APPENDIX 10.1 - Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
CURED	Calculator Using Realistic Emissions for Diesels
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the

standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides

PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
PPW	Planning Policy Wales
SPG	Supplementary Planning Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEMPro	Trip End Model Presentation Program

APPENDIX 10.2 - Construction Dust Assessment Procedure

10.1.1 The criteria developed by IAQM divide the activities on construction sites into four types to reflect their different potential impacts. These are:

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

10.1.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

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

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

STEP 2: Assess the Risk of Dust Impacts

10.1.5 A site is allocated to a risk category based on two factors:

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

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

Step 2A – Define the Potential Dust Emission Magnitude

10.1.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table 10.2.1.

Table 10.2.1: Examples of How the Dust Emission Magnitude Class May be Defined

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

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

Step 2B – Define the Sensitivity of the Area

10.1.8 The sensitivity of the area is defined taking account of a number of factors:

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

10.1.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table 10.2.2. These receptor sensitivities are then used in the matrices set out in Table 10.2.3, Table 10.2.4 and Table 10.2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

10.1.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table 10.2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

10.1.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix 10.7.

STEP 4: Determine Significant Effects

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

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

Table 10.2.2: Principles to be Used When Defining Receptor Sensitivities

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

Table 10.2.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [1]

[1] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission

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

magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 10.2.4: Sensitivity of the Area to Human Health Effects [1]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 10.2.5: Sensitivity of the Area to Ecological Effects [1]

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

Table 10.2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

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APPENDIX 10.3 - EPUK & IAQM Planning for Air Quality Guidance

10.1.14 The guidance issued by EPUK and IAQM (EPUK & IAQM, 2015) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

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

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

Recommended Best Practice

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

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

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

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

10.1.17 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

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

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

10.1.19 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;

- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

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

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

Impacts of the Development on the Local Area

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

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

10.1.21 Coupled with any of the following:

- the development has more than 10 parking spaces;
- the development will have a centralised energy facility or other centralised combustion process.

10.1.22 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, the criteria for which are set out below. The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria is likely to be more appropriate.

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor;
- the development will have one or more substantial combustion processes where the combustion unit is:
  - any centralised plant using bio fuel;
  - any combustion plant with single or combined thermal input >300 kW; or
  - a standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year).
- the development will have a combustion unit of any size where emissions are at a height that may give rise to impacts through insufficient dispersion, e.g. through nearby buildings.

10.1.23 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area.

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

Impact Descriptors and Assessment of Significance

10.1.25 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach developed by EPUK and IAQM (EPUK & IAQM, 2015) has therefore been used. This approach involves a two stage process:

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

Impact Descriptors

10.1.26 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table 10.3.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table 10.3.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

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

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

[b] This is the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration where there is an increase.

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

Assessment of Significance

10.1.27 The IAQM guidance (EPUK & IAQM, 2015) is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a

significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and

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

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

10.1.29 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix 10.4.

APPENDIX 10.4 - Professional Experience

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

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

Suzanne Hodgson, BSc (Hons) MSc CSci MIEnvSc MIAQM

Miss Hodgson is a Principal Consultant with AQC, with over eight years' experience in the field of air quality management and assessment. She has been responsible for a wide range of air quality projects covering impact assessments for new residential, commercial and industrial developments, local air quality management, ambient air quality monitoring of various pollutants and the assessment of nuisance odours and construction dust. She has extensive modelling experience, including the modelling of road traffic, energy centre (including energy from waste) and odour sources, and is familiar with preparing stand-alone air quality reports as well as chapters for inclusion within an Environment Statement. Suzanne has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. She is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Dr Austin Cogan, MPhys (Hons) PhD AMIEnvSc MIAQM

Dr Cogan is a Senior Consultant with AQC and has over four years' experience in the fields of air quality modelling, monitoring and assessment. Prior to this he studied at the University of Leicester, gaining 2 years' experience of scientific instrument design and spent 4 years' pioneering research in satellite observations of carbon dioxide, including data validation, model comparisons, bias correction and software development. He now works in the field of air quality assessment and has been involved in air quality, odour and climate change assessments of residential and commercial developments, road schemes, airports, waste management processes, and industrial processes. Dr Cogan has also been involved in the analysis and interpretation of air quality data and the preparation of review and assessment reports for local authorities.

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

APPENDIX 10.5 - Receptor Locations

Table 10.5.1: Description of Receptor Locations

Receptor (Modelled Height)	Description	In AQMA?
Existing properties		
1 (1.5 m)	Residential property at Old Abergavenny Road	No
2 (1.5 m)	Residential property at Monachty, Usk Road (A4042)	No
3 (1.5 m)	Residential property adjacent to the Secret Garden (Garden Centre), Usk Road (A4042)	No
4 (1.5 m)	Residential property at Homeleigh, Usk Road (A4042), Penperlleni	No
5 (1.5 m)	Residential property at 1 Park Y Brain Lane, adjacent to Usk Road (A4042), Penperlleni	No
6 (1.5 m)	Residential property at Wain-Y-Clare Inn, Usk Road (A4042)	No
7 (1.5 m)	Residential property at Glen View, Usk Road (A4042)	No
8 (1.5 m)	Residential property at Court Farm, Usk Road (A4042)	No
9 (1.5 m)	Residential property at Woodbury, Usk Road (A4042)	No
10 (1.5 m)	Residential property at 57 Usk Road, Pontypool	No
11 (1.5 m)	Residential property at 35 Usk Road, Pontypool	No
12 (1.5 m)	Residential property at 45 Usk Road, Pontypool	No
13 (1.5 m)	Residential property at 20 Usk Road, Pontypool	No
14 (1.5 m)	Residential property at The Highway, Pontypool	No
15 (1.5 m)	Residential property at Coed-Y-Canddo Road, Pontypool, near Usk Road (A4042)	No
16 (1.5 m)	Residential property at Coed Camlas, Pontypool, near Usk Road (A4042)	No
17 (1.5 m)	Residential property at Pen-Y-Craig Terrace, Pontypool, near the A472	No
18 (1.5 m)	Residential property at Maesderwen Road, Pontypool, near the A472	No
19 (1.5 m)	Residential property at Churchwood, near the A4042	No
20 (1.5 m)	Residential property at Woodside Cottage, Hafod-yr-ynys Road (A472)	Yes
21 (1.5 m)	Residential property at 3 Woodside Terrace, Hafod-yr-ynys Road (A472)	Yes
22 (1.5 m)	Residential property at 6 Woodside Terrace, Hafod-yr-ynys Road (A472)	Yes
23 (1.5 m)	Residential property at 20 Woodside Terrace, Hafod-yr-ynys Road (A472)	Yes
24 (1.5 m)	Residential property at 5 Herbert Terrace, A472	No
25 (1.5 m)	Residential property at Race Farm, near the A4042	No
26 (1.5 m)	Residential property at Park Panteg, Sebastopol, near the A4051	No
27 (1.5 m)	Residential property at Sour Close, Croesyceiliog, near the A4042	No
28 (1.5 m)	Residential property at Ashford Close North, Croesyceiliog, near the A4042	No
29 (1.5 m)	Residential property at Rhonfa Llysweri, Llanyrafon, near the A4042	No
30 (1.5 m)	Residential property at Crown Rise, Llanyrafon, near the A4042	No
31 (1.5 m)	Residential property at The Paddocks, Llanyrafon, near the A4042	No
32 (1.5 m)	Residential property at The Alders, Llanyrafon, near the A4042	No
33 (1.5 m)	Residential property in Llantarnam, near to the A4042	No

Receptor (Modelled Height)	Description	In AQMA?
34 (1.5 m)	Residential property at Brook Street, Pontnewydd, near the A4051	No
35 (1.5 m)	Residential property at Pontrhydyrun Road, Pontnewydd, near the A4051	No
36 (1.5 m)	Residential property at Ty-Newydd Road, Pontnewydd, near the A4051	No
37 (1.5 m)	Residential property at Stanley Place, Pontnewydd, near the A4051	No
38 (1.5 m)	Residential property at Woodside Road, Cwmbran, near the A4051	No
39 (1.5 m)	Residential property at Clos Cae Nant, Cwmbran, near the A4051	No
40 (1.5 m)	Residential property at Heol Abaty Abbey Road, Cwmbran, near the A4051	No
41 (1.5 m)	Residential property at Fields Road, Oakfield, near the A4051	No
42 (1.5 m)	Residential property at Pentre Lane, Croes-y-mwyalch, near the A4051	No
43 (1.5 m)	Residential property at Hawthorn, Malpas, near the A4042	No
44 (1.5 m)	Residential property at 26 Glassworks Cottages, Crindau, near the A4042	No
45 (1.5 m)	Residential property at Woodlands Drive, Malpas, near the A4051	No
46 (1.5 m)	Residential property at 1 Mount Pleasant, adjacent to Malpas Road (A4051)	No
47 (1.5 m)	Residential property at 482 Malpas Road (A4051), Malpas	No
48 (1.5 m)	Residential property at 421 Malpas Road (A4051), Malpas	No
49 (1.5 m)	Residential property at 382 Malpas Road (A4051), Malpas	Yes
50 (1.5 m)	Residential property at 350 Malpas Road (A4051), Malpas	Yes
51 (1.5 m)	Residential property at 260 Malpas Road (A4051), Brynglas	No
52 (1.5 m)	Residential property at 177 Malpas Road, adjacent to the M4 motorway	Yes
53 (1.5 m)	Residential property at 155 Malpas Road, adjacent to the M4 motorway	Yes
54 (1.5 m)	Residential property at 123 Malpas Road, Barrack Hill, near to the A4051	No
55 (1.5 m)	Residential property at 60 Malpas Road (A4051) , Barrack Hill	No
56 (1.5 m)	Residential property at 48 Malpas Road (A4051) , Barrack Hill	Yes
57 (1.5 m)	Residential property at 9 Malpas Road (A4051), Barrack Hill	Yes
58 (4.5 m)	Residential property at 6 Agincourt Street, Crindau, near to the A4042	No
59 (4.5 m)	Residential property at Pant Road, near to the M4 motorway	No
60 (1.5 m)	Residential property at Aston Crescent, near to the M4 motorway	No
61 (1.5 m)	Residential property at Aston Crescent, near to the M4 motorway	No
62 (4.5 m)	Residential property at Stockton Close, near to the M4 motorway	No
63 (1.5 m)	Residential property at Denbigh Road, near to the M4 motorway	Yes
64 (1.5 m)	Residential property at Denbigh Road, near to the M4 motorway	Yes
New properties		
A (1.5 m)	Property within the proposed development near to Old Abergavenny Road	No
B (1.5 m)	Property within the proposed development near to Old Abergavenny Road	No
C (1.5 m)	Property within the proposed development near to Usk Road	No
D (1.5 m)	Property within the proposed development near to Usk Road	No
E (1.5 m)	Property within the proposed development near to Usk Road	No
F (1.5 m)	Property within the proposed development near to Usk Road	No

APPENDIX 10.6 - Modelling Methodology

Model Inputs

10.1.30 Predictions have been carried out using the ADMS-Roads dispersion model (v4.0). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width, street canyon width, street canyon height and porosity, tunnels, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 7.0) published by Defra (2016b).

10.1.31 Hourly sequential meteorological data from Cardiff for 2015 have been used in the model. The Cardiff meteorological monitoring station is located at Cardiff Airport, approximately 40 km to the southwest of the application site. It is deemed to be the nearest monitoring station representative of meteorological conditions within the study area.

10.1.32 For the purposes of modelling, it has been assumed that the A4051 south of the M4 and the A472 in Crumlin are street canyons formed by the buildings along those roads. These roads have a number of canyon-like features, which reduce dispersion of traffic emissions, and can therefore lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. These road sections have, therefore, been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from local mapping and photographs.

10.1.33 AADT flows and the proportions of HDVs for the study area have been provided by Clarkebond Ltd for the current year (2015) and future year of opening (2018). AADT flows and the proportions of HDVs for the A467 and B4596 were obtained from census counts for the year of 2014, and AADT flows for Junction 25 and 26 M4 motorway slip roads were obtained from the Welsh Transport Technology Consultancy (WTTC) for the years of 2008, 2012 and 2015. The proportions of HDVs were not available from the WTTC. HDV proportions for the M4 slip roads were therefore assumed to be the same as the M4 motorway. Traffic data were not available for the eastbound off-slip and westbound on-slip of Junction 25 of the M4 motorway. The assumption has been made that all vehicles travelling along the A4042 towards the M4 motorway, also travel along these slip roads. This may result in some slight double-counting, but provides a robust assessment. Traffic data were also not available for the eastbound on-slip of Junction 26 of the M4 motorway. Traffic data for this slip road have been assumed to be the same as the westbound off-slip of Junction 26 of the M4 motorway.

10.1.34 The 2008, 2012 and 2014 AADT flows have been factored forwards to the current year of 2015 using growth factors derived from the National Transport Model and associated guidance (DfT, 2009), adjusted to local conditions using the TEMPro System v7.0 (DfT, 2016). The census and WTTC traffic data for the current year were then factored forwards to the assessment year of 2018 using growth factors derived from the National Transport Model and associated guidance (DfT, 2009), adjusted to local conditions using the TEMPro System v7.0 (DfT, 2016).

10.1.35 Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table 10.6.1.

Table 10.6.1: Summary of Traffic Data used in the Assessment

Road Link	2015		2018 (Without Scheme)		2018 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
Old Abergavenny Rd (between Mamhilad Park Access and A4042)	6,022	1.9	6,263	1.9	8,559	1.4
Old Abergavenny Rd (between Unnamed Access and Mamhilad Park Access)	2,925	1.1	3,042	1.1	3,042	1.1
Old Abergavenny Rd (between Overflow carpark and Unnamed Access)	2,034	0.8	2,115	0.8	2,115	0.8
Old Abergavenny Road (north of overflow carpark)	729	2.2	759	2.2	759	2.2
Overflow carpark	1,357	0.0	1,412	0.0	1,412	0.0
Unnamed Access	962	3.0	1,001	3.0	1,001	3.0
Mamhilad Park Access	3,220	2.8	3,350	2.8	5,645	1.7
A4042 (East of Old Abergavenny Road)	21,914	2.6	22,794	2.6	23,427	2.6
Unnamed Access opposite Old Abergavenny Road	148	16.1	154	16.1	154	16.1
A4042 northbound (between Old Abergavenny Road and Pen Y Lan Lane)	12,458	2.7	12,958	2.7	14,165	2.4
A4042 southbound (between Old Abergavenny Road and Pen Y Lan Lane)	12,458	2.7	12,958	2.7	14,165	2.4
A4042 northbound (between Pen Y Lan Lane and Usk Road)	12,458	2.7	12,958	2.7	14,165	2.4
A4042 southbound (between Pen Y Lan Lane and Usk Road)	12,458	2.7	12,958	2.7	14,165	2.4
Pen Y Lan Lane	57	0.0	59	0.0	59	0.0
Parke Davis Site Access	29	16.7	30	16.7	-	-
New Parke David Site Access	-	-	-	-	3,443	0.1
Usk Road (East of The Highway)	6,674	1.6	6,942	1.6	7,898	1.4
Usk Road (West of The Highway)	8,656	3.0	9,003	3.0	9,516	2.8
The Highway	7,489	0.0	7,789	0.0	8,233	0.0
A4042 (between Usk Road and the A472)	18,746	3.6	19,499	3.6	23,619	3.0
A472 (in Pontypool)	36,382	2.6	37,843	2.6	39,074	2.5
A4042 (between the A472 and A4051)	43,193	2.7	44,927	2.7	47,816	2.6
A472 (in Crumlin)	21,017	3.7	21,861	3.7	22,207	3.5
A467 (north of the A472)	14,233	7.3	14,804	7.3	14,804	7.3
A467 (South of the A472)	20,162	11.3	20,972	11.3	20,972	11.3
A4051 (from Sebastopol to the M4 motorway)	35,094	4.0	36,503	4.0	37,050	4.0
A4042 (from Sebastopol to the M4 motorway)	38,183	3.7	39,716	3.7	40,486	3.6

Road Link	2015		2018 (Without Scheme)		2018 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
A4042 (South of the M4 motorway)	41,327	6.6	42,986	6.6	43,395	6.3
A4051 (South of the M4 motorway)	22,005	5.3	22,888	5.3	22,922	5.0
M4 (West of Newport Tunnel)	81,972	10.1	85,263	10.1	85,263	10.1
M4 (East of Newport Tunnel)	81,972	10.1	85,263	10.1	85,263	10.1
M4 (Junction 25A)	113,793	10.4	118,361	10.4	118,722	10.3
M4 (Junction 25)	107,947	9.2	112,280	9.2	112,602	9.2
A4042 Slip Road towards the M4	18,718	4.5	19,469	4.5	19,650	4.4
A4042 Slip Road onto the M4	18,718	4.5	19,469	4.5	19,650	4.4
A4042 Slip Road away from the M4	18,718	4.5	19,469	4.5	19,650	4.4
A4042 Slip Road off of the M4	18,718	4.5	19,469	4.5	19,650	4.4
M4 Junction 26 eastbound on-slip	1,223	4.6	1,272	4.6	1,272	4.5
M4 Junction 26 westbound off-slip	1,223	4.6	1,272	4.6	1,272	4.5
M4 Junction 26 westbound on-slip	18,791	4.6	19,545	4.6	19,545	4.5
M4 Junction 26 eastbound off-slip	8,853	4.6	9,209	4.6	9,209	4.5
B4596 (North of the M4 motorway)	5,606	2.3	5,831	2.3	5,831	2.3
B4596 (South of the M4 motorway)	5,606	2.3	5,831	2.3	5,831	2.3
B4596 slip road from the A4042	18,718	4.5	19,469	4.5	19,650	4.4
M4 Junction 25 eastbound on-slip	116	2.3	126	2.3	126	2.3
M4 Junction 25 westbound off-slip	1,530	2.3	1,697	2.3	1,697	2.3
B4596 slip road to the A4042	18,718	4.5	19,469	4.5	19,650	4.4
M4 Newport Tunnel (Westbound)	40,986	10.1	42,631	10.1	42,631	10.1
M4 Newport Tunnel (Eastbound)	40,986	10.1	42,631	10.1	42,631	10.1

10.1.36 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2015).

10.1.37 Figure 10.6.1 shows the road network, speeds included within the model, and defines the study area.

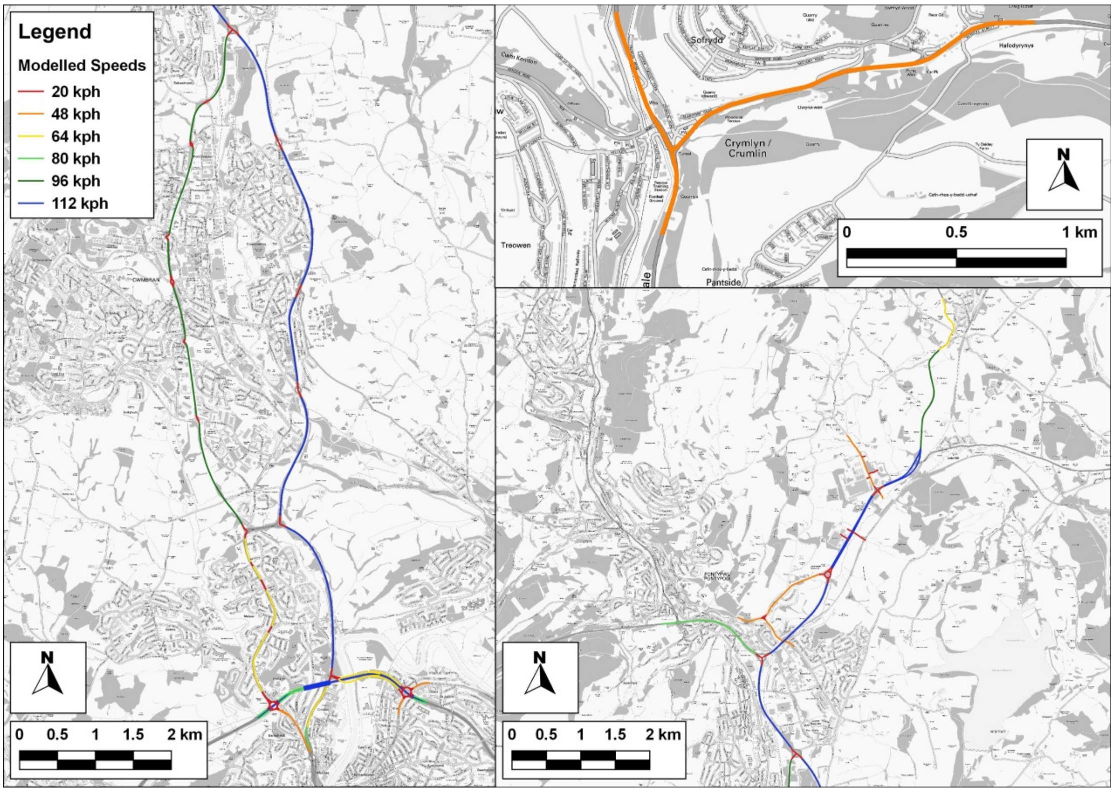

Figure 10.6.1: Modelled Road Network and Vehicle Speeds

M4 Tunnels

10.1.38 The M4 tunnels near Newport have been taken account within the model using the additional road tunnel option within ADMS-Roads. The portal depth (height) and portal width (diameter) of the tunnels have been estimated as 7.7 m and 10.3 m, respectively, based on photographs. These tunnels also have barriers to stop the re-circulation of air from one tunnel to the other. Emissions from each tunnel have been calculated using the EFT (Version 7.0) published by Defra (2016b), with an AADT flow equal to half of the flow along the M4 motorway and the same proportion of HDVs as the M4 motorway (see Table 10.6.1). Although it is acknowledged that the speed limit is managed for this part of the motorway and is often reduced from the national speed limit (70 mph) to 50 or 60 mph, the national speed limit produces more pollutant emissions and has therefore been used in this assessment to provide a worst-case approach.

Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

10.1.39 AQC has carried out a detailed analysis which showed that, where previous standards had limited on-road success in reducing nitrogen oxides emissions from diesel vehicles, the ‘Euro VI’ and ‘Euro 6’ standards are delivering real on-road improvements (AQC, 2016b). Furthermore, these improvements are expected to increase as the Euro 6 standard is fully implemented. Despite this, the detailed analysis suggested that, in addition to modelling using the EFT (V7.0), a sensitivity test using elevated nitrogen oxides emissions from certain diesel vehicles should be carried out (AQC, 2016b). A worst-case sensitivity test has thus been carried out by applying the adjustments set out in Table 10.6.2 to the emission factors used within the EFT[2], using AQC's CURED (V2A) tool (AQC, 2016a). The justifications for these adjustments are given in AQC (2016b). Results are thus presented for two scenarios: first the 'official prediction', which uses the EFT with no adjustment, and second the 'worst-case sensitivity test', which applies the adjustments set out in Table 10.6.2. The results from this sensitivity test are likely to over-predict emissions from vehicles in the future and thus provide a reasonable worst-case upper-bound to the assessment.

Table 10.6.2: Summary of Adjustments Made to Defra's EFT (V7.0)

<table>
<tr><th colspan="2">Vehicle Type</th><th>Adjustment Applied to Emission Factors</th></tr>
<tr><td colspan="2">All Petrol Vehicles</td><td>No adjustment</td></tr>
<tr><td rowspan="2">Light Duty Diesel Vehicles</td><td>Euro 5 and earlier</td><td>No adjustment</td></tr>
<tr><td>Euro 6</td><td>Increased by 78%</td></tr>
<tr><td rowspan="3">Heavy Duty Diesel Vehicles</td><td>Euro III and earlier</td><td>No adjustment</td></tr>
<tr><td>Euro IV and V</td><td>Set to equal Euro III values</td></tr>
<tr><td>Euro VI</td><td>Set to equal 20% of Euro III emissions [a]</td></tr>
</table>

[a] Taking account of the speed-emission curves for different Euro classes as explained in AQC (2016b).

Background Concentrations

10.1.40 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030. The background maps for 2015 have been calibrated against concurrent measurements from national monitoring sites. The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment year than that derived from the Defra maps (AQC, 2016c).

Background NO_2 Concentrations for Sensitivity Test

10.1.41 The road-traffic components of nitrogen dioxide in the background maps have been uplifted in order to derive future year background nitrogen dioxide concentrations for use in the sensitivity test. Details of the approach are provided in the report prepared by AQC (2016c).

Model Verification

10.1.42 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

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2 All adjustments were applied to the COPERT functions. Fleet compositions etc. were applied following the same methodology as used within the EFT.

Nitrogen Dioxide

10.1.43 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2015 at the NCC6B, NCC14A, NCC19B, NCC32D and NCC45A diffusion tube monitoring sites.

10.1.44 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2016b).

10.1.45 An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure 10.6.2). The calculated adjustment factor of 1.769 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

10.1.46 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure 10.6.3 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

10.1.47 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

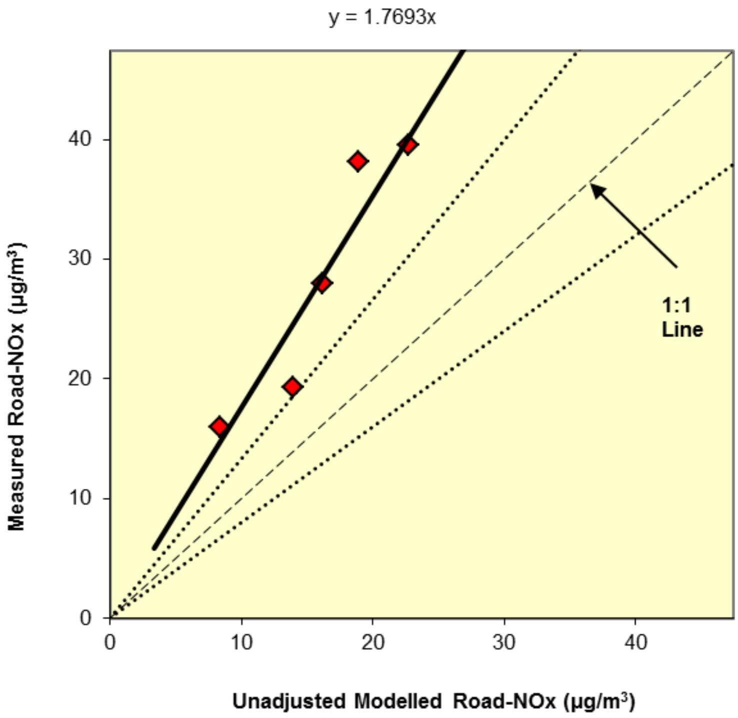

Figure 10.6.2: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

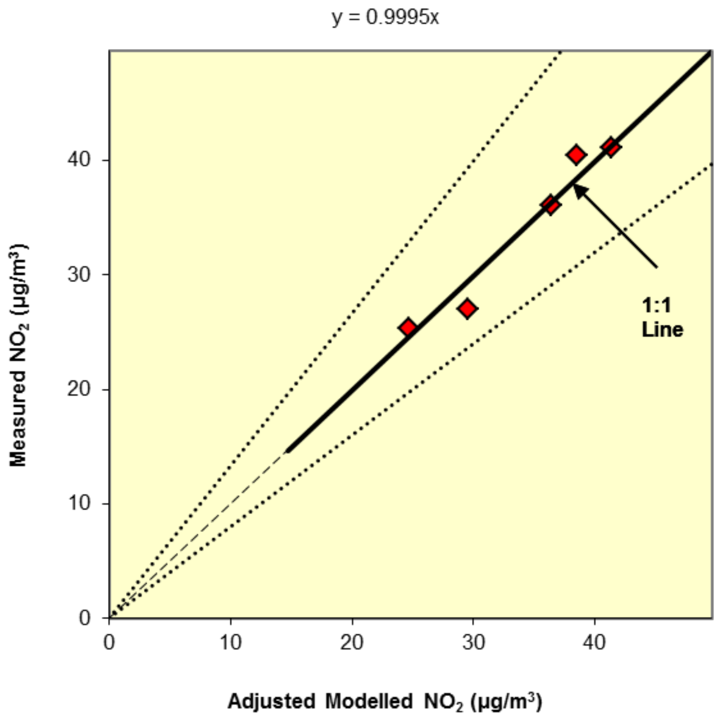

Figure 10.6.3: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Model Verification for NOx and NO_2 Sensitivity Test

10.1.48 The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 1.512, which has been applied to all modelled road-NOx concentrations within the sensitivity test.

PM_{10} and $PM_{2.5}$

10.1.49 There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor calculated for road NOx.

Model Post-processing

10.1.50 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2016b). The traffic mix within the calculator has been set to “All other urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

APPENDIX 10.7 - Hafod-yr-ynys AQMA Sensitivity Test

10.1.51 The predicted concentrations at receptors within and close to the Hafod-yr-ynys AQMA are not consistent with the conclusions of Caerphilly County Borough Council in the outcome of its Air Quality Review and Assessment work. An additional sensitivity test has therefore been carried out, whereby the model has been verified against monitoring within this AQMA.

Model Verification

10.1.52 The model has been run to predict the annual mean NOx concentrations during 2015 at the Hafod-yr-ynys automatic monitoring station and the CCBC50 diffusion tube monitoring site. Monitoring data for 2015 werer not available, so measured concentrations from 2014 have been used instead. Concentrations at these monitoring sites have remained fairly stable between 2011 and 2014. It is therefore considered that concentrations in 2014 are likely to be similar to those of 2015 and are thus suitable for the verification.

10.1.53 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2016b).

10.1.54 An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure 10.6.2). The calculated adjustment factor of 2.064 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

10.1.55 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure 10.6.3 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

10.1.56 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

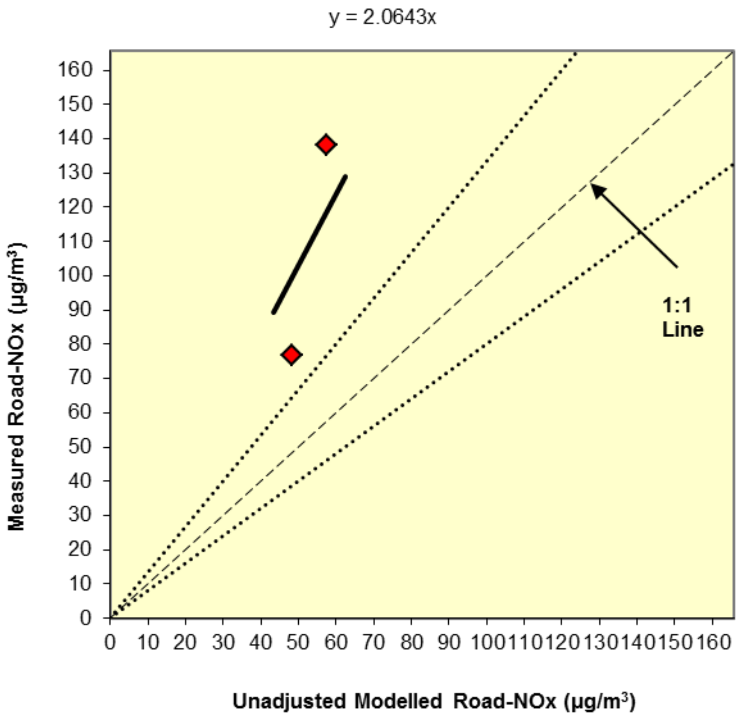

Figure 10.7.1: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

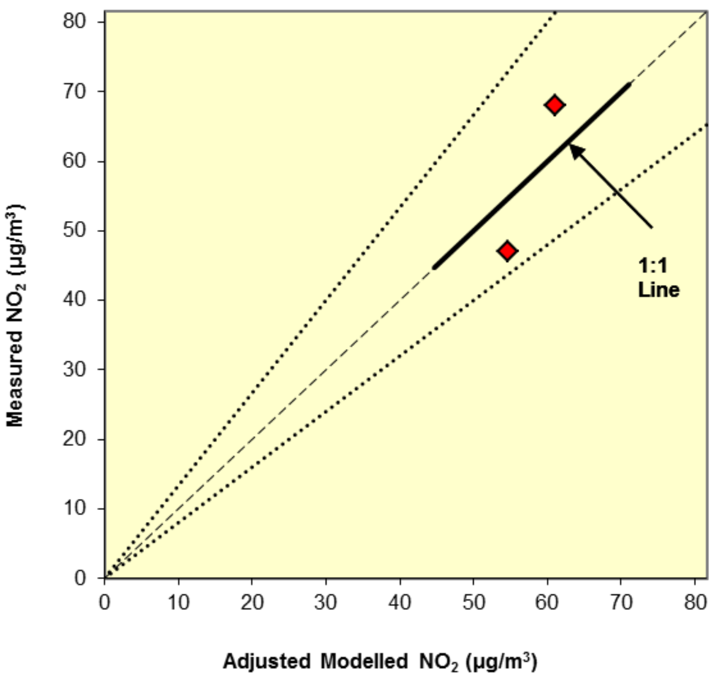

Figure 10.7.2: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Model Verification for NOx and NO_2 Sensitivity Test

10.1.57 The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 2.134, which has been applied to all modelled road-NOx concentrations within the sensitivity test.

Results

10.1.58 Predicted annual mean nitrogen dioxide concentrations verified against monitoring from within the Hafod-yr-ynys AQMA are presented in Table 10.7.1. The predicted concentrations are between 2.3% and 2.7% higher than those presented in Chapter 10. The concentrations however, are below the objective, with and without the Proposed Development. In the worst-case emissions sensitivity test, the predicted concentrations are between 6.1% and 7.1% higher than those presented in Chapter 10. These concentrations are also below the objective, with and without the Proposed Development. In both scenarios, the impacts are also all negligible.

Table 10.7.1: Predicted Nitrogen Dioxide Concentrations at Receptors Within and Close to Hafod-yr-ynys AQMA

Receptor	Without Scheme [a]	With Scheme [a]	% Change [a,b]	Impact Descriptor	*Worst-case Sensitivity Test* [c]			
					Without Scheme	*With Scheme*	*% Change* [b]	*Impact Descriptor*
20	28.4	28.5	0	Negligible	34.1	34.3	0	Negligible
21	31.0	31.2	0	Negligible	37.5	37.7	0	Negligible
22	31.1	31.3	0	Negligible	37.6	37.8	0	Negligible
23	31.3	31.4	0	Negligible	37.8	38.0	0	Negligible
24	27.3	27.5	0	Negligible	33.0	33.2	0	Negligible
Objective	**40**		**-**	**-**	***40***		**-**	**-**

[a] In line with Defra's forecasts.

[b] % changes are relative to the objective and have been rounded to the nearest whole number.

[c] Assuming higher emissions from modern diesel vehicles.

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APPENDIX 10.8 - Construction Mitigation

10.1.59 The following is a set of measures that should be incorporated into the specification for the works:

Communications

- develop and implement a stakeholder communications plan that includes community engagement before and during work on site;
- display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
- display the head or regional office contact information.

Dust Management Plan

- Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book; and
- hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust. Record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked;

- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and
- agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction (Institute of Air Quality Management, 2012).

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed, or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off their engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
- impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes, conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
- avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- only remove the cover from small areas during work, not all at once.

Measures Specific to Construction

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

- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;
- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems or mobile water bowsers, and regularly cleaned;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; and
- access gates should be located at least 10 m from receptors, where possible.