construction phase of development and discuss mitigation solutions to reduce any identified impacts.

Development of the Brickkiln scheme will result in the construction of new sensitive receptors including residential properties and a school. This assessment will consider the air quality at these new sensitive receptors constructed as part of the Brickkiln scheme.

12.3 ASSESSMENT METHODOLOGY

12.3.1 Air Quality Legislation

The significance of existing and future ambient pollutant concentrations will be assessed first and foremost in relation to national air quality standards and objectives, established by the Government. The revised Air Quality Strategy (AQS)[1] released in July 2007 provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and devolved administrations to protect human health. The air quality objectives incorporated into the

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland

AQS and UK legislation are derived from the Limit Values prescribed in the EU Directives that have to be transposed in national legislation.

The CAFÉ (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The Directive 2008/50/EC[2] replaces all previous air quality Directives. The Directive introduces obligatory standards for $PM_{2.5}$ for Government (but places no statutory duty on local Government to work towards achievement of this new standard).
The objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, particles (PM_{10} and $PM_{2.5}$), ozone and polycyclic aromatic hydrocarbons) have been prescribed within the AQS, and are also included within The Air Quality Standards Regulations (2007)[3]. Where traffic emissions are the main source of pollution, ongoing assessments, undertaken by local authorities, have shown that the main pollutants of concern are nitrogen dioxide and particulates. The objectives set out in the AQS for these pollutants are summarised in *Table 12.1*.

Table 12.1 - Air Quality Strategy Objectives for England

Pollutant	Objective	Concentration measured as	Date to be achieved by and maintained thereafter
Nitrogen dioxide (NO_2)	200 µg/m^3, not to be exceeded more than 18 times a year (99.8%ile)	hourly mean	31st December 2005
	40 µg/m^3	annual mean	31st December 2005
Particles (PM_{10})[4]	50 µg/m^3, not to be exceeded more than 35 times a year (90.4%ile)	24 hour mean	31st December 2004
	40 µg/m^3	annual mean	31st December 2004
Particles ($PM_{2.5}$)[5]	25 µg/m^3	annual mean	2020
	Target of 15% reduction in concentrations at urban background	annual mean	In urban areas between 2010 and 2020

Whilst a number of health-based standards and objectives are set down in current UK legislation, the air quality chapter focuses on those pollutants that are the primary concern in the area of the proposed development – namely those emanating from road traffic. These include nitrogen dioxide (NO_2) and fine particles (PM_{10}). Other pollutants, such as carbon monoxide and benzene are also associated with emissions from road traffic. However, the current national picture on air quality indicates that these pollutants are no longer of concern and (where traffic is the significant emission source) do not occur at sufficiently high levels to pose a threat to human health. In addition, short-term construction impacts are generally associated with the potential for nuisance to occur through the possibility of dust, and potentially PM_{10}, emissions arising from certain activities.

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

[3] The Air Quality Standards Regulations 2007, Statutory Instrument No 64,The Stationery Office Ltd

[4] Measured using the European gravimetric transfer sampler or equivalent

[5] Measured using the European gravimetric transfer sampler or equivalent

12.6.1 Local Air Quality Management

Part IV of the Environment Act 1995 places a statutory duty on local authorities to periodically review and assess the current and the future air quality within their area – a process known as Local Air Quality Management (LAQM). The air quality objectives that apply to LAQM are defined in Air Quality Regulations 2000[6] and Air Quality (England) (Amendment) Regulations 2002[7] for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide and particulates - PM_{10}.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)[8] and introduced the idea of local authority 'Review and Assessment'. The Government subsequently published policy and technical guidance related to the review and assessment processes in 1998. This guidance has since been revised in light of increased understanding and the development of additional assessment tools and the latest documents include Policy Guidance (LAQM.PG (09))[9] and Technical Guidance (LAQM.TG (09))[10]. The guidance lays down a progressive, but continuous, framework for the local authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

Where the results of the review and assessment process highlight that problems in the attainment of health-based objectives for air quality are likely to arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of health-based standards. Having declared an AQMA the authority is required to undertake further monitoring or modelling assessments through a Further Assessment and propose measures that could be used to improve air quality, through the formulation of an Action Plan.

The review and assessment process for Luton City Council and North Hertfordshire are summarised further in *Section 12.4* of this assessment.

12.6.2 Scope and Methodology

The purpose of the air quality assessment is to predict pollutant concentrations at proposed and existing sensitive receptor locations under baseline and development conditions in order to ascertain the impact of the Brickkiln scheme on local air quality. Impacts will be assessed for significance and compared to AQS objectives.

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[6] The Air Quality (England) Regulations 2000 (Statutory Instrument 928)

[7] The Air Quality (England) (Amendments) Regulations 2000 (Statutory Instrument 3043)

[8] DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationary Office

[9] Policy Guidance LAQM.PG(09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

[10] Technical Guidance LAQM.TG (09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

Baseline conditions have been established through local air quality monitoring of NO_2 using passive diffusion tubes, and through detailed dispersion modelling using the ADMS-Roads atmospheric dispersion modelling software. The impact of emissions from changes in traffic flows brought about by the development has been assessed in the vicinity of the Brickkiln site using ADMS-Roads and in the wider area (Regional) using the Design Manual for Roads and Bridges air quality model. The focus of the assessment is on the pollutants nitrogen dioxide (NO_2) and fine particles (PM_{10}).

The impact of dust generation from activities associated with the construction of the Brickkiln development has been qualitatively assessed using the latest guidance on construction dust. Possible mitigation measures have been provided to reduce further the impact of construction dust from the Brickkiln development as is normally expected through good site practices and provided for by the Draft Construction Code of Practice (CoCP).
The air quality assessment has been completed using the latest development masterplan number 390-2-40A.
The scenarios assessed within the air quality assessment include:

Base Year – this is representative of existing air quality and has been assumed for air quality purposes to be 2008 as this is the year for which monitoring data is available. The purpose of the base year air quality assessment is to demonstrate suitable agreement between available monitored and modelled .

Do-Minimum 2016 and 2031 – this is the future year without the proposed scheme. A do-minimum scenario assumes that normal growth in traffic on local roads occurs in future years.

Do-Something 2016 and 2031 – this is the future year with the proposed scheme in place. The scenario includes expected changes to traffic flows due to the scheme and include any new road links and receptors introduced by the scheme.

12.6.3 Assessment of Significance

The significance of the changes in air quality due to the operation of the Brickkiln development is described based on the changes in:

- The annual average NO2 concentrations;
- The annual average PM10 concentrations; and
- The change in the number of daily mean PM10 exceedences.

The NSCA (now Environmental Protection UK) guidance document11 on planning for air quality has been used as a framework to determine the significance of the impacts taking into account:

[11] NSCA Development Control Planning for Air Quality (2006) Updated Guidance from NSCA on Dealing with Air Quality Concerns Within the Development Control Process

- the annual mean pollutant concentration or number of exceedences relative to the Air Quality Strategy objectives both with and without the proposed development in operation;
- the direction of change (positive or negative); and
- the magnitude of change (based on percentage change for annual means, number of days for daily mean).

The impact magnitude is a range between extremely low and very high. *Table 12.2* indicates how these descriptors relate to the change in concentration between the Do-Something and Do-Minimum scenarios.

Significance assessment is assigned at each receptor where impacts are quantified based on predicted changes in air quality between the Do-Minimum and Do-Something scenarios.

Taking account of the change in concentrations at each receptor, and the position relative to the objective, the impact assessment is described in the Environmental Statement as negligible, minor, moderate or substantial, and whether the change is positive (beneficial) or negative (adverse) in terms of air quality. *Table 12.3* defines the significance assessment descriptors used within this Environmental Statement.

Table 12.2 Assignment of Magnitude of Impacts

Impact Magnitude Based On The Change Between Do-Minimum and Do-Something		
Annual Mean (NO_2 and PM_{10})	Daily Mean (PM_{10})	Air Quality Descriptor
Impact Magnitude		
>25%	>15 Days	Very High
15 - 25%	10 - 15 Day	High
10-15%	5 - 10 Days	Moderate
5-10%	3 - 5 Days	Low
1-5%	1-3 Days	Very Low
<1%	1 Day	Extremely Low

Table 12.3 - Impact Significance	
Impact Significance	**Description**
Substantial Beneficial	Impacts are large in scale (global/national) and/or have a high environmental benefit
Moderate Beneficial	Impact on a regional scale and/or represent a medium level environmental benefit
Minor Beneficial	Impacts are small scale (localised) and/or are a low environmental benefit with no measurable impact
Negligible	No measurable impact is expected to occur as a result of considering the impact
Minor Adverse	Impacts are small scale (localised) and/or are a low environmental hazard with no measurable impact
Moderate Adverse	Impact on a regional scale and/or represent a medium level environmental hazard
Substantial Adverse	Impacts are large in scale (global/national) and/or have a high environmental hazard

12.6.4 Air Quality Dispersion Modelling

Design Manual for Roads and Bridges Air Quality Model

The Design Manual for Roads and Bridges (DMRB) air quality model is a widely used tool for estimating pollutant emissions in support of new residential and commercial developments and proposed road schemes by considering the wider scale impacts of changes in traffic flows on a road network.

The DMRB regional air quality model has been used to estimate the impacts of the Brickkiln development on Regional Air Quality by comparing total emissions of NOx, PM_{10} and carbon dioxide on the road network with and without the scheme. The model considers a number of inputs including link length, AADT, average speeds and vehicle class types to calculate the total annual emissions for each road link included in the assessment.

ADMS-Roads Detailed Dispersion Model

Detailed dispersion modelling in order to predict concentrations of NO_2 and PM_{10} in the vicinity of the Brickkiln scheme has been undertaken in this assessment using the ADMS-Roads (version 2.3) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC). ADMS-Roads is an advanced Gaussian dispersion model, which has been extensively used for air quality impact assessments of development schemes.

Road traffic emissions due to traffic are included within the dispersion modelling, and background concentrations due to other sources in the area are also accounted for.

Traffic Data

The traffic data used within the air quality assessment was produced by David Tucker Associates and further details of the transport assessment are provided in *Chapter 10* of this

Environmental Statement. *Table H1.2* of *Appendix H1* summarised the traffic data used for this air quality assessment.

The Brickkiln development will involve the construction of a small network of new roads to support the site and provide access to the proposed properties. The Brickkiln scheme is designed to result in minimal traffic impacts to the existing villages of Cockernhoe and Tea Green. The proposed site road network and traffic measures described in Chapter 10 reduce the overall traffic impacts of the scheme and changes to traffic flows are generally minor.

All main roads in the vicinity of the Brickkiln site have been modelled, as listed in Appendix H1.2, and include Eaton Green Road, Crawley Green Road, Beech Hill, Lilley Bottom, Stoney Lane, Chalk Hill, Ashcroft Road, Vauxhall Way and Stopsley Way.

Emissions Factors

The vehicle emissions have been calculated using the vehicle emission factors presented on the National Atmospheric Emissions Inventory website[12] (version 02/3). These are the most up-to-date emission factors available and were released in 2002 by the Department for Transport (D*f*T).

The emissions factors are available for three different road types which act as a proxy for the differences in fleet composition of traffic in different conditions; urban, rural and motorway. For this assessment, "urban" was selected to represent the emissions profiles for types of road included in air quality model.

Emissions factors for vehicles are currently only available up to 2025, beyond these years the emissions are assumed to be the same.

Background Concentrations

Background pollutant concentrations have been chosen using background pollutant concentrations maps produced by Defra and published on the Air Quality Archive[13] website. These maps provide the contribution of different sources to general background air quality including motorways, major roads, domestic emissions, industrial sources, and other sources such as airports.

The background concentrations vary across the Brickkiln development site and sensitive receptors identified due to different roads in the area and proximity to London Luton Airport. Background concentrations have been determined for sensitive receptors using Defra mapped background and where necessary the contributions of major roads have been removed in order to avoid double counting (where these sources have been modelled using ADMS-Roads), but the background pollutant concentrations do include relevant contribution

[12] www.naei.org.uk

[13] www.airquality.co.uk

from London Luton Airport. In total, 11 separate background concentrations have been calculated and applied to each model receptor dependent on its location.

Background pollutant concentrations have been obtained for the air quality baseline year (2008), and future years (2016 and 2031). It should be noted that the background pollutant maps produced by Defra cover all years up to 2020 only. Therefore background pollutant concentrations for 2020 have used for 2031.

The background pollutant concentrations used for each receptor in the assessment are displayed in *Table 12.4*.

Table 12.4 Background Pollutant Concentrations

	Background NO_2 Concentrations ($\mu g/m^3$)			Background PM_{10} Concentrations ($\mu g/m^3$)			Receptors to which each background concentration applies
	2008	**2016**	**2031***	**2008**	**2016**	**2031***	
1	14.9	11.8	10.7	17.4	16.6	16.4	43
2	15.7	12.4	11.3	17.8	16.9	16.7	44, 45, DS8, DS11
3	16.8	13.0	11.8	18.4	17.5	17.3	32, 33
4	17.0	13.4	12.2	18.4	17.4	17.3	39, 40, 41, 42, DS2, DS3, DS4, DS6, DS7, DS9, DS10, DS12
5	17.1	13.7	12.5	18.3	17.4	17.3	47, 48, DS1, DS5
6	18.7	14.8	13.6	18.9	18.0	17.8	13, 14, 15, 34, 35, 36, 37, 38, 60
7	19.4	15.1	13.7	19.7	18.7	18.5	21, 22, 23, 24, 25, 26, 27, 31
8	20.2	15.8	14.4	19.8	18.8	18.6	16, 17, 18, 19, 20, 61, 62, 63
9	20.7	16.9	15.7	20.3	19.2	19.0	7, 9, 10, 11, 12
10	22.1	17.4	15.9	21.0	19.8	19.6	1, 2, 3, 4, 5, 6, 28, 29, 30
11	22.2	17.6	16.2	20.9	19.8	19.5	8

*Background pollutant concentrations for 2020 have been used for 2031

Meteorological Data

Dispersion of pollutant emissions is partly dependent upon the prevailing meteorological conditions at the time of emissions release. Hourly sequential meteorological data from High Wycombe, the closest representative station, has been used in the dispersion modelling assessment.

Whilst meteorological data is available for London Luton Airport, the data capture for wind speeds and cloud cover in 2008 were less than 70% which is not sufficient for the purposes of air dispersion modelling. As such, an alternative, more complete dataset, was selected. The High Wycombe station has been selected based on its proximity (within 25 miles of the Brickkiln site) and its high level of successful data capture during 2008. The data shows predominant westerly and south westerly wind directions.

Sensitive Receptors

Air pollutant concentrations have been estimated at specific receptors representing the locations of proposed residential properties on the Brickkiln site and existing residential properties in the areas surrounding the Brickkiln development site. In total, 63 existing residential receptors and an additional 12 proposed residential receptors have been included in the air quality model.

Pollutant concentrations were modelled at a height of 1.5m above ground which represents the average respirable height of an adult.

A map showing the location of the model receptors is displayed in *Figure H1.1*.

12.4 BASELINE CONDITIONS

12.6.1 Summary of LAQM Review and Assessment in North Hertfordshire

North Hertfordshire District Council has been undertaking review and assessment of air quality since 1999. To date, North Hertfordshire District Council have completed three rounds of statutory review and assessment and are currently undertaking their fourth round of review and assessment (2009-2011).

The first and second rounds of review and assessment concluded that all air quality objectives would be met in North Hertfordshire. The third round however, concluded that there was a risk of exceedence of the NO_2 annual mean objective at three junctions in the district. These three junctions were subject to a Detailed Assessment in 2007 which concluded that North Hertfordshire District Council should consider declaring an AQMA at the junction of Hitchin Street and Whitehorse Street in Baldock.

The latest LAQM report, USA 2009, has identified two areas in Baldock and two areas in Hitchin with potential risk of exceedence for NO_2. North Hertfordshire District Council is currently reviewing the options for undertaking the Detailed Assessments for these areas.

North Hertfordshire District Council have not declared any AQMAs at or near to the Brickkiln site boundary.

12.6.2 Summary of LAQM Review and Assessment in Luton

Luton City Council has been undertaking review and assessment of air quality since 1999. To date, Luton City Council have completed three rounds of statutory review and assessment and are currently undertaking their fourth round of review and assessment (2009-2011).

Luton City Council has currently declared two AQMAs. Both AQMAs have been declared on the basis of expected exceedences of the NO2 annual mean objective at residential receptors adjacent to the M1 motorway due to road traffic emissions.

Luton City Council's AQMA No1, declared in 2003, comprises 24 properties adjacent to the M1 motorway. Luton's AQMA No2, declared in 2005, comprises 431 properties around Junction 11 of the M1 motorway.

Luton City Council have not declared any AQMAs at or near to the Brickkiln site boundary.

12.6.3 Local Authority Air Quality Monitoring

Luton City Council Air Quality Monitoring

Luton City Council currently undertake automatic monitoring of NO_2 at one location in the area, Luton Background at Challney Community College on Stoneygate Road. Luton City Council also undertake automatic monitoring of PM_{10} at two locations in the area, Luton Background and Luton Airport. NO_2 monitoring is undertaken using a chemiluminescent analyser and PM_{10} monitoring is undertaken using a Tapered Element Oscillating Microbalance (TEOM) at Luton Background and a Beta Attenuation Mass (BAM) monitor at Luton Airport. The Quality Assurance/Quality Control (QA/QC) procedures for the site are equivalent to the UK Automatic Urban and Rural Network (AURN) procedures. Data from these sites are displayed in *Table 12.5*.
Luton City Council does not currently undertake monitoring for NO_2 at any diffusion tube sites in the city.

Table 12.5 - Luton City Council Automatic Monitoring Results 2006-2008

Location	Objective	Annual Mean Concentrations in µg/m^3		
		2006	2007	2008
Luton Background (Challney Community College)	Annual Mean NO_2 > 40 µg/m^3	33.8	35	34
	NO_2 Hourly Mean > 200 µg/m^3 no more than 18 times per year	0	0	0
	% Data Capture	83	87	81
	Annual Mean PM_{10} > 40 µg/m^3	24.3	23.1	21.3
	PM_{10} Daily Mean > 50 µg/m^3 no more than 35 times per year	10	12	4
	% Data Capture	95	92	92
Luton Airport	Annual Mean PM_{10} > 40 µg/m^3	27.8	22.8	20.5
	PM_{10} Daily Mean > 50 µg/m^3 no more than 35 times per year	15	10	4
	% Data Capture	87	97	95

North Hertfordshire District Council Air Quality Monitoring

North Hertfordshire District Council currently undertake automatic monitoring of NO_2 and PM_{10} at one location in the area, Breachwood Green urban background site. NO_2 monitoring is undertaken using a chemiluminescent analyser and PM_{10} monitoring is undertaken using a TEOM. The Quality Assurance/Quality Control (QA/QC) procedures for the site are equivalent to the UK AURN procedures. Data from the Breachwood Green urban background site is displayed in *Table 12.6*.

North Hertfordshire District Council also currently undertake monitoring for NO_2 at 34 diffusion tube sites in the district, however there are no diffusion tube sites in North Hertfordshire that are relevant to the Brickkiln development site.

Table 12.6 North Hertfordshire DC Automatic Monitoring Results 2006-2008

Location	Objective	Annual Mean Concentrations in µg/m^3		
		2006	2007	2008
Breachwood Green Urban Background	Annual Mean NO_2 > 40 µgm^3	16	18	19
	NO_2 Hourly Mean > 200 µgm^3 no more than 18 times per year	0	0	0
	% Data Capture	91	96	98
	Annual Mean PM_{10} > 40 µgm^3	20	19	17
	PM_{10} Daily Mean > 50 µgm^3 no more than 35 times per year	4	5	1
	% Data Capture	85	97	96.2

12.6.4 Bureau Veritas Air Quality Monitoring

Air quality monitoring was undertaken for NO_2 at ten locations near to the Brickkiln development site in 2008. In 2009, the NO_2 monitoring was extended to 16 locations. This monitoring, by Bureau Veritas, has been carried out in order to inform the air quality assessment as no monitoring close the Brickkiln site is available from local authorities. The monitoring data collected for the scheme also enables the results of dispersion modelling to be checked in order to ensure predicted concentrations are representative of local air quality.

Bureau Veritas Air Quality Monitoring Methodology

Monitoring was undertaken using passive diffusion tubes which are exposed to ambient air and analysed in a laboratory to identify average atmospheric concentrations of NO_2 during the exposure period.

Diffusion tubes were prepared and analysed using the 50% TEA in acetone method. The diffusion tubes were supplied and analysed by Gradko International Ltd who hold UKAS accreditation for this process.

The results will be corrected for bias and annualised where applicable in line with Luton City Council and North Hertfordshire District Council's local air quality monitoring. Results for 2008 have been bias adjusted using the default adjustment factor for the analysis method used (0.93) and those sites with less than 75% data capture have been annualised. At present, the monitoring results for 2009 remain uncorrected as the monitoring study is still ongoing, however, the data shows similar levels to those for 2008.

Bureau Veritas Air Quality Monitoring Results

Results of Bureau Veritas' diffusion tube monitoring for NO_2 around the Brickkiln development site in 2008 and 2009 are displayed in *Table 12.7*. Exceedences of the NO_2 annual mean AQS objective of 40µg/m^3 are underlined.

Table 12.7 - Results of Bureau Veritas' NO_2 Monitoring Brickkiln (2008-2009)

Site ID	Site Location	Annual Mean NO_2 Concentrations (µg/m^3)	
		2008	2009*
1	Chalk Hill / Cockernhoe	16.7	18.6
2	Lilley Bottom Road	17.5	18.0
4	Hawthorn Avenue	20.0^	24.6
5	A505 N bound	35.3	30.9
6	A505 S bound	35.9	35.5
7	Ashcroft Road off A505	31.0^	34.5
8	Crawley Green Road	27.9^	34.2
9	Crawley Green Road	38.2^	38.7
10	Eaton Green Road	19.2	20.2
13	Crawley Green Road	33.9$^+$	32.7
14	Wongs Chinese Take-Away	**42.5**$^+$	**41.0**
15	Hartsfield Road / Vauxhall Way 1*		-
16	Hartsfield Road / Vauxhall Way 2	31.1$^+$	30.0
17	Hartsfield Road / Vauxhall Way 3	26.5$^+$	25.6
18	A505 Hitchin Road 1	40.1$^+$	38.7
19	A505 Hitchin Road 2	32.2$^+$	31.1

* 0% data capture for monitored period as tube was repeatedly removed.
^ Annualised due to less than 75% data capture.
$^+$ Results projected from 2009 based on Defra Technical Guidance (LAQM.TG09)

Monitoring results suggest that concentrations at most sites are below the air quality objective of 40 µg/m^3 for NO_2. The highest concentrations are measures at locations close to the busier roads in Luton and concentrations close to or above the air quality objective are measured near the A505 Hitchin Road and Crawley Green Road near Vauxhall Way in the centre of Luton. In particular diffusion tubes close the development site area all well below the air quality objective and are representative of background locations, include Crawley Green Road and Eaton Green Road.

12.5 MITIGATION MEASURES

12.6.1 Construction Dust

Although this chapter primarily examines the impact to local air quality of the operation of the Brickkiln development, there is also potential for impacts during the construction phase. Construction of the Brickkiln scheme will take several years and involve activities likely to generate emissions to air. The main pollutant of concern with respect to construction activities is particulate matter (PM_{10} and dust).
A Construction Code of Practice (CoCP) for the Brickkiln scheme will be prepared and adhered to during development of the scheme. The CoCP will include measures designed to mitigate the impact of a number of environmental concerns associated with construction, including dust and PM_{10}.

The Best Practice Guidance for the control of dust and emissions from construction and demolition[14] classifies the Brickkiln site as "High Risk" with respect to construction dust. This classification is based on the site being greater than 15,000 square metres in size and involving the development of more than 150 properties.

During construction, consideration would need to be given to the movement of vehicles on and off the development site, the operation of on-site machinery and re-suspended dust from stockpiles, earthworks, and haul routes.

Demolition of existing structures can be a significant source of dust and particulate emissions due the release of emissions into the air which may cause elevated concentrations and deposition of dust onto surfaces. There is no demolition to be undertaken for the proposed scheme and there are no potential sources of pollution due to demolition.

Those activities which may be associated with the construction phase of the Brickkiln scheme which have the potential to generate emissions of PM_{10} and dust include:

- Earthworks including land clearing, ground excavation and laying of foundations;
- Construction of new infrastructure including site access, site roads and drainage;
- Vehicle movements to, from and on the site;
- Material handling e.g. the transfer of materials to trailers or stockpiles and distribution of raw materials on-site;
- Storage of aggregate materials in open stockpiles; and
- Operating of machinery such as bulldozers, drills, saws and cement mixers;

The Best Practice Guidance states that mitigation of the impact of construction dust from high risk sites must be implemented in the existence of sensitive receptors within a 200m radius of the proposed site. Sensitive receptors lie within 200m of the site boundary in Wigmore, Cockernhoe and in Wandon End and therefore mitigation measures must be employed during the construction phase to reduce, at source, the emissions of dust and pollutants which have the potential to impact these nearby sensitive receptors. Consideration of such measures can facilitate project planning and enable priorities for the control of on-

[14] Best Practice Guidance (2006) The control of dust and emissions from construction and demolition – Produced in partnership by the Greater London Authority and London Councils

site emissions to be drawn up at an early stage.

Possible mitigation measures for high risk sites are outlined in the Best Practice Guidance for construction dust. Possible mitigation measures appropriate to the Brickkiln site are included in *Table 12.8*.

Table 12.8 Possible Mitigation Measures for Construction Dust Impacts

Activity	**Dust Mitigation Measures**
Site Planning	• Erect solid barriers where dust generating activities are operated near to residential receptors • Do not allow on-site burning and bonfires • Plan site layout to help locate dust generating activities away from receptors as far as practicable • All site personnel to be fully trained • Identify a responsible person in charge • Hard surface all haul routes that lie within 200m of residential receptors
Construction Traffic	• Site access to avoid residential areas where possible • No idling vehicles • Damp down all hard-surfaced haul routes within 200m of sensitive receptors • Effective vehicle cleaning and wheel washing • No site runoff of water or mud • All loads entering and leaving site to be covered • Minimise movement of construction traffic around site • Designate an appropriate on-site speed limit
Site Activities	• Minimise dust generating activities • Use water and fine mists as a dust suppressant where applicable • Cover, seed or fence stockpiles to prevent wind whipping • Re-vegetate earthworks and exposed areas as soon as possible

If deemed necessary, a regime for particulate monitoring would be agreed with the Council and established well in advance of the construction works commencing in order to determine a suitable baseline. Where local receptors are deemed particularly sensitive, agreed monitoring would be undertaken in order to establish whether relevant standards or criteria are being exceeded, and local thresholds for dust and particulates may also be established in order to demonstrate that mitigation measures employed are successful. Furthermore, monitoring locations would be modified to reflect the ongoing construction programme, such that they remain relevant to the area of works.

12.6.2 Operational

The Brickkiln scheme is designed to result in minimal traffic impacts to the existing villages of Cockernhoe and Tea Green. The proposed site road network, traffic measures and travel plan described in Chapter 9 reduce the overall traffic impacts of the scheme and changes to traffic flows are generally minor.

12.6 ASSESSMENT OF IMPACTS

Concentrations of NO_2 and PM_{10} have been predicted using the ADMS-Roads v2.3 atmospheric dispersion model at 63 existing residential properties and 12 proposed residential properties on and in the area around the Brickkiln development site. Concentrations have been predicted for the baseline year, and with and without the Brickkiln development in operation in future years 2016 and 2031.

A summary of the predicted annual average NO_2 concentrations for the baseline year, 2016 and 2031 at selected receptors is displayed in *Table 12.9*. A summary of predicted annual average and daily average concentrations of PM_{10} for the baseline year, 2016 and 2031 at selected receptors is displayed in *Table 12.10*. Full model results are displayed in *Tables H1.3* and *H1.4* in *Appendix H1*.

12.6.1 Model Verification

Model verification involves the comparison of modelled pollutant concentrations to measured pollutant concentrations from local air quality monitoring sites.

In this assessment, concentrations of annual average NO_2 have been compared to local air quality monitoring data. No suitable roadside PM_{10} monitoring data within the assessment area is available and PM_{10} results have not been verified.

Verification for NO_2 involves the predicted oxides of nitrogen (NO_X) contribution from modelled roads included in the ADMS-ROADS model being compared to the same contribution from local monitoring sites. For the monitoring sites, this contribution is calculated by subtracting background NO_2 from the total monitored NO_2 value and converting the remainder (road contribution) to NO_X using methods provided in Defra's Technical Guidance document LAQM TG(09).

A total of 9 of the Bureau Veritas NO_2 diffusion tubes sites were suitable to use in model verification. Use of the methods described in LAQM.TG09 has produced a model road NO_X correction factor of 3.6 which has been applied to predicted road NOx contribution derived from ADMS-ROADS. Following this adjustment, NO_2 concentrations are derived by converting the road NOx contribution, also accounting for background NO_2 concentrations, using the Defra preferred method described in LAQM.TG09. Overall good agreement between monitored and modelled results was obtained, with an estimated model uncertainty

of 2.6 µg/m^3 NO_2. A summary of the final verification of NO_2 is shown in *Table H1.2 Appendix H1*.

In the absence of local PM_{10} monitoring, the PM_{10} model results have not been verified. Therefore, these results are considered to be more uncertain than those for NO_2, and are likely to be under-predicted. However, neither Luton City Council or North Hertfordshire District Council have declared an AQMA on the basis of PM_{10} and are expected to meet the air quality objectives for PM_{10}.

12.6.2 Assessment of NO_2

The modelled results suggest that the NO_2 annual mean AQS objective of 40µg/m^3 will be met at all modelled receptors, which represent locations of residential facades, in the baseline year. The maximum modelled NO_2 concentration in the baseline year is 38.1µg/m^3 at receptor 4 adjacent to Crawley Green Road. NO_2 concentrations within the Luton area are predicted to be typically 25-35µg/m^3 at modelled receptors in the baseline year. Concentrations reduce further in the vicinity of the development site and are less than 20 µg/m^3 NO_2.

The modelled results show that the NO_2 annual mean AQS objective will also be met at all modelled receptors in future years 2016 and 2031 both without (Do-Minimum) and with the development (Do-Something). The maximum modelled NO_2 concentration in 2016 is 29.9µg/m^3 without development and 30.4µg/m^3 with the proposed development in operation. The maximum modelled NO_2 concentration in 2031 is 30.0µg/m^3 without development and 30.5µg/m^3 with the proposed development in operation. These maximum modelled concentrations are all predicted for receptor 4 adjacent to Crawley Green Road close to Vauxhall Way. With the exception of receptor 4, there are no receptors with predicted annual mean NO_2 concentrations greater than 30µg/m^3 in 2016 or 2031. The annual average NO_2 concentrations are well below the air quality objective of 40 µg/m^3, and are significantly lower at all other modelled receptors.

NO_2 concentrations in the Luton area are predicted to be typically 20-30µg/m^3 at modelled receptors in 2016 and 2031, reducing even further to below 17 µg/m^3 at receptors close to the development site.

Table 12.9 Summary of Annual Average NO_2 Results at Selected Receptors

Receptor ID	Annual Mean NO_2 Concentrations (µg/m^3)				
	Baseline	2016 Do Minimum	2016 Do Something	2031 Do Minimum	2031 Do Something
1	35.7	27.9	28.3	27.8	28.2
2	37.3	29.2	29.7	29.3	29.7
4	38.1	29.9	30.4	30.0	30.5
5	31.2	24.3	24.7	23.8	24.1
17	29.1	22.9	23.8	22.6	23.4
18	28.8	22.6	22.9	22.3	22.6
34	24.9	19.6	20.9	19.2	20.4
35	23.9	18.8	19.9	18.3	19.3
36	25.1	19.8	21.2	19.4	20.8

Table 12.9 Summary of Annual Average NO_2 Results at Selected Receptors					
Receptor ID	Annual Mean NO_2 Concentrations (µg/m^3)				
	Baseline	2016 Do Minimum	2016 Do Something	2031 Do Minimum	2031 Do Something
37	23.0	18.1	19.3	17.4	18.6
38	23.3	18.3	19.6	17.7	18.9
39	20.4	15.7	16.7	14.7	15.7
40	20.3	15.7	16.5	14.7	15.5
47	19.0	14.8	16.2	13.9	15.2
62	29.2	23.0	23.9	22.7	23.6
DS1	18.2	14.1	14.5	13.1	13.5
DS2	20.1	15.5	16.7	14.5	15.6
DS3	18.8	14.5	15.7	13.4	14.5
DS4	18.2	14.1	14.4	12.8	13.1
DS5	18.1	14.1	14.3	13.0	13.2
DS6	18.0	13.9	14.5	12.6	13.2
DS7	17.9	13.8	14.2	12.5	12.9
DS8	16.5	13.0	13.4	11.7	12.3
DS9	18.0	13.9	14.0	12.6	12.8
DS10	18.0	13.9	14.1	12.6	12.8
DS11	16.4	12.9	13.0	11.6	11.7
DS12	18.1	14.0	14.6	12.7	13.3

12.6.3 Assessment of PM_{10}

The modelled results suggest that the PM_{10} annual mean AQS objective of 40µg/m^3 will be met at all modelled receptors in the baseline year. The maximum modelled PM_{10} concentration in the baseline year is 20.5µg/m^3 at receptor 62 adjacent to Crawley Green Road.

The modelled results show that the PM_{10} annual mean AQS objective will also met at all modelled receptors in 2016 and 2031 with and without the development in operation. The maximum modelled PM_{10} concentration in 2016 is 19.4µg/m^3 without development (Do-Minimum) and 19.9µg/m^3 with the proposed development in operation (Do-Something). The maximum modelled PM_{10} concentration in 2031 is 19.3µg/m^3 without development and 19.7µg/m^3 with the proposed development in operation. These maximum modelled concentrations are predicted at receptor 62 adjacent to Crawley Green Road without development and at receptor DS3 in the south west of the proposed Brickkiln site adjacent to one of the proposed new development road links.

Model results also suggest that the daily mean PM_{10} objective of no more that 35 days with concentrations greater than 50µg/m^3 will be met at all modelled receptors in the baseline year and with and without development in 2016 and 2031.

Table 12.10 - Summary of PM_{10} Model Results at Selected Receptors										
Receptor ID	**Annual Mean (AM) Concentrations and Number of Days > 50 µg/m^3**									
	Baseline		**2016 Do Minimum**		**2016 Do Something**		**2031 Do Minimum**		**2031 Do Something**	
	AM (µg/m^3)	DM (Days)	AM (µg/m^3)	DM (Days)	AM (µg/m^3)	DM (Days)	AM (µg/m^3)	DM (Days)	AM (µg/m^3)	DM (Days)
1	21.3	5	20.1	4	20.1	4	19.9	3	19.9	3
2	21.4	5	20.1	4	20.1	4	20.0	3	20.0	3
4	21.4	5	20.2	4	20.2	4	20.0	3	20.0	3
5	21.2	5	20.0	3	20.0	3	19.8	3	19.8	3
17	20.1	3	19.0	2	19.0	2	18.8	2	18.8	2
18	20.1	4	19.0	2	19.0	2	18.8	2	18.8	2
34	19.1	2	18.1	1	18.1	1	17.9	1	18.0	1
35	19.1	2	18.1	1	18.1	1	17.9	1	17.9	1
36	19.1	2	18.1	1	18.1	2	17.9	1	18.0	1
37	19.0	2	18.0	1	18.1	1	17.9	1	17.9	1
38	19.0	2	18.1	1	18.1	1	17.9	1	17.9	1
39	18.4	2	17.5	1	17.5	1	17.3	1	17.4	1
40	18.4	2	17.5	1	17.5	1	17.3	1	17.3	1
47	18.3	2	17.5	1	17.5	1	17.3	1	17.3	1
62	20.1	4	19.0	2	19.0	2	18.8	2	18.8	2
DS1	18.3	2	17.4	1	17.4	1	17.3	1	17.3	1
DS2	18.4	2	17.5	1	17.5	1	17.3	1	17.4	1
DS3	18.4	2	17.5	1	17.5	1	17.3	1	17.3	1
DS4	18.4	2	17.4	1	17.5	1	17.3	1	17.3	1
DS5	18.3	2	17.4	1	17.4	1	17.3	1	17.3	1
DS6	18.4	2	17.4	1	17.5	1	17.3	1	17.3	1
DS7	18.4	2	17.4	1	17.5	1	17.3	1	17.3	1
DS8	17.8	1	16.9	1	16.9	1	16.7	1	16.8	1
DS9	18.4	2	17.4	1	17.4	1	17.3	1	17.3	1
DS10	18.4	2	17.4	1	17.4	1	17.3	1	17.3	1
DS11	17.8	1	16.9	1	16.9	1	16.7	1	16.7	1
DS12	18.4	2	17.4	1	17.5	1	17.3	1	17.3	1

12.6.4 Assessment of Significance

The changes in NO_2 and PM_{10} concentrations predicted in 2016 and 2031 without (Do-Minimum) and with development (Do-Something) scenarios at selected receptors are summarised in *Table 12.11* and *Table 12.12* respectively. Changes in pollutant concentrations are expressed in µg/m^3 and as a percentage. A full table of changes in NO_2 and PM_{10} concentrations and magnitude of impact as a result of the Brickkiln development at all receptors is displayed in *Tables H1.5* and *H1.6* of *Appendix H1*.

Results show that in 2016 and 2031 the impact of the development on annual mean NO_2 is predicted to be Low to Extremely Low at all receptors. Results show that the impact of the development on annual mean PM_{10} is predicted to be Extremely Low at all modelled receptors.

Table 12.11 - Predicted Impact to Local Air Quality of the Brickkiln Development in 2016						
Receptor ID	2016					
	Change in Annual Mean NO_2 ($\mu g/m^3$)	Change in Annual Mean PM_{10} ($\mu g/m^3$)	% Change in Annual Mean NO_2	% Change in Annual Mean PM_{10}	NO_2 Impact Magnitude	PM_{10} Impact Magnitude
1	0.44	0.01	1.6	0.1	Very Low	Extremely Low
2	0.46	0.02	1.6	0.1	Very Low	Extremely Low
4	0.52	0.02	1.7	0.1	Very Low	Extremely Low
5	0.31	0.01	1.3	0.0	Very Low	Extremely Low
17	0.83	0.03	3.6	0.1	Very Low	Extremely Low
18	0.35	0.01	1.5	0.1	Very Low	Extremely Low
34	1.23	0.04	6.3	0.2	Low	Extremely Low
35	1.05	0.03	5.6	0.2	Low	Extremely Low
36	1.39	0.04	7.0	0.2	Low	Extremely Low
37	1.16	0.03	6.4	0.2	Low	Extremely Low
38	1.26	0.04	6.9	0.2	Low	Extremely Low
39	0.95	0.03	6.0	0.2	Low	Extremely Low
40	0.82	0.02	5.2	0.1	Low	Extremely Low
47	1.37	0.04	9.3	0.2	Low	Extremely Low
62	0.90	0.03	3.9	0.1	Very Low	Extremely Low
DS1	0.40	0.01	2.8	0.1	Very Low	Extremely Low
DS2	1.19	0.03	7.7	0.2	Low	Extremely Low
DS3	1.16	0.03	8.0	0.2	Low	Extremely Low
DS4	0.34	0.01	2.4	0.1	Very Low	Extremely Low
DS5	0.25	0.01	1.8	0.0	Very Low	Extremely Low
DS6	0.59	0.02	4.3	0.1	Very Low	Extremely Low
DS7	0.35	0.01	2.5	0.1	Very Low	Extremely Low
DS8	0.44	0.02	3.4	0.1	Very Low	Extremely Low
DS9	0.15	0.00	1.1	0.0	Very Low	Extremely Low
DS10	0.17	0.00	1.2	0.0	Very Low	Extremely Low
DS11	0.11	0.00	0.9	0.0	Extremely Low	Extremely Low
DS12	0.68	0.02	4.9	0.1	Very Low	Extremely Low

Table 12.12 - Predicted Impact to Local Air Quality of the Brickkiln Development in 2031						
Receptor ID	2031					
	Change in Annual Mean NO2 ($\mu g/m^3$)	Change in Annual Mean PM_{10} ($\mu g/m^3$)	% Change in Annual Mean NO_2	% Change in Annual Mean PM_{10}	NO_2 Impact Magnitude	PM_{10} Impact Magnitude
1	0.41	0.01	1.5	0.1	Very Low	Extremely Low
2	0.45	0.02	1.5	0.1	Very Low	Extremely Low
4	0.50	0.02	1.7	0.1	Very Low	Extremely Low
5	0.31	0.01	1.3	0.0	Very Low	Extremely Low
17	0.80	0.03	3.5	0.1	Very Low	Extremely Low
18	0.33	0.01	1.5	0.1	Very Low	Extremely Low
34	1.19	0.04	6.2	0.2	Low	Extremely Low
35	1.01	0.03	5.5	0.2	Low	Extremely Low
36	1.34	0.04	6.9	0.2	Low	Extremely Low
37	1.11	0.03	6.4	0.2	Low	Extremely Low
38	1.21	0.04	6.8	0.2	Low	Extremely Low
39	0.92	0.03	6.2	0.2	Low	Extremely Low
40	0.79	0.02	5.4	0.1	Low	Extremely Low
47	1.32	0.04	9.5	0.2	Low	Extremely Low
62	0.87	0.03	3.8	0.1	Very Low	Extremely Low
DS1	0.39	0.01	3.0	0.1	Very Low	Extremely Low
DS2	1.14	0.03	7.9	0.2	Low	Extremely Low
DS3	1.11	0.03	8.3	0.2	Low	Extremely Low
DS4	0.33	0.01	2.6	0.1	Very Low	Extremely Low
DS5	0.24	0.01	1.8	0.0	Very Low	Extremely Low
DS6	0.56	0.02	4.4	0.1	Very Low	Extremely Low
DS7	0.34	0.01	2.7	0.1	Very Low	Extremely Low
DS8	0.67	0.02	5.7	0.1	Low	Extremely Low
DS9	0.14	0.00	1.1	0.0	Very Low	Extremely Low
DS10	0.16	0.00	1.3	0.0	Very Low	Extremely Low
DS11	0.05	0.00	0.4	0.0	Extremely Low	Extremely Low
DS12	0.65	0.02	5.1	0.1	Low	Extremely Low

Based on the changes in predicted concentrations, and because the resulting concentrations both with and without development are well below the air quality objectives at all modelled receptors, it is considered that the development will have a Negligible impact on local air quality. That is to say that largely, air quality is expected to be unaffected by the operation of the development and no significant impacts are predicted to occur.

12.6.5 Regional Impact Assessment

The results of the regional impact assessment using DMRB are displayed in *Table 12.13*.

Regional assessment of oxides of nitrogen (NO_X) demonstrates a maximum annual NO_X emission of 53,859kg from road traffic on all the roads included in the air quality assessment in the 2007 baseline. The operation of the development is predicted to result in a 5.2%

increase in annual NO_X emissions in 2016 reduced to a 4.3% increase in annual NO_X emissions in 2031. However it should be noted that the maximum modelled NO_X emissions in 2016 and 2031 are significantly lower than the baseline modelled NO_X emission in 2007.

Regional assessment of fine particles (PM_{10}) demonstrates a maximum annual PM_{10} emission of 2,113kg from road traffic on all the roads included in the air quality assessment in the 2007 baseline. The operation of the development is predicted to result in a 6.7% increase in annual PM_{10} emissions in 2016 reduced to a 5.6% increase in annual PM_{10} emissions in 2031. However it should be noted that the maximum modelled PM_{10} emissions in 2016 and 2031 are significantly lower than the baseline modelled PM_{10} emission in 2007.

Regional assessment of carbon dioxide (CO_2) indicates annual CO_2 emissions of 15,167 tonnes from road traffic on all the roads included in the air quality assessment in 2031 with the development in operation. Changes to road traffic flows due to the development is predicted to result in a 6.8% increase in annual CO_2 emissions in 2016 reduced to a 5.5% increase in annual CO_2 emissions in 2031. The road network for which CO_2 emissions are calculated for represents less than 10% of the CO_2 emissions from the wider road network within Luton, and represent less than 2% of all CO_2 emissions within Luton, based upon the most recent national CO_2 emissions[15].

Table 12.13 - Regional Air Quality Assessment Results

Emission	Base Year	2016 Do Minimum	2016 Do Something	2031 Do Minimum	2031 Do Something	2016 % Change	2031 % Change
NOx (kg/year)	53859	32027	33682	36848	38419	5.2	4.3
PM_{10} (kg/year)	2113	1141	1218	1391	1468	6.7	5.6
CO_2 (tonnes/ year)	15167	14338	15313	17602	18578	6.8	5.5

12.7 SUMMARY

The impact of the proposed Brickkiln development on local air quality has been assessed using the ADMS-Roads v2.3 atmospheric dispersion modelling software.

The impact of the proposed Brickkiln development on regional air quality has been assessed using the DMRB air quality model.

Ambient concentrations of NO_2 and PM_{10} have been predicted at a number of sensitive receptor locations including 63 existing residential properties in the Luton area in addition to 12 residential properties proposed as part of the Brickkiln development.

[15] www.naei.org.uk provide CO_2 emissions by local authority for year 2006.

Results of ADMS-Roads modelling of NO_2 and PM_{10} suggest that the AQS objectives for both pollutants will be met at all receptor locations in the baseline year (2007) and in future years 2016 and 2031, with or without the development in operation.

Results show that in 2016 and 2031 the impact of the development on annual mean NO_2 is predicted to be Low to Extremely Low at all receptors. Results show that the impact of the development on annual mean PM_{10} is predicted to be Extremely Low at all modelled receptors.

Results of the regional air quality assessment suggest that the development will result in a very small increase in regional contributions of NO_X, PM_{10} and CO_2 with the development in operation in 2016 and 2031. Overall, the contributions of the development represent less than 1% of CO_2 emissions for whole of Luton.

The overall significance of the impact of the Brickkiln development is considered to be Negligible and no significant impacts are predicted to occur.