Durham CC Local Air Quality Management

Durham City Further Assessment 2012

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Table of Contents

1 Introduction

AECOM were commissioned by Durham County Council to undertake this Further Assessment of air quality in the City of Durham, for the nitrogen dioxide (NO_2) Air Quality Management Area (AQMA).

The Council declared the AQMA in parts of the city on the basis of detailed dispersion modelling and air quality monitoring. This report is intended to satisfy the Council's Local Air Quality Management (LAQM) responsibilities by reviewing and confirming the extent of the AQMA and to provide information to support future local air quality strategies and action plans.

1.1 Further Assessment

The Environment Act 1995 requires local authorities to complete a Further Assessment within 12 months of declaring an AQMA. A Further Assessment is intended to supplement existing information published through ongoing Review and Assessments and achieve the following key objectives as defined in the LAQM.TG(09) Guidance:

- Reassess the extent of the AQMA with reference to new monitoring data and local developments or policy changes.
- Calculate the reduction in pollutant concentration that may be required to achieve the air quality objectives within the AQMA.
- Determine the major sources of pollution within the AQMA to inform the Air Quality Action Plan.
- Consider new guidance and legislation that may have been published since the AQMA was declared.
- Consider new developments and policy changes that have occurred since the AQMA was declared.
- Undertake monitoring to support the declaration of the AQMA.
- Respond to any comments made by statutory consultees in respect of the Detailed Assessment.

1.2 Report Structure

- Section 2 provides an overview of air quality guidance and legislation;
- Section 3 explains the methodology which was followed in this assessment;
- Section 4 presents the current air quality in the City of Durham based on recent monitoring data and previous LAQM reports;
- Section 5 presents the results of the Further Assessment; and
- Section 6 concludes the report.

This assessment has been undertaken at the same time as a Detailed Assessment for Colpitts Terrace and Nevilles Cross to the west of the City Centre, which considers areas outside of the AQMA. Whilst the reports are effectively independent, they are mutually supporting and may be read in conjunction[1]. To this end, the modelling methodologies, presentation structure and sensitive receptor numbering may be compared directly.

The extent of the model used in this assessment covers the roads within AQMA and the immediately adjacent roads in order to assess the air quality within the AQMA. The roads assessed in the model are shown in Appendix B, Figures 4 and 5, and include:

- Millburngate Bridge;
- Leazes Road;
- Southern part of Claypath;
- Gilesgate;
- Sunderland Road, including the junction with Sherburn Road

[1] The publication of the Detailed Assessment has however been delayed; it is expected that it will be undertaken by early 2013, once further monitoring data has been collected.

2 Legislation and Policy

2.1 Overview of Relevant Air Quality Legislation and Policy

The provisions of Part IV of the Environment Act 1995 establish a national framework for air quality management, which requires all Local Authorities in England, Northern Ireland, Scotland and Wales to conduct local air quality reviews. Section 82(1) of the Act requires these reviews to include an assessment of the current air quality in the area and the predicted air quality in future years. Should the reviews indicate that the objectives prescribed in the UK Air Quality Strategy (Defra, 2007) and the Air Quality (England) Regulations (Defra, 2010) will not be met, the Local Authority is required to designate an AQMA. Action must then be taken at a local level to ensure that air quality in the area improves.

2.1.1 UK Air Quality Strategy

The UK Air Quality Strategy (AQS) identifies nine ambient air pollutants that have the potential to cause harm to human health. These pollutants are associated with local air quality problems, with the exception of ozone, which is instead considered to be a regional problem. The Air Quality Regulations set objectives for the seven pollutants that are associated with local air quality. These objectives aim to reduce the health impacts of the pollutants to negligible levels.

2.1.2 Local Air Quality Management Review and Assessment

It is the responsibility of the Local Authority to undertake Review and Assessment work in accordance with the regime defined in the technical Guidance LAQM.TG(09). The purpose of the regime is to update and publish information regarding local air quality monitoring and to identify possible areas of exceedence through screening and modelling.

The regime also specifies that a Further Assessment (FA) should be undertaken for areas where an AQMA has been declared. The FA should include an assessment of existing and predicted exposure, as well as a study of source apportionment and the reduction in pollutants required to achieve the relevant objectives.

2.1.3 European Air Quality Directives

The Air Quality Framework Directive (96/62/EC) on ambient air quality assessment and management defines the policy framework for 12 air pollutants known to have a harmful effect on human health and the environment. The limit values for the specific pollutants are set through a series of Daughter Directives.

- Directive 1999/30/EC (the 1st Daughter Directive) sets limit values (values not to be exceeded) for sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x), particulate matter and lead in ambient air.
- Directive 2000/69/EC (the 2nd Daughter Directive) establishes limit values for concentrations of benzene and carbon monoxide in ambient air.
- Directive 2002/3/EC (the 3rd Daughter Directive) establishes long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.
- Directive 2004/107/EC (the 4th Daughter Directive) establishes a target value for the concentration of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air so as to avoid, prevent or reduce harmful effects of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons on human health and the environment as a whole.

The Air Quality Standards Regulations 2010 replaced the previous Regulations that gave effect to the provisions of Air Quality Framework; First; Second; and Third Air Quality Directives; and give effect to the latest Fourth Air Quality Daughter Directive too. The new Regulations apply to England with the exception of Regulation 29 (relating to reporting requirements) which applies to the entire UK.

Council Directive 2008/50/EC came into force in 2008, and was transposed into national legislation in 2010.

Key points to note are that it:

- consolidates existing air quality legislation apart from the 4th Daughter Directive, which will be brought within the new Directive at a later date;
- provides a new regulatory framework for $PM_{2.5}$; and
- makes provision under Article 22 for Member States to postpone attainment deadlines and allow an exemption from the obligation to limit values for certain pollutants, subject to strict conditions and assessment by the European Commission (EC).

2.1.4 Air Quality Objectives and Limit Values

The air quality objectives and limit values currently applicable to the UK can therefore be split into two groups. Each has a different legal status and is therefore handled differently within the framework of UK air quality policy. These are:

- UK air quality objectives set down in regulations for the purposes of local air quality management; and
- European Union (EU) limit values transcribed into UK legislation for which compliance is mandatory.

2.2 Nitrogen Dioxide

The Government and the Devolved Administrations adopted two Air Quality Objectives for NO_2 to be achieved by the end of 2005. In 2010, mandatory EU air quality limit values on pollutant concentrations were to apply in the UK, however the UK Government applied for derogation. For some parts of the UK the application has been refused, and for major cities a decision has yet to be reached. The EU limit values for NO_2 are the same as the national objectives for 2005 but the limit values are mandatory (Defra, 2007):

- An annual mean concentration of 40 micrograms per cubic metre (µg/m^3); and
- An hourly mean concentration of 200 µg/m^3, to be exceeded no more than 18 times per year.

The number of exceedences of the hourly objective show considerable year-to-year variation, and is driven by meteorological conditions, which give rise to winter episodes of poor dispersion and summer oxidant episodes.

NO_2 and nitric oxide (NO) are both oxides of nitrogen, and are collectively referred to as NO_X. All combustion processes produce NO_X emissions, largely in the form of NO, which is then converted to NO_2, mainly as a result of its reaction with ozone in the atmosphere. Therefore the ratio of NO_2 to NO is primarily dependent on the concentration of ozone and the distance from the emission source.

In recent years a trend has been recognised whereby roadside NO_2 concentrations have not been falling, or have been increasing, at certain monitoring sites, despite emissions of NO_X falling. The 'direct NO_2' phenomenon is having an increasingly marked effect at many urban locations around the country and must be considered when undertaking modelling studies and in the context of future local air quality strategy. At the end of September 2010 Defra released a brief FAQ (Frequently Asked Question) note on the issue (Defra, 2010), acknowledging that NO_2 concentrations have not fallen as projected over the past 6-8 years, and also published a draft report in March 2011 entitled "Trends in NO_X and NO_2 emissions and ambient measurements in the UK" (Defra, 2011), which discusses the disparity between modelling and monitoring in detail. In September 2012, Defra published the Emission Factors Toolkit (EFT) (v5.1.3) to incorporate the updated NO_X emissions factors and vehicle fleet information based on current measurements and projections. Further details are provided in Section 3.3.

3 Assessment Methodology

3.1 Assessment Procedure

The modelling assessment was undertaken in accordance with the methodology defined in technical guidance LAQM.TG(09) (Defra, 2009b) (See Section 1.1). The modelling assessment considered all roads within the AQMA, including:

- Millburngate Bridge;
- Leazes Road;
- Southern part of Claypath;
- Gilesgate;
- Sunderland Road.

Additional roads were also included in the modelling study, as indicated in Appendix B and discussed in Section 3.6.

3.2 AAQuIRE

The AAQuIRE dispersion modelling software, developed by AECOM, was used to predict pollutant concentrations. AAQuIRE uses the CALINE4 model for the dispersion of road-traffic emissions. The model is fully validated and has been extensively used worldwide. Further details are provided in Appendix A.

3.3 Emissions Factors

As discussed in Section 2.2, in recent years it has been noted that NO_2 concentrations have typically not been falling, particularly at roadside monitoring sites nationwide, despite emissions of NO_X falling. At the end of September 2010 Defra released a brief FAQ note on the issue (Defra, 2010), acknowledging that NO_2 concentrations have not fallen as projected over the past 6-8 years. One of the reasons for this is because vehicle emissions factors for diesel vehicles have underestimated NO_X and NO_2 emissions in '*real-world*' conditions.

This modelling study uses the emission database published by Defra in September 2012 in the Emission Factors Toolkit EFT (v5.1.3) (http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft). The EFT specifically incorporates updated NO_X emissions factors and vehicle fleet information based on current measurements and projections, which are essential for the modelling study.

3.4 Conversion of NO_X to NO_2

The proportion of NO_2 in NO_X varies greatly with location and time according to a number of factors including the amount of oxidant available and the distance from the emission source. NO_X concentrations are expected to decline in future years due to falling emissions, therefore NO_2 concentrations will not be limited as much by ozone and consequently it is likely that the NO_2/NO_X ratio will increase in the future.

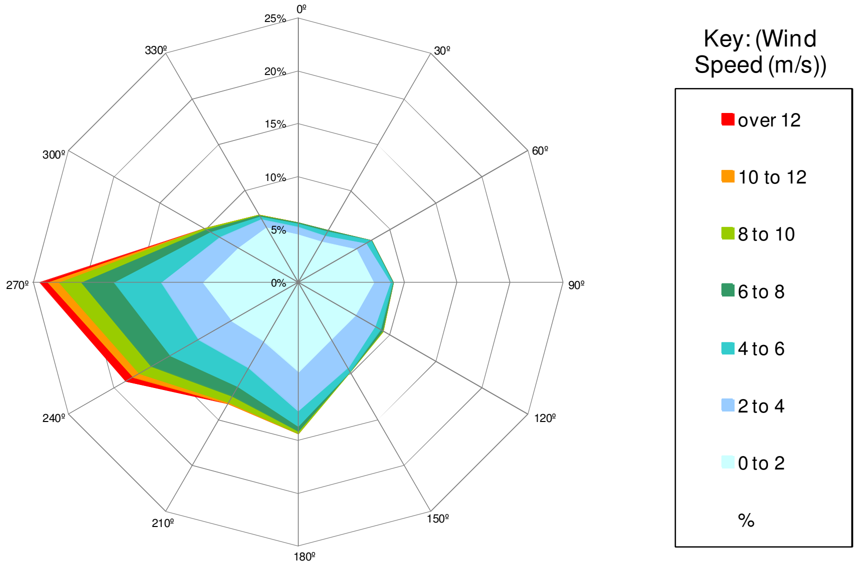
In this assessment modelled NO_X values were converted to NO_2 using the 'NO_X to NO_2' calculator version 3.1, published in September 2012, and available on the Defra local air quality management website (Defra, 2012). The year and region for which the modelling has been undertaken are specified and local factors, such as an appropriate factor of NO_X emitted as NO_2, are used in the calculation.

3.5 Meteorological Data

The meteorological dataset applied to the model was recorded at Newcastle Airport in 2011. The airport is located approximately 15 km to the north of the study site and is considered to be a good representation of the regional conditions at the study site.

The prevailing meteorological conditions are indicated by the wind rose in Figure 1, whereby the prevailing direction is from the west, with a strong south-westerly component, which is considered to be broadly typical for the study area and the UK as a whole. The prevailing wind direction will increase dispersions of atmospheric pollutants towards the east and north, resulting in slightly greater exposure at receptor locations to the north-east of the roads.

Figure 1: Newcastle Airport Windrose, 2011



3.6 Traffic Data

Traffic data in the form of Annual Average Daily Traffic (AADT) flows, Heavy Goods Vehicle (HGV; vehicles greater than 3.5t) percentages and average vehicle speeds for all road links within the model domain are required to predict pollutant concentrations arising from traffic. The traffic flow data used in the model are provided in Appendix B, and are calculated from automatic and manual counts recorded between 2010 and 2012 by DCC.

The vehicle types that were measured are slightly different on each road due to the type of counting equipment that was used. However, where possible, the car, LGV, HGV and bus components have been separated for the purposes of source apportionment. Where the bus component was not explicitly measured, the proportion of buses comprising the total HGV flow was estimated from the flows recorded on similar roads.

The data were also used to determine daily average speed and flow profiles (Figure 2 and 3), which were assigned to the modelled roads. These profiles account for congestion when peak traffic times results in greater numbers of vehicles and lower speeds:

- Figure 2 illustrates the daily flow profile, which was very similar for all of the roads for which these data were available. Flows increase substantially from 06:00 to a morning rush-hour peak at 08:00, then increase gradually through the day to an afternoon peak at 16:00 before tailing-off slowly during the evening.
- Figure 3 illustrates the speed profile of roads for which hourly speed data were available. Typically, the speed profile mirrors the flow profile, as would be expected.

Figure 2: Average Diurnal Vehicle Flow Profile for Modelled Roads

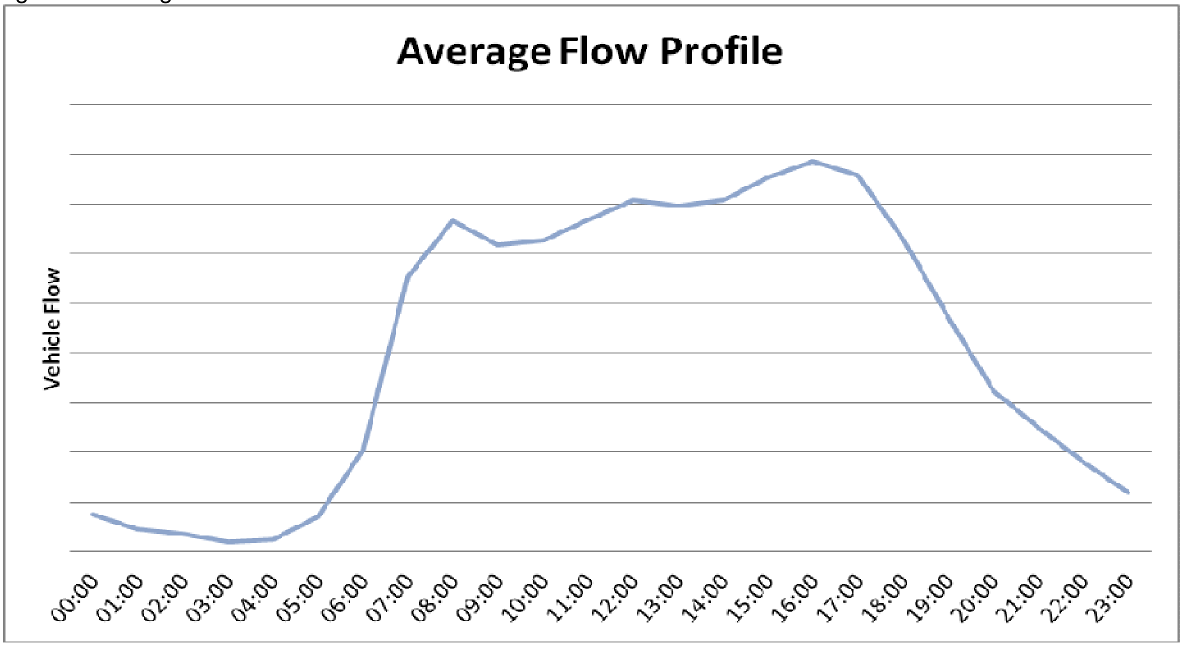
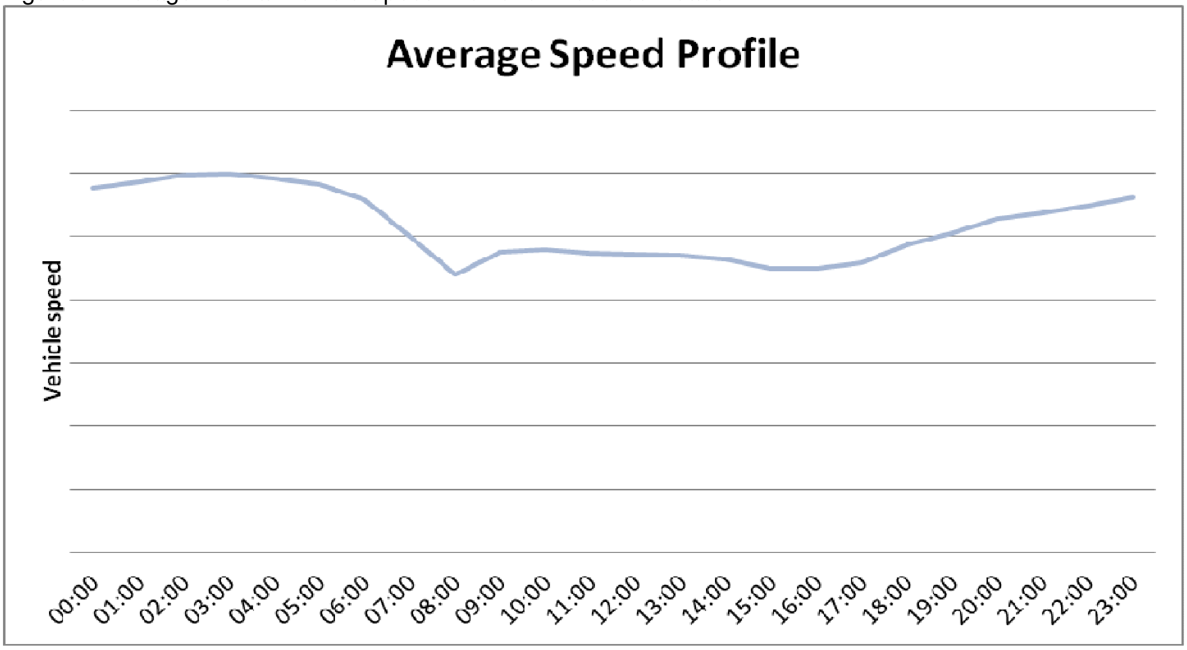


Figure 3: Average Diurnal Vehicle Speed Profile for Modelled Roads



3.6.1 Queuing Traffic

Queuing traffic is acknowledged as a potentially significant emission source in many urban areas. Several areas within Durham City are subject to significant congestion and queuing at busy times, particularly at the approaches to the following roundabouts:

- Gilesgate Roundabout

- Millburngate Roundabout
- Framwellgate Roundabout

The locations of these roundabouts are illustrated in Appendix E, Figure 10.

The approximate hourly average numbers of vehicles queuing during the morning and evening peak hours (07:00-10:00 and 1500-19:00) were obtained from manual counts. The numbers of vehicles were converted to queue lengths using an average Passenger Car Unit (PCU) length of 6m.

In order to represent this emission source, the queue links were modelled for the correlating length and hour, and laid over the free-flowing model links. The queue links used the minimum speed permitted by the EFT of 5 km/hr.

3.7 Study Area and Modelled Receptors

3.7.1 Durham City

The City of Durham is a medieval settlement with many narrow, steep hills, although a significant road with dual-carriageway sections has been constructed through the centre, providing a major east-west link across the City. The different areas of the City have very different characteristics, with regard to the road attributes and the proximity of receptors.

The residential areas to the east of the city are predominantly terraced and semi-detached properties set back from the road. This area includes Gilesgate and Sunderland Road, which comprises part of the AQMA.

The centre of the City is predominantly commercial, although there are also residential properties and flats near the major roads. The Leazes Road and Millburngate Bridge are wide multi-lane roads that are typically at different levels to the surrounding properties and link two major roundabouts where peak-hour queues typically occur.

The New Elvet area is south of the City Centre and is comprised of relatively narrow lanes, terraced buildings and residential properties. This is not a major vehicle thoroughfare, but is an access route to the City Centre from the south and south-east.

The area to the west of the City Centre between Millburngate and Nevilles Cross comprises part of the main east-west road link. It is comprised of terraced residential properties facing directly onto narrow steep roads which are characteristic of street-canyons where air flow is constrained.

3.7.2 Receptors

A number of residential properties were selected as sensitive receptors and are presented in Table 1, and Appendix C, Figure 6. Receptors were selected as those anticipated to be exposed to the highest concentrations of road vehicle emissions, due to proximity to areas of congestion and high flows. One receptor at the Government Offices (Receptor 11) was selected as it is near a very busy road and represents potential exposure to the short-term hourly objective, where an annual mean concentration >60 $\mu g/m^3$ may indicate a potential breach.

The Council undertakes air quality monitoring at locations throughout the City, which is discussed in the following Section 4. Many of the monitoring sites are considered to be representative of relevant exposure, and so they have also been used as sensitive receptor locations (Table 2).

In addition to the sensitive receptor locations, a plot of the predicted NO_2 concentrations was provided. In accordance with LAQM.TG(09) a fine 10 m grid was used to predict areas of potential high pollutant concentrations.

As discussed in Section 1.2, this assessment was undertaken alongside a Detailed Assessment for areas outside of the AQMA to the west of the City Centre around the Collpits Terrace and Nevilles Cross area. The submission of the Detailed Assessment has been delayed until early 2013 to benefit from a new continuous monitor which was recently installed at the Crossgate Lights junction. The sensitive receptor ID numbering has been divided across both reports so the model outputs can be directly compared without causing confusion.

Table 1: Modelled Sensitive Receptor Locations

ID	Location	Within AQMA?	Study Area	Height (m)	X	Y
10	45 Highgate	Yes	Millburngate	1.5	427134	542709
11	Government Offices, Milburngate Bridge	Yes	Millburngate	1.5	427203	542664
16	Durham University (Gilesgate Roundabout)	Yes	Millburngate	1.5	427976	542660
17	81 Gilesgate Hill	Yes	Gilesgate	1.5	428370	542733
20	15 Marshall Terrace (Sunderland Road)	Yes	Gilesgate	1.5	429462	542992
21	97 Claypath (Rear)	Yes	Millburngate	8	427477	542602
22	22 Leazes Court (Facing Leazes Road)	Yes	Millburngate	3	427667	542590
23	Ravensworth Terrace (Leazes Road)	Yes	Millburngate	1.5	427814	542601
24	57 Gilesgate (Gilesgate Roundabout)	Yes	Millburngate	1.5	428193	542712
25	5 Gilesgate (Gilesgate Roundabout)	Yes	Millburngate	1.5	428266	542693
26	150 Gilesgate	Yes	Gilesgate	1.5	428424	542711
27	Green lane (Sunderland Road)	Yes	Gilesgate	1.5	428710	542792
28	1 Young Street (Sunderland Road)	Yes	Gilesgate	1.5	428821	542793
29	10 Sunderland Road	Yes	Gilesgate	1.5	429099	542841
30	37 Sunderland Road	Yes	Gilesgate	1.5	429250	542907
31	1 Sunderland Road	Yes	Gilesgate	1.5	429653	543094
32	10 Sunderland Road	Yes	Gilesgate	1.5	429746	543163

Table 2: Monitoring at Locations of Representative Exposure

ID	Location	Within AQMA?	Study Area	Height (m)	X	Y
D1	Dragon Lane Juction	Yes	Gilesgate	1.5	429658	543113
D2	121 Gilesgate	Yes	Gilesgate	1.5	428569	542757
D7	Highgate	Yes	Milburngate	6	427134	542688
D20	Gilesgate	Yes	Gilesgate	1.5	428305	542718
D42	Claypath	No	Claypath	1.5	427484	542623
D56	56 McKintosh court	No	Gilesgate	1.5	429104	542881
D58	49 Sunderland Road	No	Gilesgate	1.5	428903	542828
D60	AQMA Monitor Gilesgate	Yes	Gilesgate	1.5	428535	542750

3.8 Model Verification

When using modelling techniques to predict concentrations, it is desirable to make a comparison between the modelling results and monitoring data, to ensure that the model is reproducing actual observations. The accuracy of the future year modelling results are relative to the accuracy of the base year results, therefore greater confidence can be placed in the future year concentrations if good agreement is found for the base year.

Modelling results are subject to systematic and random error; systematic error arises due to many factors, such as uncertainty in the traffic data and the composition of the vehicle fleet, and uncertainty in the meteorological dataset. This can usually be addressed and, if necessary, adjusted for by comparison with monitoring data.

The model results were compared with the monitoring undertaken at locations throughout the study area, which determined that it would be necessary to apply an adjustment factor to the raw model results. Due to the diverse characteristic of the modelled areas, as described in Section 3.7.1, two adjustment factors were derived. An adjustment factor of 1.9 was derived for the area around Milburngate, extending from the Framwellgate Roundabout to the Gilesgate Roundabout. While an adjustment factor of 1.6 was derived for the area to the east of the Gilesgate Roundabout.

Furthermore, sufficient monitoring data was available to calculate a Root Mean Square Error (RMSE), which is indicative of the range of confidence that may be applied to the model results for each area. The range for each area was used to identify all areas of potential exceedences. Further details of the procedure are provided in Appendix D.

4 Baseline Conditions

4.1 Air Quality Management Area

Durham County Council (DCC) is a 'unitary' Council, established on 1st April 2009 when the seven former District and Borough Councils within the County merged with the previous Durham County Council. This authority is now responsible for Review and Assessment duties for the county administrative area, including the City of Durham.

With regard to the City of Durham, the declaration of an AQMA was recommended in 2008, although due in part to the Council reorganisation it was not declared until May 2011. The extent of the AQMA is provided in Appendix E, Figure 10 and is composed of a single area including Highgate, Milburngate, Framwellgate Peth, Milburngate Bridge, Leazes Road and Gilesgate as far as the area around Dragons Lane.

The outcomes of recent LAQM reports are summarised below.

4.1.1 2011 Progress Report

The 2011 Progress Report reviewed monitoring data from the local NO_2 diffusion tube network, which was significantly extended in 2011. This report identified exceedences of the annual mean NO_2 objective at areas outside the AQMA and concluded that it would be necessary to undertake the following Detailed Assessments:

- Claypath, in the city centre (see below)
- New Elvet, Church Street and Hallgarth, south of the city centre (see below)
- Crossgate lights, Nevilles Cross, The Peth and Colpitts Terrace, to the west of the city centre (the DA is due to be submitted in early 2013).

4.1.2 2011 Claypath Detailed Assessment

The model predicted that exceedences of the NO_2 annual mean objective were likely to occur at the western end of Claypath. This area of exceedence was partly due to the contribution from traffic using Claypath, but was predominantly due to its proximity to Leazes Road, which is within the existing AQMA.

From September 2011 the lower end of Claypath was used for a taxi rank with restricted vehicle access, which was particularly busy during Friday and Saturday nights. Queuing and idling cars in this areas was raised as a potential local air quality concern and so a number of additional monitoring locations were installed on this road. However, the taxi rank has recently been moved across the road bridge, which is expected to alleviate these concerns.

The assessment recommended that whilst the AQMA should be amended to specifically include the properties at the western end of Claypath, local traffic on this road is not predicted to be the major cause of the exceedence and it is not appropriate to declare the whole of Claypath as an AQMA.

4.1.3 2011 New Elvet, Church Street and Hallgarth Detailed Assessment

Whilst the model predicted elevated concentrations of NO_2 at some locations, it was not considered likely that the annual mean objective for NO_2 would be exceeded at any locations of relevant exposure. It was therefore recommended that the existing AQMA should not be extended to the south. The model predicted high concentrations of NO_2 at the junction of Church Street and Hallgarth, although exceedences were not predicted at any locations of relevant exposure.

Despite these conclusions, a diffusion tube was relocated in October 2011 to the façade of a property at the junction of Church Street and Hallgarth Street. Since monitoring commenced at this location, the measured monthly levels of NO_2 have exceeded the objective. If the objective continues to be exceeded then the assessment undertaken in 2011 should be revisited and a new Detailed Assessment will be undertaken.

4.2 Monitoring

4.2.1 Passive Monitoring

The Council currently undertakes monitoring for NO_2 using passive diffusion tubes at 47 locations in Durham City, including 21 new locations (Table 3). Figures 11, 12 and 13 in Appendix F show the monitoring locations of the current diffusion tube network.

Fourteen exceedences of the annual mean objective were recorded in 2011, and eleven of these locations were outside the extent of the current AQMA; of these, several were at locations of relevant exposure. Exceedences of annual mean NO_2 objective were recorded at the following locations within the Durham City AQMA:

- D8, Highgate North
- D20, Gilesgate
- D1, Dragon Lane

Exceedences of annual mean NO_2 objective were also recorded at locations in Durham City outside the AQMA, although these are not considered as part of this Further Assessment.

A new monitoring location at an urban background site was installed at The Sands (D59) in 2011 and has been used to inform the background NO_2 concentrations (discussed below in Section 4.3).

Gilesgate automatic monitor was used as part of a co-location study and determined a bias adjustment factor of 0.92. However, it was only operational from June 2011 and achieved data capture of only 57% (97% of the operational period). In comparison, the national bias adjustment value of 0.89 was determined from version 03/12 of the national bias adjustment spread sheet. These calculations are provided in the 2012 Updating and Screening Assessment (DCC, 2012).

Box 3.3 of LAQM.TG(09) states that where the automatic monitor is operational for >9 months, it may be preferable to use the national bias adjustment factor. However, the local and national factors were very similar, and so a cautious approach was taken whereby the slightly higher value (i.e. the locally derived factor) was used to adjust the 2011 diffusion tube data. This was considered to be a conservative approach.

Table 3: Non-continuous Monitoring in the City of Durham

ID	Location	Co-ordinates X	Co-ordinates Y	Site Type	Within AQMA	Relevant Exposure	Data Capture for full calendar year 2011 %	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)[B]	Distance to kerb, m	Annual mean concentration µg/m³ 2007	2008	2009	2010	2011
D5	Milburngate	427357	542606	Kerbside	Yes	N (3 m)	100%	N/A	N	0 m	22.2	25.3	28.0	34.5	23.6
D8	Highgate North	427119	542869	Kerbside	Yes	N (3 m)	100%	N/A	Y	0 m	37.8	39.4	**44.3**	**43.7**	**42.9**
D20	Gilesgate	428305	542718	Roadside	Yes	Y	83%	Y	N	3 m	39	**41.8**	**47.6**	**45.4**	**43.4**
D3	Claypath	427983	542712	Kerbside	Yes	N (3 m)	100%	N/A	N	0 m	-	-	34.2	31.4	32.1
D21	Sherburn Road	428745	542732	Roadside	No	N (3 m)	100%	N/A	N	2m	-	-	25.4	29.0	25.2
D1	Dragon Lane	429658	543113	Roadside	Yes	Y (<1 m)	100%	N/A	Y	2 m	-	-	**52.5**	**41.6**	**41.9**
D2	121 Gilesgate	428569	542757	Roadside	Yes	Y	83%	Y	N	2 m	-	-	-	35.1	36.7
D14	The Gates	427166	542634	Roadside	Yes	N	92%	N/A	N	2 m	-	-	-	**43.2**	35.5
D42	Claypath	427484	542623	Roadside	No	Y	83%	Y	N	2 m	-	-	-	38.9	37.7
D45	Young Street	428824	542710	Roadside	Yes	N (1 m)	92%	N/A	N	1 m	-	-	-	27.4	28.2
D56	56 McKintosh court	429104	542881	Roadside	Yes	Y	75%	Y	N	10 m	-	-	-	-	18.4
D57	56 McKintosh court	429096	542864	Kerbside	Yes	N (15 m)	67%	Y	N	4 m	-	-	-	-	19.7
D58	49 Sunderland Road	428903	542828	Roadside	Yes	Y	67%	Y	N	3 m	-	-	-	-	18.3
D59	The Sands	427652	542991	Backgrnd	No	N (10 m)	75%	Y	N	N/A	-	-	-	-	17.7
D60	AQMA Monitor Gilesgate	428535	542750	Roadside	Yes	Y	75%	Y	N	2 m	-	-	-	-	22.2
D61	AQMA Monitor Gilesgate	428535	542750	Roadside	Yes	Y	75%	Y	N	2 m	-	-	-	-	21.8
D62	AQMA Monitor Gilesgate	428535	542750	Roadside	Yes	Y	75%	Y	N	2 m	-	-	-	-	21.8

Note: Exceedences of the UK air quality standard objective highlighted in bold.

4.2.2 Automatic Monitoring

A continuous NO_2 analyser was installed at a roadside location on Gilesgate in 2011, and was used to determine a local diffusion tube bias adjustment factor. The site was operational from 1st June 2011 until 13th June 2012. Therefore the data in Table 4 is presented as an adjusted annual mean concentration for the 2011 calendar year, and full 12-months of recorded data.

These data were seasonally adjusted (annualised) by comparison with four regional automatic monitoring stations operated as part of the Defra Automatic Urban and Rural Network (AURN); Sunderland Silksworth, High Muffles, Billingham an Newcastle Centre. The calculations are provided in the 2012 Updating and Screening Assessment (DCC, 2012).

The full 12-months of monitoring data are very similar to the 2011 annualised values, which is considered to validate the annualised data.

The annual mean concentration was well-below the annual mean objective, and there is not considered to be significant risk of the hourly objective being breached in this location.

Table 4: Continuous Monitoring in the City of Durham, 2011

ID	Location	Type	Annual Mean, µg/m^3	Number of Exceedences of Hourly Mean (200 µg/m^3)
D60	Gilesgate	Roadside	23.6 (May-December 2011 inclusive) [A]	0 (94.0 µg/m^3) [B]
			23.4 (June 2011 to June 2012) [C]	0 (97 µg/m^3) [C]

Note: [A] The annual mean concentration has been seasonally adjusted as monitoring was not carried out for the full year.
[B] The period of valid data is less than 90%, so the 99.8th percentile of hourly means* is provided in brackets.
[C] The annual mean concentration was recorded for the total operational period, and is not comparable to the calendar year.

4.3 Estimated Background Concentrations

A large number of sources of air pollutants exist which individually may not be significant, but collectively, over a large area, need to be considered. The concentrations calculated by the model due to vehicle emissions can then be added to background concentrations to give the total concentration.

Modelled estimates of background air quality concentrations are also provided on the Defra Air Quality website (Defra, 2011b) for each 1 km Ordnance Survey (OS) square in the UK. The estimated background concentrations for the OS grid squares containing the study area are provided in Table 5. These data were downloaded in September 2012. Adjusted NO_2 concentrations, to account for contributions from roads that have been modelled, were calculated using version 3.1 of the NO_2 Background Selector Tool.

Table 5: Archive Background Pollutant Concentrations (µg/m^3)

Pollutant	2011	
	Total	Adjusted
NO_X	27.9	24.0
NO_2	18.6	16.3

The estimated background concentrations in Table 5 are well below the annual mean objective, although it is noted that the square centred over the centre of Durham indicates generally higher concentrations, which are due to a greater density of various emission sources.

Monitored pollutant concentrations at locations away from the direct influence of roads or industrial sources ('background' locations) are discussed above in Section 4.2. For modelling purposes it is preferential to use actual monitored rather than modelled background concentrations. Therefore the NO_2 concentration recorded in 2011 at The Sands was used for the Further Assessment. The annual mean concentration recorded at The Sands was 17.7 µg/m^3, which is very similar to the estimated value.

5 Results

5.1 Sensitive Receptors

As discussed in Section 3.7.2, the annual mean concentration of NO_2 was predicted at sensitive receptor locations considered to represent locations of relevant exposure. In addition, many of the air quality monitoring sites in the AQMA are representative of relevant exposure, and so these were also included in the model.

As discussed in Section 3.8, the model was verified by comparison with the air quality monitoring data recorded by DCC.

The results presented in Table 6 indicate the annual mean objective for NO_2 was predicted to be breached at only two of the chosen receptors within the AQMA, at Government Offices (Receptor 11) and 57 Gilesgate Roundabout (Receptor 24). As the Government Offices (Receptor 11) is not a residential location, it represents potential exposure to the short-term hourly objective rather than the annual mean objective. As discussed in Section 3.7.2, an annual mean concentration > 60 $\mu g/m^3$ indicates a potential breach of the short term hourly objective. According to Table 6 a maximum annual mean concentration (taking account of model error) of 55.8 $\mu g/m^3$ was predicted at this receptor and therefore does not indicate that this is an issue.

The model under predicted at some locations when compared to monitoring data. However, the addition of the RMSE calculated in Appendix D compensates for this effect, and is considered to be a cautious approach to identify possible areas of exceedence. The adjustment using the RMSE of the model identifies four further sensitive receptor locations that are at risk of exceeding the annual mean objective, located on Ravensworth Terrace (Receptor 23), the west end of Claypath (D42), Gilesgate roundabout (Receptor D20) and the Dragon Lane junction (Receptor D1).

Table 6: Predicted Annual Mean NO_2 Concentrations, 2011, $\mu g/m^3$

ID	Location	Type	Within AQMA?	Annual Mean NO_2	
				Modelled	Modelled Inc. RMSE
10	45 Highgate	SR	Y	31.4	36.7
11	Government Offices, Milburngate Bridge	SR (1 hr)[B]	Y	**50.4**	**55.8**
16	Durham University (Gilesgate Roundabout)	SR	Y	33.3	38.7
17	81 Gilesgate Hill	SR	Y	28.9	34.3
20	15 Marshall Terrace (Sunderland Road)	SR	Y	23.3	28.7
21	97 Claypath (Rear)	SR	Y	30.5	35.9
22	22 Leazes Court (Facing Leazes Road)	SR	Y	31.9	37.2
23	Ravensworth Terrace (Leazes Road)	SR	Y	36.3	**41.7**
24	57 Gilesgate (Gilesgate Roundabout)	SR	Y	**49.5**	**54.9**
25	5 Gilesgate (Gilesgate Roundabout)	SR	Y	27.4	32.8
26	150 Gilesgate	SR	Y	24.7	30.1
27	Green lane (Sunderland Road)	SR	Y	28.4	33.8
28	1 Young Street (Sunderland Road)	SR	Y	23.8	29.1
29	10 Sunderland Road	SR	Y	21.5	26.9
30	37 Sunderland Road	SR	Y	22.2	27.5
31	1 Sunderland Road	SR	Y	31.2	36.5
32	10 Sunderland Road	SR	Y	29.2	34.5
D1	Dragon Lane	Monitor	Y	36.1	**41.5**
D2	121 Gilesgate	Monitor	Y	32.4	37.8
D7	Highgate	Monitor	Y	30.9	36.3
D20	Gilesgate	Monitor	Y	37.6	**42.9**
D42	Claypath	Monitor	Y	37.6	**43.0**
D56	56 McKintosh court	Monitor	Y	21.9	27.3
D58	48 Sunderland Road	Monitor	Y	24.9	30.3
D60 [A]	AQMA Monitor Gilesgate	Monitor	Y	30.2	35.6

Note: Bold values indicates breaches of the annual mean objective. [A] Collocated tubes at the continuous monitoring site. [B] Location sensitive only to hourly objective.

5.2 Plotted Results

The plotted concentrations are provided in Appendix G.

According to Appendix G, Figure 14, exceedences of the annual mean NO_2 objective were predicted at a single property adjacent to the Framwellgate Roundabout, when taking into account the model error. Predicted exceedences extended eastwards along Milburngate and Leazes Road; however locations of relevant exposure, such as residential properties, are set back from these roads and therefore are not predicted to exceed the objective. The exception to this is are two properties behind the Bluecoat Buildings between Claypath and Leazes Road, and one residential property on Ravensworth Terrace facing Leazes Road (modelled as Receptor 23) where exceedences were anticipated.

Continuing eastwards, the AQMA extends along Gilesgate, where exceedences of the annual mean objective were predicted at residential properties near to the Gilesgate Roundabout. More specifically, the modelling predicted that six properties on the northern side of Gilesgate, nearest the roundabout, will exceed the annual mean objective. If the model error is taken into account, then a further 17 properties along the northern side of Gilesgate are at risk of exceeding the objective. Beyond this, the AQMA then extends along Sunderland Road, past Dragon Lane to where the residential properties cease making way for playing fields.

On Sunderland Road, at the junction with Sherburn road, and also along the length of Sherburn Road no exceedences of the annual mean objective at relevant exposure were predicted, even when taking into consideration the model error. This is consistent with the monitoring undertaken in this area (Receptor D21), which has consistently recorded annual mean concentrations below the objective.

A breach of the annual mean objective for NO_2 was predicted at junction of Sunderland Road and Dragon Lane, where a modelled concentration including the RMSE predicted a value similar to the monitored value of 41.9 $\mu g/m^3$. This is likely to be due to the high volume of cars slowing and accelerating at the traffic lights. The model is considered to slightly under-predict concentrations in this area when compared with the monitoring data, and so it is considered likely that breaches of the annual mean NO_2 objective are continuing to occur at the property opposite his junction.

5.2.1 Number of Properties above the Objective

Despite the extent of the AQMA the number of properties where exceedences of the annual mean objective was predicted to be experienced was relatively small. Modelling indicated that a total of six properties would experience concentrations above 40 $\mu g/m^3$, all of which are located on Gilesgate.

The number of properties increases to 28 if the model error is taken into account, with 23 properties located on Gilesgate, one on Leazes Road, one near the Framwellgate Roundabout and one at the Dragon Lane junction with Sunderland Road.

The list of properties where an exceedence has been identified is provided in Section 5.5.

5.2.2 Summary

As discussed in Section 1.1, an objective of the Further Assessment is to confirm the extent of the declared AQMA. As described above, an extensive section of the AQMA declared on Sunderland Road, eastwards of the junction with Sherburn Road was not predicted to exceed the annual mean objective. This is further supported by monitoring data recorded at diffusion tubes D45, D58, D56 and D57.

The monitoring and modelling predicts a breach of the annual mean objective at a discrete location at the eastern end of the AQMA at the junction of Dragon Lane and Sunderland Road.

5.3 Required Reduction to meet the Air Quality Objectives

The model predicted that the annual mean concentration of NO_2 may be breached at several locations within the AQMA. In order to achieve the annual mean NO_2 objective within the AQMA, it is necessary to reduce the NO_X emissions from pollutant sources that can be influenced by the Council, such as from vehicle emissions on roads in Durham.

Table 7 demonstrates the percentage decrease in Road-NO_X emissions that is required at the modelled sensitive receptor locations to achieve the annual mean NO_2 objective, (which is equivalent to approximately 51 $\mu g/m^3$ of NO_X). Only those receptors where exceedences were predicted are shown.

Taking account of the model error (RMSE) the required reduction in Road-NO_X emissions to meet the air quality objectives is calculated to be up to 98%. However, such a large decrease is predicted to be restricted to a very small area, including a small number of properties near the Gilesgate Roundabout, where queuing traffic occurs on a steep hill. Elsewhere, reductions of up to approximately 20-25%% would ensure no exceedences of the annual mean objective.

Table 7: Required Reduction to meet the Air Quality Objectives

ID	Location	Monitored Road-NO_X	Model Results		Model Results Including RMSE	
			Modelled Road-NO_X	Required Reduction in Road-NO_X Emissions	Modelled Road-NO_X	Required Reduction in Road-NO_X Emissions
23	Ravensworth Terrace (Leazes Road)	-	41.3	-	60.0	18%
24	57 Gilesgate (Gilesgate Roundabout	-	77.7	53%	100.4	98%
D1	Dragon Lane	55.8	40.8	-	59.4	17%
D20	Gilesgate	59.8	55.9	-	63.4	25%
D42	Claypath	44.8	44.4	-	63.5	25%

5.4 Source Apportionment

The source apportionment study is an essential aspect of the Further Assessment, as it determines the contribution due to emission sources that may be controlled or influenced by the Council.

5.4.1 Background Pollutant Concentrations

Background NO_X pollutant information cannot be determined directly from locally monitored NO_2 background data, and so the relative proportions were determined from the estimated background pollutant concentrations published by Defra, and discussed in Section 4.3.

The breakdown of the background source contributions are shown in Table 8.

The Primary and Minor roads may be directly influenced by the Council and clearly contribute the greatest proportion of the local background pollutant concentration, with 42% of the total contribution, of which 26% of the contribution is from within the AQMA and are represented by the modelled outputs. This leaves a contribution of 16% from Primary and Minor roads outside the study area that may also be directly influenced by the Council.

A further 29% of the total background contribution is due to Motorways, Trunk Roads, Industrial Sources and Domestic Sources, although these may not be so readily influenced by the Council.

Table 8: Background NO_X Source Apportionment

Component	Sources		Influence	2011 Annual Mean NO_X			
Regional Background	Rural, Rail, Aircraft		None	8.5 $\mu g/m^3$		30%	
Local Background	Motorway, Trunk Roads, Industry, Domestic		Limited	8.0 $\mu g/m^3$		29%	
Local Sources (LA Control)	Primary Roads, Minor Roads	inside AQMA	Principal sources for the local authority to control within the Action Plan	11.4 $\mu g/m^3$	42%	7.0 $\mu g/m^3$	26%
		outside AQMA				4.4 $\mu g/m^3$	16%
Total				27.9 $\mu g/m^3$			

5.4.2 Road Source Contribution

The contribution of the different road sources within and outside the AQMA are predicted to contribute approximately 26% and 16% of the total, as discussed in Section 5.4.1, above. The data in Table 9 show how the specific components of the road traffic contribute to the predicted concentrations at each receptor location.

The greatest contributing sources are cars, as may be expected given they represent the greatest proportion of the overall flow. LGVs are not a major component of the total traffic flow and are predicted to contribute relatively little. The combined emissions from HGVs and buses are predicted to contribute approximately the same proportion as cars, although this contribution is disproportionally significant as they typically represent <10% of the total traffic volume.

Overall, traffic is predicted to contribute approximately 40% to the total concentrations, although at the worst case location on Leazes Road (Receptor 24) this rises to approximately 70%, 40% being attributable to HGVs and buses.

Table 9: Contribution from Road Sources

ID	Location	Road Source Contribution Within AQMA					Total Road Contribution Outside AQMA
		Cars	LGV	HGV	Bus	Total	
10	45 Highgate	10%	0%	6%	5%	21%	32%
11	Government Offices, Milburngate Bridge	35%	1%	12%	12%	61%	16%
16	Durham University (Gilesgate Roundabout)	33%	1%	9%	10%	53%	6%
17	81 Gilesgate Hill	17%	1%	16%	8%	43%	7%
20	15 Marshall Terrace (Sunderland Road)	13%	2%	8%	1%	23%	6%
21	97 Claypath (Rear)	22%	0%	5%	7%	34%	14%
22	22 Leazes Court (Facing Leazes Road)	21%	0%	7%	8%	36%	19%
23	Ravensworth Terrace (Leazes Road)	34%	1%	9%	10%	54%	8%
24	57 Gilesgate (Gilesgate Roundabout)	26%	2%	26%	14%	69%	7%
25	5 Gilesgate (Gilesgate Roundabout)	15%	1%	13%	8%	38%	9%
26	150 Gilesgate	13%	1%	11%	7%	32%	7%
27	Green lane (Sunderland Road)	19%	3%	11%	2%	34%	10%
28	1 Young Street (Sunderland Road)	12%	1%	7%	2%	23%	8%
29	10 Sunderland Road	9%	1%	5%	1%	16%	6%
30	37 Sunderland Road	11%	1%	7%	0%	18%	5%
31	1 Sunderland Road	14%	2%	11%	2%	28%	24%
32	10 Sunderland Road	22%	3%	14%	2%	41%	5%
D1	Dragon Lane	21%	3%	16%	3%	42%	19%
D2	121 Gilesgate	24%	3%	22%	9%	57%	5%
D7	Highgate	13%	0%	7%	5%	25%	24%
D20	Gilesgate	26%	2%	24%	12%	64%	6%
D42	Claypath	29%	1%	8%	15%	52%	11%
D56	56 McKintosh court Durham56	10%	0%	6%	0%	16%	6%
D58	49 Sunderland Road Durham58	17%	2%	9%	1%	29%	5%
D60	AQMA Monitor Gilesgate Durham60	21%	2%	18%	8%	50%	6%
Average		19%	1%	11%	6%	38%	11%

Note: Vales are presented as percentage of the total concentration, including all sources.

5.4.3 Congestion/Queuing Contribution

There are several specific locations where traffic queues occur regularly within the City and are considered to represent a significant local emission source in addition to the free-flowing traffic emissions. As discussed in Section 3.6.1, these queuing sources were specifically included in the model.

The model predicted that the contribution from the queuing vehicles is generally not a significant source, except where it is directly adjacent to a receptor location. As discussed in Section 3.6.1, several areas within Durham are subject to congestion and queuing during busy periods, particularly on the approaches to several of the roundabouts in Durham, including the Gilesgate Roundabout and the Framwellgate Roundabout. Therefore, as expected the contribution from queuing vehicles was more significant at Receptors 10, 11 and D7, near the Framwellgate Roundabout and Receptor 24, near the Gilesgate Roundabout.

Table 10: Contribution from Congested Traffic

ID	Location	Queuing Contribution %
10	45 Highgate	19%
11	Government Offices, Milburngate Bridge	30%
16	Durham University (Gilesgate Roundabout)	2%
17	81 Gilesgate Hill	1%
20	15 Marshall Terrace (Sunderland Road)	0%
21	97 Claypath (Rear)	2%
22	22 Leazes Court (Facing Leazes Road)	1%
23	Ravensworth Terrace (Leazes Road)	1%
24	57 Gilesgate (Gilesgate Roundabout)	8%
25	5 Gilesgate (Gilesgate Roundabout)	3%
26	150 Gilesgate	2%
27	Green lane (Sunderland Road)	0%
28	1 Young Street (Sunderland Road)	1%
29	10 Sunderland Road	0%
30	37 Sunderland Road	0%
31	1 Sunderland Road	0%
32	10 Sunderland Road	0%
D2	121 Gilesgate	1%
D7	Highgate	18%
D1	Dragon Lane	0%
D20	Gilesgate	2%
D42	Claypath	3%
D56	56 McKintosh court Durham56	0%
D58	49 Sunderland Road Durham58	0%
D60	AQMA Monitor Gilesgate Durham60	1%
Average		4%

5.5 Summary

The annual mean concentration of NO_2 within the AQMA is predicted to continue to breach the objective, but only at a relatively small number of receptors. Specific locations of concern are the 23 properties on the northern side of GIlesgate, nearest the roundabout, where the steep hill and congestion is resulting in high concentrations. Other areas of concern are relevant exposure near the Framwellgate Roundabout, where a single property is anticipated to potentially exceed the objective, when the model error is taken into consideration. Two properties behind the Bluecoat Buildings between Claypath and Leazes Road and a single property at Ravensworth Terrace facing Leazes Road was predicted to experience concentrations above the objective, when the model error is accounted for, whilst a further single property is predicted to breach the annual mean objective at Dragon Lane. Despite the size of the AQMA, only 28 properties are considered to be at risk of exceeding the objective, taking account of the model error:

- No.44 Highgate, at corner of junction between Framwellgate Peth and Castle Chare
- Two properties behind the Bluecoat Buildings between Claypath and Leazes Road,
- No.1 Ravensworth Terrace facing Leazes Road
- No.57-78 Gilesgate
- No.4 Sunderland Road, opposite Dragon Lane

In contrast, annual mean concentrations within the AQMA were predicted to be below the annual mean objective on Sunderland Road, between the junction with Sherburn Road and as far as Dragon Lane. This is further supported by recent monitoring data.

One area outside the AQMA was identified as exceeding the annual mean objective. Claypath has previously been the subject of a Detailed Assessment, which concluded that the AQMA should extend to include several properties at the western end. The results of this modelling study confirm the findings of the 2011 Detailed Assessment (DCC, 2011).

With regard to the required reduction and source apportionment, the model predicted that the required reduction in NO_X at locations within the AQMA varies between approximately 10-90% to achieve the annual mean objective for NO_2 within the AQMA. The requirement for the greatest reductions are restricted to a very small area in the vicinity of the Gilesgate Roundabout; whereas elsewhere reductions of up to 20-25% should be sufficient to ensure that the air quality objectives will be achieved.

The Council have influence or control over approximately 40% of the total emission sources, with cars being the most significant single component. However, the contribution from buses and HGVs is similar to that from cars, despite comprising a significantly smaller proportion of the total flow. Therefore, reducing the emission from buses and HGVs will achieve the greatest benefits, although additional measures may still be required to achieve the required reduction in the direct vicinity of the Gilesgate roundabout.

6 Conclusions

A detailed air quality dispersion modelling assessment was undertaken to quantify and better understand air quality within the AQMA in the City of Durham. The results of the model were used to identify the extent of exceedences of the annual mean objective for NO_2.

The findings of the assessment can be summarised:

- The highest predicted concentrations of NO_2 were on Gilesgate, near the roundabout.
- Similarly high concentrations of NO_2 were predicted on Leazes Road and Millburngate, which are considered to contribute to high concentrations at the western end of Claypath.
- Concentrations were also predicted to exceed the annual mean objective at a property near the Framwellgate Roundabout and at the Dragon Lane junction with Sunderland Road, if model error is accounted for.
- Predicted concentrations of NO_2 are below the objective east of the junction between Gilesgate and Sherburn Road as far as Dragon Lane.
- The number of properties where exceedences of the annual mean objective were predicted to be experienced is relatively small. Modelling indicated that a total of six properties may experience concentrations above 40 µg/m^3, all of which are located on Gilesgate. However, the number of properties increases to 28 if the model error is taken into account, with 23 properties located on Gilesgate, three on Leazes Road, one near the Framwellgate Roundabout and one at Dragon Lane

The source apportionment study concluded:

- The required reduction in NO_X necessary to achieve the annual mean objective at the most significantly impacts locations may be as high as approximately 90%. However, the greatest reductions are restricted to a very small area in the vicinity of the Gilesgate Roundabout; elsewhere reductions of up to 20-25% should be sufficient to ensure that the air quality objectives will be met.
- The Council has direct influence or control over approximately 40% of the total emission sources that affect concentrations within the AQMA.
- Cars contribute to a similar extent as HGVs and buses combined, although there is significant variation from receptor to receptor.

6.1 Recommendations

6.1.1 AQMA

Exceedences of the annual mean NO_2 objective are predicted to occur at locations within the AQMA, mainly at the western end of Gilesgate. Exceedences may also occur at a small number of properties near Framwellgate Roundabout and Leazes Road.

However, the eastern parts of the AQMA, on Sunderland Road to the east of the junction with Sherburn Road, are predicted to fall below the annual mean objective. It is recommended that monitoring should continue in this area until a full 12 month dataset has been recorded. If no further breaches are identified, these monitoring locations may be closed.

A breach at one property opposite the junction of Sunderland Road and Dragon Lane has been verified by the model and monitoring data. Whilst this is a single discrete location, it is clearly an ongoing concern and should be retained within the AQMA.

Outside the AQMA, the modelling study also identified two properties on Claypath, near the junction with Milburngate, which exceeded the objective. This area was the subject of a Detailed Assessment undertaken in 2011, which recommended that the AQMA is extended to cover the western part of Claypath. Another area where exceedences were predicted was on New Elvet; however, the area of exceedence did not include any sensitive receptors (this area was also the subject of a Detailed Assessment in 2011). The area to the west of the AQMA is the subject of a Detailed Assessment due early 2013; therefore recommendations regarding the extent of the AQMA to the west will be made in this Detailed Assessment.

In summary, the existing AQMA should be retained, but amended to remove the eastern section beyond Sherburn Road. Extension of the AQMA to include the area to the west of the AQMA should be undertaken subject to the forth Detailed Assessment due early 2013.

6.1.2 Action Planning

The source apportionment study has determined that cars are the single most significant emission source, although buses and HGVs contribute a similar but disproportionally significant amount. Therefore, reducing emissions from buses and HGVs should be a specific target of the AQAP.

However, alternative measures should be considered to reduce concentrations at the worst case areas, such as the Gilesgate roundabout.

7 References

Air Quality Framework Directive (96/62/EC).

COMEAP (1998). The Quantification of the Effects of Air Pollution on Health in the United Kingdom.

Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.

Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe.

Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

Defra (2009). Local Air Quality Management Technical Guidance LAQM.TG(09)

Defra (2010) The Air Quality Standards Regulations 2010 Statutory Instrument 2010 No. 64

Defra (2011a). http://laqm1.defra.gov.uk/review/tools/background-maps-info.php?year=2008

Defra (2011b). http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php

Defra (2012) Emission Factors Toolkit for Vehicle Emissions http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft

Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air.

Directive 2002/3/EC relating to ozone in ambient air.

Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

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.

Durham County Council (2011) Progress Report

Durham County Council (2011) Durham County Council: Detailed Assessment of Air Quality 2011 - New Elvet, Hallgarth and Church Street

Durham County Council (2011) Durham County Council: Detailed Assessment of Air Quality 2011 - Claypath

Durham County Council (2012) Updating and Screening Assessment

Kings College London (2011) Trends in NO_x and NO_2 Emissions and Ambient Measurements in the UK

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