

Detailed Assessment of Air Quality in Tyne & Wear – Report



Carried out by:



On behalf of:



South Tyneside Council



North Tyneside Council

Detailed Assessment of Air Quality in Tyne & Wear

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on behalf of

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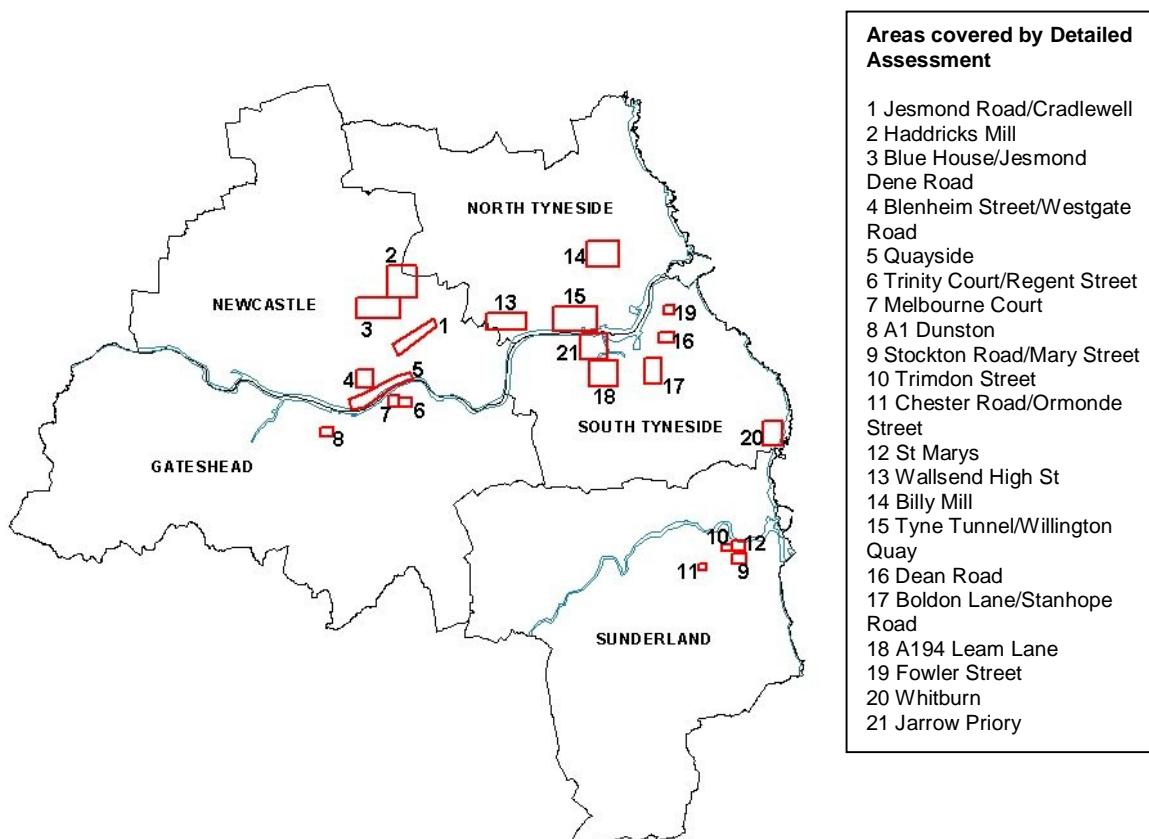
1 Introduction

1.1 Air Quality Consultants Ltd., has been commissioned by the five Tyne and Wear local authorities to carry out Detailed Assessments of air quality. The five local authorities covered by this report are:

- Newcastle City Council;
- Gateshead Council;
- Sunderland City Council;
- South Tyneside Council; and
- North Tyneside Council.

The local authorities forming the Tyne & Wear region are shown in Figure 1.

Figure 1 Map of Tyne & Wear Local Authorities and Locations Covered by Detailed Assessments



Introduction to the Second Round of Review and Assessment

- 1.2 The Government's Air Quality Strategy for England, Scotland, Wales and Northern Ireland¹ and the addendum to it, published in February 2003², set out a framework for air quality improvements, which includes a series of air quality objectives. National and international measures are likely to achieve these objectives in most locations, but where areas of poor air quality remain, local air quality management will be necessary. Part IV of the Environment Act 1995 requires local authorities to periodically review and assess the current, and likely future, air quality in their area. The role of this process is to identify areas where it is unlikely that the air quality objectives will be achieved. These locations must be designated as Air Quality Management Areas (AQMAs) and subject to active management.
- 1.3 Air quality objectives and Review and Assessment guidance change with advances in knowledge, much of which is learnt from the Review and Assessment process itself. As a result, Review and Assessment is a long-term, rolling process, structured as a series of 'rounds'. Most local authorities in England, Scotland and Wales have now completed the first round of Review and Assessment and the second round is currently underway.
- 1.4 The revised Local Air Quality Management Technical Guidance (LAQM. TG(03))³ sets out a phased approach to Review and Assessment. This prescribes an initial Updating and Screening Assessment (USA), which all authorities must undertake. It is based on a checklist to identify any matters that have changed since the first round and may now require further assessment. If the USA identifies any potential areas where there is a risk that the objectives may be exceeded, which were not identified in the first round, then the Local Authority should progress to a Detailed Assessment (DA).
- 1.5 The purpose of the Detailed Assessment is to determine whether an exceedence of an air quality objective is likely and the extent of that likely exceedence. If it is found that an air quality objective is likely to be exceeded, then an Air Quality Management Area (AQMA) must be declared. Subsequent to the declaration of an AQMA, a further assessment needs to be carried out to ascertain the sources contributing to the exceedence and to calculate the magnitude of reduction in emissions required to achieve the objective. An Air Quality Action Plan then needs to be created, which identifies measures to improve air quality, in pursuit of the air quality objectives.
- 1.6 This report describes Detailed Assessments for the five Tyne & Wear local authorities. It evaluates the likelihood of air quality objectives being exceeded at a number of locations that were identified in the USAs. In all, 20 areas have been examined, as shown in Figure 1. The findings have been discussed in full with the local authorities.

The Air Quality Objectives

- 1.7 The Government's Air Quality Strategy¹ defines both standards and objectives for each of a range of air pollutants. The 'standards' are set as concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The objectives are prescribed within The Air Quality (England) Regulations 2000⁴ and The Air Quality (England) (Amendment) Regulations 2002⁵. This latter publication set revised, more stringent objectives for benzene and carbon monoxide which are relevant to this second round, but which were absent in the first. The addendum to the air quality strategy² contains provisional objectives for PM₁₀ to be achieved in 2010. As these are not in the regulations, they do not strictly need to be covered in the Review and Assessment process. However, for completeness they are discussed in this report. Table 1 summarises the objectives, which are relevant to this report. Appendix 1 provides a brief summary of the health effects of the three pollutants under consideration.
- 1.8 The air quality objectives are only applicable where members of the public are likely to be regularly present and are likely to be exposed over the averaging time of the objective³. For annual mean and 24-hour objectives relevant exposure is limited to residential properties, schools and hospitals. The 1-hour objective applies at these and at any outdoor location where a member of the public might reasonably be expected to stay for the averaging period of the objective, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

Table 1 Air Quality Objectives Relevant to This Report.

Pollutant	Time Period	Objective	To be achieved by ¹
Nitrogen Dioxide	1-hour mean	200 µg/m ³ not to be exceeded more than 18 times a year	2005
	Annual mean	40 µg/m ³	2005
Fine particles (PM10) ²	24-hour mean	50 µg/m ³ not to be exceeded more than 35 times a year	2004
	Annual mean	40 µg/m ³	2004
	24-hour mean ³	50 µg/m ³ not to be exceeded more than 7 times a year	2010
	Annual mean ³	20 µg/m ³	2010
Benzene	Annual mean	16.25 µg/m ³	2003
	Annual mean	5.00 µg/m ³	2010

¹ The achievement dates are all by the end of the specified year.

² Measured by the gravimetric method.

³ Provisional objective not included in the Regulations.

2 Assessment Methodology

Existing Air Quality

- 2.1 Air pollutant concentrations in the vicinity of an emission source will be related to both the source strength and the background concentration to which the local source is added. Background concentrations of nitrogen dioxide and PM₁₀ across the Tyne & Wear region have been taken from the national maps of background concentrations available from the Air Quality Archive on the internet⁶, and adjusted in the case of nitrogen dioxide using local monitoring data (Appendix 2).
- 2.2 Information on air quality across the region has been collected from a number of measurement campaigns. The results of automatic air quality monitoring carried out in Tyne & Wear are published on the internet as part of the Tyne & Wear Air Quality Network (T&WAQN)⁷, which is maintained by the University of Sunderland. Newcastle City Council also operates an urban background site as part of the Government's Automatic Urban and Rural Network (AURN)⁶. Results from the T&WAQN are summarised in Appendix 3. The locations of these monitoring sites are shown in Appendix 4. Details of the quality assurance and control procedures in place for each of the automatic monitoring stations are presented in Appendix 5.
- 2.3 Monitoring for nitrogen dioxide is also carried out using passive diffusion tubes, which are exposed for a month at a time, before being returned to the laboratory for analysis. Newcastle and Gateshead Councils use Jesmond Dene Laboratory for their diffusion tube analysis, whereas Sunderland and South Tyneside use tubes which are supplied and analysed by Gradko using the 50% TEA in acetone method. Lambeth Scientific Services supply and analyse diffusion tubes for North Tyneside. All of the data presented in this report have been adjusted to account for diffusion tube bias. Further details of the adjustment factors used, are supplied in Appendix 6.
- 2.4 This report has been prepared predominantly using the data that were available in October 2004. For many of the monitoring sites, data are not available for a full calendar year. Unless otherwise stated, all data presented in this report have been adjusted to an annual mean equivalent. Further details of these adjustments are provided in Appendix 7.
- 2.5 In order to calculate pollutant concentrations at receptors, the modelled concentration due to local roads has been added to an estimated background concentration. Comparison of the estimated background concentrations from the UK Air Quality Archive (www.airquality.co.uk),

with measured background concentrations, indicates that the estimated concentrations are too high for Tyne and Wear. Therefore, the estimated background concentrations used in the modelling have been adjusted by a factor derived from this comparison. Details of this comparison and adjustment are presented in Appendix 8.

Modelling

2.6 ADMS Roads (version 2.0) and atmospheric dispersion modelling software developed by Cambridge Environmental Research Consultants Ltd (CERC) was used to model nitrogen dioxide concentrations at the locations identified for Detailed Assessment. The following input data were utilised:

- Annual hourly average data and heavy duty/light duty vehicle mix obtained from the Tyne & Wear Traffic and Accident Data Unit. Future year traffic flows estimated using a combination of the national NRTF and local Tempro factors, as advised on the Review and Assessment Helpdesk website⁸. Further details are provided in Appendix 9.
- As measured speeds were unavailable, estimate speeds were used based on local knowledge, taking into account congestion at peak periods. Further details are provided in Appendix 9.
- The location of roads and buildings (including road width) were obtained using OS Landline Plus 1:10000 mapping information. Building heights alongside modelled roads (used for the model to calculate street canyon effects) were estimated from current local knowledge.
- Meteorological data from the Newcastle meteorological station, for 2003.
- The emission factors used were those built into the model derived from DMRB 2003.

2.7 The model has been verified by comparing the model results with local measurements and the model output adjusted accordingly. For the majority of areas, a regional adjustment factor has been applied, based on comparison of data at five continuous monitoring sites. At A1 Dunston in Gateshead, where the terrain is significantly different a local adjustment has been applied. Further details of model verification and adjustment are supplied in Appendix 10.

Uncertainty

- 2.8 There is an element of uncertainty in all measured and modelled data. This includes uncertainty within the model itself as well as in the input data (e.g. existing and predicted traffic flow and composition). There is also uncertainty arising from the year to year variability in air quality data, the likely reduction in background air quality concentrations and the monitoring equipment.
- 2.9 The uncertainty in modelled data has been minimised by carrying out model verification and adjustment. Any known uncertainty in measured data is highlighted in the discussion of the results. Due to the number and variety of locations covered in this assessment, no attempt has been made to quantify the level of uncertainty in the measured and modelled data presented in this report. However, the overall picture, in terms of all the available measured and modelled data and the quality of that data has been taken into consideration in the decision whether or not to declare an AQMA and, if an AQMA is required, the minimum extent of the boundary.

4 Gateshead

Locations to be considered in the Detailed Assessments

- 4.1 The conclusions of the Gateshead USA, which was completed in May 2003, are summarised in Table 11. It was concluded that the objectives for carbon monoxide, lead, benzene, 1,3-butadiene, sulphur dioxide and PM₁₀ would all be achieved at relevant locations. However, a Detailed Assessment would be required for each of the busy junctions where potential exceedences of the annual mean nitrogen dioxide objectives were identified.
- 4.2 Monitoring data that have become available since the USA indicate that there may be a risk of the annual mean nitrogen dioxide objective being exceeded at relevant locations near to the A1 at Dunston and A184 Askew Road (Melbourne Court). Therefore these locations are also considered in the Detailed Assessments.

Table 11 Locations considered in the Gateshead Detailed Assessments

Pollutant	Conclusion
<i>Conclusions of USA</i>	
Carbon monoxide	DA not required
Benzene	DA not required
Lead	DA not required
1,3 –butadiene	DA not required
Sulphur dioxide	DA not required
Nitrogen dioxide	DA required - Trinity Court (A184/A167), - Regent Street/West Street
PM ₁₀	DA not required
<i>Additional locations identified since USA</i>	
Nitrogen dioxide	DA required based on monitoring - A1 Dunston - Melbourne Court (A184 Askew Road)

Detailed Assessments

Trinity Court (A184/A167) and Regent Street/West Street

- 4.3 DMRB modelling data in the USA identified this as an area where there could be potential exceedences of the annual mean nitrogen dioxide objective. Monitoring data for the area are presented in Table 12 for the sites identified in Figure 2A. The monitoring results indicate that there is a risk of the objective being exceeded in 2005 at diffusion tube location 42. This is attached to the property in Trinity Court that is closest to the roundabout and it is representative of relevant exposure. Monitoring at relevant locations further from the roundabout indicate that the area of exceedence may be small and confined to a few properties in Trinity Court.

Table 12 Nitrogen Dioxide Monitoring Data – Trinity Court (A184/A167)

Site number	Location	Site type	Relevant exposure	Monitor type	Concentration (mg/m ³)	Data capture (%)
2003 Measured						
TC	Trinity Court	Roadside	Yes	Chemi-luminescence	N/A	N/A
2	Priory Court	Roadside	Yes	Diffusion Tube	37.6	100
42	Trinity Court	Roadside	Yes	Diffusion Tube	44.7	100 (June-Dec)
43	Regent Court	Roadside	Yes	Diffusion Tube	32.9	100 (June-Dec)
January to August 2004 measured adjusted to 2003						
TC	Trinity Court	Roadside	Yes	Chemi-luminescence	36.1	99.7 (Mar-Sept)
2	Priory Court	Roadside	Yes	Diffusion Tube	40.5	100
42	Trinity Court	Roadside	Yes	Diffusion Tube	50.2	100
43	Regent Court	Roadside	Yes	Diffusion Tube	38.5	100
2005 Projected from 2003 (from 2004 adjusted to 2003 in brackets)						
TC	Trinity Court	Roadside	Yes	Chemi-luminescence	N/A (34.2)	N/A
2	Priory Court	Roadside	Yes	Diffusion Tube	35.6 (38.4)	N/A
42	Trinity Court	Roadside	Yes	Diffusion Tube	42.4 (47.6)	N/A
43	Regent Court	Roadside	Yes	Diffusion Tube	31.2 (36.5)	N/A
Objective = 40 mg/m³ in 2005						

- 4.4 Concentrations of nitrogen dioxide have been modelled alongside the A184/A167 junction using ADMS-Roads (for further information on model input and verification see the Methodology section). The model results which are presented in Figure 2B, suggest that there are no potential exceedences of the annual mean nitrogen dioxide objective, at relevant locations. Although the model results show good agreement with the monitoring at locations 2, 43 and TC, at diffusion tube location 42, which is attached the property in Trinity Court closest to the junction, the model is under-predicting concentrations (further comparison of modelled with measured concentrations presented in Appendix 12). The measured data at this location indicate that the objective will be exceeded at this property, whereas the model suggests concentrations well below the objective. It is possible, that this under-prediction is due to uncertainties in the traffic data, which have been estimated for the nearby road at this location.
- 4.5 Based on monitored and modelled results, an AQMA will be declared, which as a minimum, will include Trinity Court and Peareth Court, which are the residential properties to the south west and north west of the junction.

Melbourne Court (A184 Askew Road)

- 4.6 Melbourne Court which is situated near to the A184 Askew Road was not identified in the USA as an area where there could be potential exceedences of the annual mean nitrogen dioxide objective. However, monitoring data from a kerbside location (Askew Road) carried out in 2003/4 indicated that there may be potential exceedences of the objective, therefore it has been included in this Detailed Assessment. Monitoring data for the area are presented in Table 13 and Figure 2C. The monitoring results indicate that, although concentrations at relevant locations are elevated, due to traffic emissions, it is unlikely that the objective will be exceeded at relevant locations in 2005.
- 4.7 Although monitoring data indicate that the nitrogen dioxide objective is likely to be achieved, concentrations have been modelled alongside the A184 Askew Road using ADMS-Roads as part of the model verification exercise (for further information on model input and verification see the Methodology section). The results, which show good agreement with the measured concentrations, are shown in Figure 2D (further comparison of modelled with measured concentrations presented in Appendix 12).
- 4.8 The model results confirm the findings of the monitoring data, that the annual mean objective is expected to be achieved at relevant locations in the area. Therefore an AQMA is not required at this location.

Table 13 Nitrogen Dioxide Monitoring Data – Melbourne Court

Site number	Location	Site type	Relevant exposure	Monitor type	Concentration (mg/m ³)	Data capture (%)
2003 Measured						
AR	Askew Road	Kerbside	No	Chemi-luminescence	59.9	95 (Oct 02-Sept 03)
MC	Melbourne Court	Roadside	Yes	Chemi-luminescence	33.9	91 (Nov 03 – Sept 04)
3	Melbourne Court	Roadside	No	Diffusion tube	41.8	92
37, 38, 39	Melbourne Court	Roadside	Yes	Diffusion tube	36.9	100 (Mar-Dec)
44	Adelaide Court	Roadside	Yes	Diffusion tube	29.3	86 (Jun-Dec)
45	Brisbane Court	Roadside	Yes	Diffusion tube	37.4	(Oct-Dec)
January to August 2004 measured adjusted to 2003						
AR	Askew Road	Kerbside	No	Chemi-luminescence	N/A	N/A
MC	Melbourne Court	Roadside	Yes	Chemi-luminescence	N/A	N/A
3	Melbourne Court	Roadside	No	Diffusion tube	38.2	63
37, 38, 39	Melbourne Court	Roadside	Yes	Diffusion tube	40.4	100
44	Adelaide Court	Roadside	Yes	Diffusion tube	30.7	88
45	Brisbane Court	Roadside	Yes	Diffusion tube	35.4	88
2005 Projected from 2003 (from 2004 adjusted to 2003 in brackets)						
AR	Askew Road	Kerbside	No	Chemi-luminescence	56.8	N/A
MC	Melbourne Court	Roadside	Yes	Chemi-luminescence	32.1	N/A
3	Melbourne Court	Roadside	No	Diffusion tube	39.6 (36.2)	N/A
37, 38, 39	Melbourne Court	Roadside	Yes	Diffusion tube	34.9 (38.3)	N/A
44	Adelaide Court	Roadside	Yes	Diffusion tube	27.8 (29.1)	N/A
45	Brisbane Court	Roadside	Yes	Diffusion tube	35.4 (33.6)	N/A
Objective = 40 mg/m³ in 2005						

A1 Dunston

4.9 The A1 near Dunston was not identified in the USA as an area where there could be potential exceedences of the annual mean nitrogen dioxide objective. However, monitoring data from a roadside location operated in 2004 indicated that there may be potential exceedences of the objective, therefore it has been included in the Detailed Assessment. Monitoring data for the area are presented in Table 14 for the sites identified in Figure 2E. Measured data for 2004 appear to be significantly higher than those for 2003. The reason for the much higher levels in

2004, when adjusted to 2003, is unclear. The predicted concentration in 2005 at the roadside monitoring site, based on the 2004 result is $40.5 \mu\text{g}/\text{m}^3$ (i.e. marginally above the objective). However, the monitor is approximately 8 m closer to the road than any houses in the area indicating that objective is likely to be achieved at relevant locations in the area.

Table 14 Nitrogen Dioxide Monitoring Data – A1 Dunston

Site number	Location	Site type	Relevant exposure	Monitor type	Concentration (mg/m^3)	Data capture (%)
2003 Measured						
A1	A1 Dunston	Roadside	No	Chemi-luminescence	30.0	95.1
14	Park Terrace	Roadside	No	Diffusion tube	33.7	100
35, 40, 41	A1 Dunston	Roadside	No	Diffusion tube	33.0	100 (Mar-Dec)
January to August 2004 measured adjusted to 2003						
A1	A1 Dunston	Roadside	No	Chemi-luminescence	42.8	83 (Jan-Dec 04)
14	Park Terrace	Roadside	No	Diffusion tube	40.9	100
35, 40, 41	A1 Dunston	Roadside	No	Diffusion tube	40.8	100
2005 Projected from 2003 (from 2004 adjusted to 2003 in brackets)						
A1	A1 Dunston	Roadside	No	Chemi-luminescence	28.5 (40.5)	N/A
14	Park Terrace	Roadside	No	Diffusion tube	31.9 (38.5)	N/A
35, 40, 41	A1 Dunston	Roadside	No	Diffusion tube	31.3 (38.8)	N/A
Objective = $40 \text{ mg}/\text{m}^3$ in 2005						

- 4.10 Concentrations of nitrogen dioxide have been modelled alongside the A1 at Dunston using ADMS-Roads (for further information on model input and verification see the Methodology section). The model does not have the capacity to model the full complexity of this type of location, where the motorway is in a cutting below the level of the receptors and the slip roads. To account for this difference, the model has been verified against local monitoring data, rather than the regional verification carried out for other locations in this assessment. As there are large differences in measured data for 2003 and 2004, local verification has been carried out using the 2004 data, adjusted to 2003, as this represents a worst case scenario. The model results with the local verification carried out are presented in Figure 2F (further comparison of modelled with measured concentrations presented in Appendix 12). The results presented in Figure 2F suggest that the annual mean nitrogen dioxide objective will be achieved at all relevant locations.

- 4.11 Based on the monitoring and modelled data, there is no requirement to declare an AQMA. However, due to uncertainties in the measurement and modelling results, the results of monitoring in the area will be kept under careful review.

Conclusions

- 4.12 The conclusions of these Detailed Assessments for Gateshead are summarised in Table 15. An AQMA will be required for Trinity Court.

Table 15 Conclusions of Detailed Assessments for Gateshead Council

Pollutant	Location	Conclusion
Nitrogen dioxide	Trinity Court (A184/A167)	AQMA required
	Regent Street/West Street	AQMA not required
	Melbourne Court (A184 Askew Road)	AQMA not required
	A1 Dunston	AQMA not required