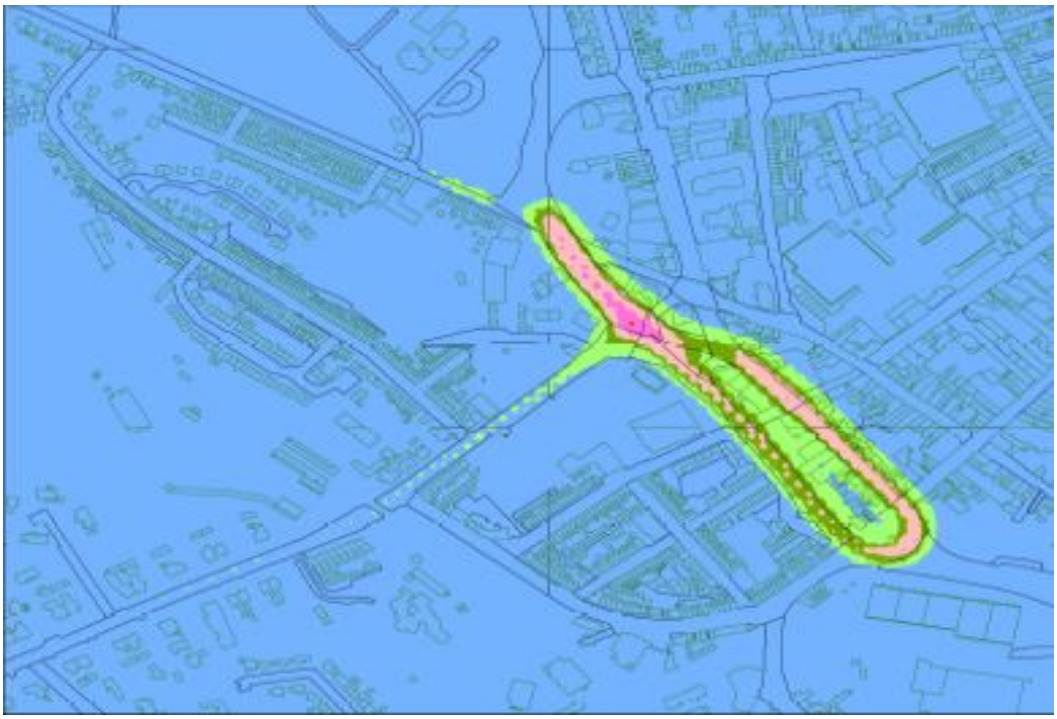
2011 Air Quality Progress Report for *Ballymena Borough Council*

In fulfillment of the Environment (Northern Ireland) Order 2002 –
Local Air Quality Management



Local Authority Officer	Sinead Sargent Senior Environmental Health Officer

Department	Environmental Health Department
Address	Ballymena Borough Council Ardeevin 80 Galgorm Road Ballymena BT42 1AB
Telephone	028 2566 0431
e-mail	sinead.sargent@ballymena.gov.uk

Report Reference number	BBC/PR/04/11
Date	June 2011

Executive Summary

The 2011 Progress Report prepared for Ballymena Borough Council has concluded the following:

Conclusions from New Monitoring Data

- **Nitrogen Dioxide**

Automatic Monitoring Data

The mean nitrogen dioxide concentrations for the period 1 January 2010 to 31 December 2010 at the North Road site was 32 μgm^{-3} therefore below the Annual Mean Air Quality Objective of 40 μgm^{-3}. Two exceedences occurred of the hourly mean, 202μgm^{-3} exceeded the Hourly mean objective of 200 μgm^{-3}. There was no exceedence of the Daily mean objective.

In summary during the 2010 monitoring period there was no exceedences of the daily or the annual mean, with two marginal exceedences of the hourly mean, for nitrogen dioxide automatic monitoring data.

Diffusion Tube Monitoring

UWE Bias adjustment figure:

An exceedence of the nitrogen dioxide annual mean was noted at Linenhall Street. Additionally the George St location was marginally below the annual mean objective. Both these locations are within the AQMA for nitrogen dioxide and as such will remain under focus.

Local Bias Adjustment figure:

On using the locally derived figure in addition to the above locations, a further two locations which fall outside the AQMA for nitrogen dioxide, exceeded the annual mean objective. In addition a third location is marginally under the annual mean objective. All three of these locations were considered in the further assessment for nitrogen dioxide, undertaken by AEA on behalf of Ballymena Borough Council, completed in February 2011.

On balance and consideration of Box 3.3 of the technical guidance, in making a choice of bias adjustment factor (locally derived versus national database) for use the **nationally** derived factor is chosen. Reasons for choice include;

1. Tube exposure is monthly
2. Data capture for the automatic site was 83.6% and is not an AURN site.

3. Tubes on monitoring station are in a 'open' environment, those tubes in the AQMA are in a 'canyon', thus better to use the results from a variety of studies.
4. Diffusion tube study was over one year.
5. Study was based on 41 sites using Gradko tubes.

In using the UWE bias adjustment figure, this means our diffusion tubes have over read. Please note as a precaution the locally derived figure was not discounted and the three additional locations were re-considered in the further assessment.

- **PM_{10} and Sulphur Dioxide**

During the 2010 monitoring period there was no exceedences of the 15- minute, hourly, daily or the annual means. A detailed assessment was undertaken with a view to revocation of the Ballykeel and Dunclug AQMAs. This study was completed in early 2011 with a conclusion to revoke Dunclug AQMA, but to retain the Ballykeel AQMA.

Conclusions relating to New Local Developments

There are no new local developments that will require more detailed consideration in the next Updating and Screening Assessment in 2012.

Other Conclusions

Planning application consultations will continue to be assessed with regard to potential impact on local air quality.

Proposed Actions

Proposed actions are detailed in the following table;

Action	**Date**
Consultation and action planning in respect of the declared AQMA for nitrogen dioxide.	Continuing
Revocation of the Dunclug AQMA	September 2011
Review Ballykeel AQMA after benefit of Winter 2011/12 data and completion on on-going fuel switching.	April 2012
Submit 2012 Update and Screening Report	April 2012

Table of contents

Appendices

List of Tables

List of Figures

1 Introduction

1.1 Description of Local Authority Area

Ballymena Borough has a population of approximately 60,000. The borough is approximately 200 square miles, of a mixed urban and rural character, located in the centre of a prosperous farming region. The Borough has a central location within Northern Ireland with good roads and rail communication network. It is served by the M2 motorway and with a station on the Belfast to Londonderry rail-line.

The International Airport itself is only 18 miles away and the Belfast City Airport is 30 miles from Ballymena. It is also accessible to the seaports of Larne and Belfast, 20 and 27 miles respectively.

The Antrim Coast and Giants Causeway bound it to the north, to the east by Slemish Mountain, to the west the river Bann, and to the south by Lough Neagh. The figure below illustrates the positioning of both Ballymena Town and the surrounding villages.

Figure 1.1 Showing the location of Ballymena Town and surrounding villages.

Local conditions that have a bearing on air quality include:

- Good transport infrastructure
- High levels of owner occupied housing/good quality housing
- Strong manufacturing base
- Above average reliance on agriculture, retail/distribution and public sectors in comparison to Northern Ireland overall.

1.2 Purpose of Progress Report

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in Northern Ireland** are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003, no. 342, and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre $\mu g/m^3$ (milligrams per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Northern Ireland.

Pollutant	Concentration	Measured as	Date to be achieved by
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	3.25 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

First stage review and assessment (2000/01)

A First Stage Review and assessment of local air quality in Ballymena had highlighted the need to progress to second stage for:

- SO_2 and PM_{10} for domestic fuel burning
- PM_{10} and NO_2 for traffic data
- SO2 from Two Industrial point sources, i.e. plant burning over 5 MW

Second stage review and assessment (2003/04)

A Second Stage Review and assessment concluded the following:

- NO_2 and PM_{10} from Road Traffic

Further DMRB modelling in February 2004 using 2002-04 monitoring data and 2003 road traffic counts confirmed that there was no need to declare an AQMA due to Road Traffic sources for either NO_2 or PM_{10} as these would not exceed objectives in 2004/05.

- SO_2 and PM_{10} from Domestic Fuel Burning

Commenced monitoring of SO_2 by means of Real Time Analyser in August 2002 within the worse case square, Ballykeel in relation to domestic fuel combustion.

Relocation of two existing smoke and sulphur dioxide bubblers in 2002 to more appropriate locations within residential coal burning areas, namely Ballykeel and Dunclug.

Commenced monitoring of SO_2 by Diffusion Tubes in residential areas (10).

Modelling undertook in 2003/04 in respect of domestic fuel combustion for 6 areas of concern. This modelling has concluded that an AQMA be declared in respect of PM_{10} for two areas of concern, broadly named Ballykeel and Dunclug. However further investigative work was required.

- SO_2 and PM_{10} from Industrial Point Sources

GSS Modelling for two industrial plants confirmed that SO_2 and PM_{10} objectives would not be exceeded in 2004.

Third stage review and assessment (2004)

The outcome of domestic fuel combustion modelling resulted in declaration of two AQMAs broadly named Dunclug and Ballykeel in respect of predicted exceedence on PM^{10}. Ballymena Borough Council proceeded to declare two AQMA's in respect of

PM10 on 25th October 2004. A copy of the AQMA Order together with maps is shown in Appendix One.

The department's technical guidance stresses the importance of verifying the dispersion modelling by conducting local monitoring. Therefore a decision to co-locate a PM_{10} Real Time analyser with our existing SO_2 Real Time analyser within the Ballykeel AQMA was implemented in December 2004.

Stage Four Review and Assessment (2004/05).

With updated fuel use data obtained in late 2004 NETCEN were commissioned to conduct a Stage 4 Air Quality Review for domestic emissions sources within both AQMA'S. Importantly at this stage NIHE had embarked on a fuel conversion scheme with the Dunclug AQMA. Fresh data in respect of both areas was incorporated into the study. The report dated September 2005 assessed current and potential future PM_{10} and SO_2 concentrations as a result of domestic fuel combustion emissions in two grids Ballykeel and Dunclug.

It should be noted that the modelling methodology used in the Stage 4 assessment differed from that used in the Stage 3 assessment. Until model verification with local monitoring data can be undertaken these model results are not finalised. This Stage 4 study represents a more accurate modelling exercise using more up to date information than the previous stage 3 modelling.

The conclusions of this report were:

- Particulate Matter (PM_{10} gravimetric)

Detailed modelling has shown that PM_{10} emissions arising from domestic fuel combustion in Ballymena Borough Council was predicted to cause an exceedence of the daily PM_{10} objective at relevant receptors within the assessed areas, specifically Ballykeel.

- Sulphur dioxide (SO_2)

Detailed modelling has shown that SO_2 emissions arising from domestic fuel combustion in Ballymena Borough Council were not predicted to cause an exceedence of the air quality objectives at relevant receptors within the assessed areas.

The modelling had predicted an exceedance of the regulated objectives. The designation of an AQMA remained valid subject to verification of the modelling using local monitoring data. Continuous monitoring of SO_2 was already in place to capture data for the purpose of verification and PM_{10} monitoring was introduced in December 2005.

The modelling has also predicted an exceedance of the provisional PM_{10} annual objective in 2010 in Ballykeel.

Update and Screening Assessment (April 2006)

The purpose of the update and screening assessment (USA) report was to reconsider all seven pollutants screened at first stage accounting for new or changed circumstances which may influence air quality. There are two key findings within the report:

Firstly, detailed assessment to particulate matter in relation to domestic coal burning within the two AQMA's should continue, with a verification study required as sufficient data was now available.

Secondly, in respect of nitrogen dioxide from traffic, a co-location study which was being undertaken using diffusion tubes and our real time analyser, indicated further investigative work is required regarding bias adjustment to diffusion tube data.

The conclusions of this report in respect of all pollutants were as follows;

Pollutant	Detailed Assessment Required
Carbon Monoxide	Yes/No
Benzene	Yes/No
1,3 Butadiene	Yes/No
Lead	Yes/No
Nitrogen Dioxide	Yes/No. However the diffusion tube co-location study remains under review.
Sulphur Dioxide	Yes/No
Particulate Matter	Detailed assessment continues, with the preparation of an action plan.

Progress Report (2007)

The main sources of pollutants in the Ballymena Borough continue to be nitrogen dioxide from road traffic and sulphur dioxide / particulate matter from domestic sources. Nitrogen dioxide, sulphur dioxide and particulate matter will continue to be monitored in key locations, with update to the department provided with reference to the objectives of relevance.

- Nitrogen Dioxide

The 2006 annual average concentrations for the passive nitrogen dioxide monitoring sites at Galgorm Road and Queen Street are above the Annual Mean Air Quality Objective of 40 μgm^{-3} with the application of a **local** (2.07) bias adjustment factor. In using the **national** (1.33) bias adjustment factor all sites remain below the 40 μgm^{-3} objective. In 2005 using a local bias adjustment (1.51) Galgorm Road was under the objective at 36.7 μgm^{-3}, however Queen Street was in exceedence of the objective at 45.7 μgm^{-3}. Importantly in 2005 using a national bias adjustment no site was in exceedence of this objective.

There has been some doubt as to diffusion tube precision used during 2006. Efforts have been made to address this issue, this includes renewing our diffusion tube

contract with an alternative service provider. The contract commenced 1st October 2007. It is proposed to review the matter at the earliest opportunity when sufficient diffusion tube data becomes available and provide an update within the next progress report due April 2008.

- Sulphur Dioxide and Particulate Matter (PM_{10})

The mean 2006 concentrations for both SO_2 and PM_{10} are below the annual air quality objectives for both these pollutants.

The Council has relocated the Ballykeel AQMS to a best-fit location within the Ballykeel AQMA. Once sufficient monitoring data becomes available consideration will be given to the revocation of the Dunclug AQMA and either revocation / amendment of the Ballykeel AQMA.

Progress Report (2008).

The main sources of pollutants in the Ballymena Borough continue to be nitrogen dioxide from road traffic and sulphur dioxide / particulate matter from domestic sources. Nitrogen dioxide, sulphur dioxide and particulate matter will continue to be monitored in key locations, with update to the department provided with reference to the objectives of relevance.

- Nitrogen Dioxide

In using the **national** (1.06 Lambeth) bias adjustment factor all sites remain below the 40 μgm^{-3} objective, however the Gradko bias adjusted (0.89) levels show Linenhall Street and George Street are in exceedence. Four other sites are close to the 40 μgm^{-3} objective. Of these six sites two are not considered relevant as there are no residential properties in these locations, i.e.

- George Street
- Ballymoney Street

For the other four sites it is this departments intention to undertaken further detailed assessment to determine whether declaration of an AQMA(s) is necessary

- Sulphur Dioxide and Particulate Matter (PM_{10})

The mean 2007 concentrations for both SO_2 and PM_{10} are below the annual air quality objectives for both these pollutants.

The Council had relocated the Ballykeel AQMS to a best-fit location within the Ballykeel AQMA and will continue to monitor SO_2 and PM_{10} in this area. FDMS upgrade to the Ballykeel analyser is currently operating and once sufficient monitoring data comparable with that produced within the DEFRA National Network becomes available consideration will be given to either revocation / amendment of the Ballykeel AQMA as required.

It is likely that in light of the re-verification modelling in relation to the 2006 Updating and Screening Assessment that the AQMA for Dunclug will be revoked in 2008.

Update and Screening Report (2009)

The update screening and assessment findings are summarised as follows;

- **Conclusions from New Monitoring Data**

There are two significant conclusions from new monitoring data which support ongoing work since the last round of update and screening, these are;

1. Revocation of the Ballykeel and Dunclug AQMAs.

In October 2004 Ballymena Borough Council declared two Air Quality Management Areas broadly termed Ballykeel and Dunclug. Both AQMAs were designated in relation to likely exceedences of PM10 (annual and daily mean) objectives as specified by the air quality regulations. Source apportionment showed these exceedences were due to domestic coal burning.

The Air Quality Regulations state that PM10 gravimetric concentration as a daily average of 50ug/m^3 should not be exceeded more than 35 times per annum, in addition a target annual mean of 40ug/m^3 should be achieved. Local monitoring in 2008 has shown these objectives are being achieved even within the worst case contour for which the conversion to gas will not be completed until 2011. The major contributor to this improvement in air quality being that over 50% of NIHE housing stock has been converted to natural gas there has been a positive impact even on this worst case contour. In addition it is hoped that fuel efficiency work undertaken by this department has also had a beneficiary impact, including owner occupiers available of various grant aided schemes through sign posting by this department.

2. Declaration of an AQMA in the Linenhall / George Street Area.

A detailed assessment has just been completed by AEA technology on behalf of Ballymena Borough Council (April 2009). This concluded an air quality management area be designated in the Linenhall / George Street area due to modelled nitrogen concentrations along Linenhall and George Street above the objective of 40 ug/m3. This is reflected in the nitrogen dioxide diffusion tube monitoring results.

- **Conclusions from Assessment of Sources**

The assessment of sources has not highlighted any new areas of concern.

- **Proposed Actions**

The Updating and Screening Assessment has not identified the need to proceed to a Detailed Assessment for any new pollutant. As discussed above a detailed assessment has just been completed by AEA technology on behalf of Ballymena Borough Council (April 2009). This concluded an air quality management area be designated in the Linenhall / George Street area due to modelled nitrogen concentrations along Linenhall and George Street above the objective of 40 ug/m3. This report is currently with assessors for validation and approval to proceed with a declaration for an AQMA, as described above.

The Updating and Screening Assessment has not identified any need for additional monitoring, or changes to the existing monitoring programme mainly because there as been a continual review of same since 2006, in particular regarding domestic fuel burning and road traffic sources.

There are changes required to existing Ballykeel and Dunclug AQMAs by way of revocation. The air quality objectives within both areas are now being achieved due to substantial fuel conversion work undertaken by the NIHE since the declaration of these areas. This matter is with the devolved administration for approval. It is not proposed to proceed to a Detailed Assessment due to the number of fuel burning sources that have been removed and local monitoring data.

Next course of action;

- To declare an AQMA along the Linenhall Street / George Street area (subject to approval) due to modelled nitrogen concentrations above the objective of 40 ug/m3. Then to proceed with Action Planning as required.
- To revoke both Ballykeel and Dunclug AQMAs (subject to approval) as local monitoring has shown PM_{10} objectives are being achieved
- Submit 2010 Progress Report.

Progress Report 2010

The 2010 progress Report highlighted the following actions were necessary.

A further assessment for nitrogen dioxide should be undertaken to review the recently declared AQMA, including scenarios with a view to action planning.

A detailed assessment with a view to revocation of the AQMAs in Dunclug and Ballykeel should be undertaken.

Planning application consultations should continue to be assessed with regard to potential impact on local air quality.

1.5 Progress since Progress Report (2010)

The following works has been undertaken to progress Air Quality within the Borough since the 2010 progress Report:

A further assessment for nitrogen dioxide was undertaken to review the recently declared AQMA, including scenarios with a view to action planning.

A detailed assessment with a view to revocation of the AQMAs in Dunclug and Ballykeel was also undertaken.

Planning application consultations continued to be assessed with regard to potential impact on local air quality.

Further detailed in provided within the main body of this report.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

There are three continuous analysers currently in operation, at two locations. All sites were in operation at the last round of update and screening in 2010. Details of monitoring are as follows:-

(1) Sulphur dioxide continuous analyser at Ballykeel
(2) Particulate matter (with FDMS) continuous analyser at Ballykeel
(3) Nitrogen dioxide continuous analyser at North Road

All continuous monitoring stations are part of the Calibration Club managed by AEA. Data from these sites are quality assured to the AURN standards as part of the Calibration Club. In addition a QA/QC audit which includes calibration of the analysers using zero and span gas standards, and other tests for efficiency is undertaken by AEA. Data are fully ratified by AEA staff using procedures as applied to data from the AURN UK national monitoring network sites.

Further information regarding Quality Assurance/Quality Control for Automatic Continuous Analysers is detailed in Appendix Two.

Figure 2.1 Details of Automatic Monitoring Sites

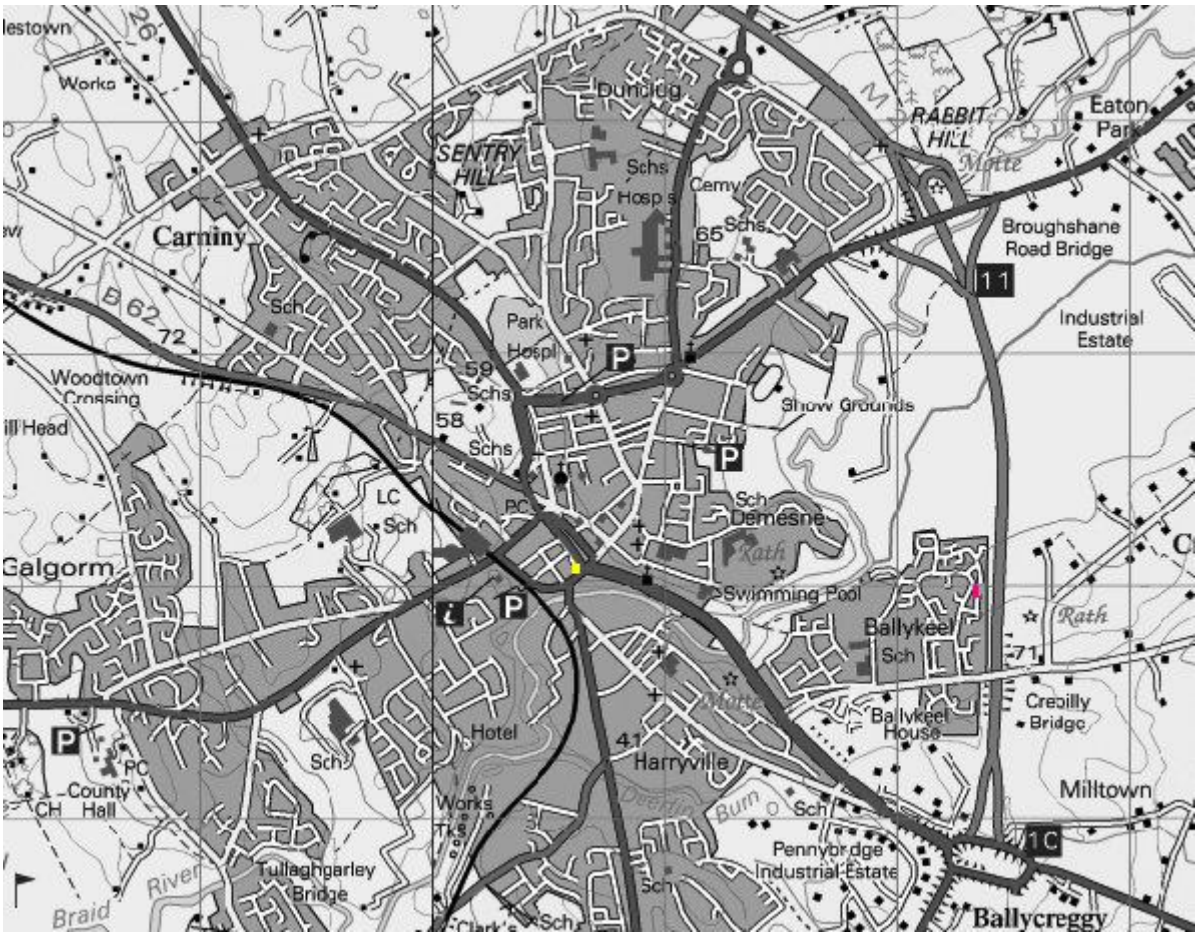
Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
Ballykeel	AQMA	402600 N 311900 E	SO_2, PM_{10}	Y	Y	N/A	Y
North Road	Roadside	310636N 403072 E	NO, NOx, NO_2	N	Y	2m	N*

*As preferred worst-case location not an option due to a narrow footpath, the second preferred worst-case location was chosen. This location is currently being reviewed.

Figure 2.2 Showing photograph of Ballykeel Automatic Analyser

Figure 2.3 Showing photograph of North Road Automatic Analyser

Figure 2.4 Showing location map of Ballykeel and North Road Automatic Analysers



Ballykeel Site

North Road Site

2.1.2 Non-Automatic Monitoring

Ballymena Borough Council operates a network of nitrogen dioxide diffusion tubes across the borough. The diffusion tubes are exposed for a four-week period. In 2010 the diffusion tubes were analysed by Gradko Environmental. The locations of the diffusion tubes in the assessed areas are listed in Table 2.2 also shown in Figures 2.5. In addition, diffusion tubes were collocated with the North Road monitoring site (diffusion tubes 14a, 14b and 14c) in 2010. The location of the monitoring station also represents the location of the co-located diffusion tubes in Figure 2.5.

Table 2.2 Details of Non- Automatic Monitoring Sites – NOx Diffusion Tubes

Site No. & Name	Site Type	OS Grid Ref (Easting, Northing)	Pollutants Monitored	In AQMA?	Relevant Exposure?	Worst-case Location?
1. Leighinmohr Ave	UB	310220 402580	NO_x	N	Y	Y
2 Galgorm Rd	K	310335 403195	NO_x	N	Y	Y
3 Main St C'Backey	K	305730 405730	NO_x	N	Y	Y
4 Cullybackey Rd	K	310346 403442	NO_x	N	Y	Y
5 Larne St	K	310680 402850	NO_x	N	Y	Y
6 Ballyloughan Ave	UB	309530 404480	NO_x	N	Y	Y
7 George St	K	310591 403229	NO_x	N	Y	Y
8 Wellington St	K	310810 403420	NO_x	N	Y	Y
9 Ballymoney St	K	310800 403570	NO_x	N	Y	Y
10 Parkway	K	310900 403920	NO_x	N	Y	Y
11 Lisnevenagh Rd	R	311900 497010	NO_x	N	Y	Y
12 Queen St	K	310744 402213	NO_x	N	Y	Y
14a/b/c North Rd	R	310636 403072	NO_x	N	Y	Y
15 Linenhall St	K	310684 403121	NO_x	N	Y	Y

UB = urban background
K = kerbside
R = Roadside

Figure 2.5 Location Map showing NOx monitoring site locations.

Gradko laboratory overall precision in accordance Para 3.23 in TG (09) has been assessed as 'Good' (in 38 of 41 studies). The following web link verifies this. **http://laqm.defra.gov.uk/documents/Tube_Precision2010_v06_11.pdf** A summary of Gradko performance is in Appendix 5

A database of bias adjustment factors determined from Local Authority co-location studies throughout the UK has been collated by the Local Air Quality Management Helpdesk. Using orthogonal regression combined bias adjustment factors have been calculated for each laboratory, year and preparation method combination for which data are available.

Bias adjustment for Gradko with 20% TEA in water has been calculated using the spreadsheet tool and is shown in Appendix 4. A bias adjustment factor of 0.92 was calculated from this diffusion tube spreadsheet tool http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html which used 41 studies from Gradko Services using 20% TEA in water for 2010.

A local co-location study was carried out by exposing triplicate tubes at the location of the automatic station in North Road. A bias adjustment factor of 1.1 was calculated from the diffusion tubes co-located with the North Road site. This was done using the AEA Energy and Environments "Spreadsheet for Checking Precision and Accuracy of Triplicate Tubes'', utilizing both passive and automatic monitoring data for the North Road Site.

Both bias adjustment factors calculated from these two studies were applied to the raw diffusion tube data from the survey, for annual 2010 annual average at each location. This is shown in the following section. Appendix three shows how the local bias adjustment figure was derived.

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

An air quality management was declared in March 2010 in the Linenhall / George Street area due to modelled nitrogen dioxide exceedences of the objective of 40ug/m3.

Automatic Monitoring Data

During the 2010 monitoring period there was no exceedences of the daily or the annual mean, however the hourly mean was exceeded on two occasions, as shown in the table below.

Table 2.3 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

BALLYMENA NORTH ROAD
01 January to 31 December 2010

These data have been fully ratified by AEA

POLLUTANT	NO_X	NO	NO_2
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	7326
Maximum 15-minute mean	1331 µg m^{-3}	699 µg m^{-3}	338 µg m^{-3}
Maximum hourly mean	1010 µg m^{-3}	530 µg m^{-3}	202 µg m^{-3}
Maximum running 8-hour mean	691 µg m^{-3}	350 µg m^{-3}	156 µg m^{-3}
Maximum running 24-hour mean	477 µg m^{-3}	229 µg m^{-3}	127 µg m^{-3}
Maximum daily mean	470 µg m^{-3}	225 µg m^{-3}	126 µg m^{-3}
99.8th percentile of hourly means	-	-	166 µg m^{-3}
Average	72 µg m^{-3}	26 µg m^{-3}	32 µg m^{-3}
Data capture	83.6 %	83.6 %	83.6 %

All gaseous pollutant mass units are at 20'C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	2	2

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

The mean nitrogen dioxide concentrations for the period 1 January 2010 to 31 December 2010 at the North Road site was 32 μgm^{-3} therefore below the Annual Mean Air Quality Objective of 40 μgm^{-3}. Further two marginal exceedences occurred of the hourly mean, 202μgm^{-3} , the Hourly mean objective being 200 μgm^{-3}. There was no exceedence of the Daily mean objective, with the maximum daily mean of 126. μgm^{-3}. (Air Quality Regulations (Northern Ireland) 2003)

Diffusion Tube Monitoring Data

Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes

Site No. & Name	Site Type	Unadjusted annual mean*	Corrected with UK bias adjustment figure for Gradko 20% TEA (0.92)	Corrected with local bias adjustment figure (1.1)
			Annual mean*	Annual mean*
1. Leighinmohr Ave	UB	14.13	13	15.54
2 Galgorm Rd	**K**	**37**	**34.04**	**40.7**
3 Main St C'Backey	K	26.7	24.56	
4 Cullybackey Rd	**K**	**34.5**	**31.74**	**37.95**
5 Henry Street	K	31.4	28.89	34.54
6 Ballyloughan Ave	UB	15.7	14.44	17.27
7 George St	**K**	**43.3**	**39.84**	**47.63**
8 Wellington St	K	29.9	27.5	32.89
9 Ballymoney St	K	33.7	31	37.07
10 Parkway	K	32.8	30.18	36.08
11 Lisnevenagh Rd	R	30	27.6	33
12 Queen St	**K**	**40.2**	**36.98**	**44.22**
14a/b/c North Rd	R	30.1	27.69	33.11
15 Linenhall St	**K**	**63.2**	**58.14**	**69.52**

*** Indicates nitrogen dioxide concentration in ug/m3**
Yellow shading indicates an exceedence of annual objective.

National Bias adjustment figure:

It can be seen from the above table that exceedences of the nitrogen dioxide annual mean remains at location 15 (highlighted in yellow), namely Linenhall Street. In addition the value at George Street is marginally below the annual objective. Both these locations are within the declared AQMA for nitrogen dioxide.

Local Bias Adjustment figure:

On using the locally derived figure in addition to locations 7 and 15, a further two locations 2 and 12, Galgorm Road and Queen Street respectively (also highlighted in yellow), which fall outside the AQMA for nitrogen dioxide, exceed the annual mean objective. In addition a third location 4, at Cullybackey Road, is close to breaching the annual objective. All three of these locations were considered in the Detailed Assessment in 2009 and the Further Assessment of Nitrogen Dioxide in 2010. Both studies were undertaken by AEA on behalf of Ballymena Borough Council.

On consideration of Box 3.3 of the technical guidance, in making a choice of bias adjustment factor (locally derived versus national database) for use the nationally derived factor is chosen. Reasons for choice include;

1. Tube exposure is monthly
2. Data capture for the automatic site was 83.6% and is not an AURN site.
3. Tubes on monitoring station are in an ‘open’ environment, those tubes in the AQMA are in a ‘canyon’, thus better to use the results from a variety of studies.
4. Diffusion tube study was over one year.
5. Study was based on 41 sites using Gradko tubes.

However in using the UWE bias adjustment figure, this means our diffusion tubes have over read. However, as a precautionary note, the three additional locations were re-considered in the further assessment.

Further Assessment of Nitrogen Dioxide in 2011.

In the Further Assessment concentrations of NO2 have been assessed in and around the Linenhall Street AQMA and North Road through the town of Ballymena for the period 01 January 2009 to 31 December 2009. A combination of available monitoring data and a dispersion modelling techniques using ADMS-Roads were used throughout the study. The study took account of traffic conditions in each area and meteorological data available for the specified study period.

The study has confirmed the findings of the previous Detailed Assessment for Ballymena, namely that there are exceedences of the annual mean NO2 objective where relevant exposure exists in the study area.

Within the Linenhall Street study area it is estimated that approximately two properties lie within the area of exceedance equating to an exposed population of 5.

It is estimated that ambient NOx reductions for Linenhall Street of some 43.7% are required in order to achieve compliance with the annual mean NO2 objective. Projection of NO2 concentrations for the worst case receptor (Receptor 4) to future years indicates that NO2 concentrations may not be in compliance with the objective in the AQMA by 2015 though this prediction is treated with some caution.

In the study area source apportionment indicates that the primary source of emissions is derived from local moving traffic, although queuing vehicles are also particularly important near traffic lights. Heavy vehicles are thought to be the main source type although important contributions are also noted from other light vehicles.

Modelling of the mitigation scenarios indicate that significant NO2 reductions are achievable if any of the schemes described were to proceed. Removing all exceedances would obviously depend on the package of measures chosen but the Linenhall Street study provides evidence that the combination of removing a proportion of HDVs has capability to deliver the air quality improvements required to achieve the NO2 annual mean objective.

The monitoring and dispersion modelling demonstrate that any AQMA boundary encompasses Receptor 4 and 5, and any additional residential buildings that lie in the immediate vicinity. The assessment confirms that although conservative, the existing AQMA boundary is appropriate for the monitored and modelled exceedances of NO2 along Linenhall Street.

Appendix seven shows the contour plate from the further assessment study.

Appendix eight describes the scenarios for action planning.

2.2.2 PM_{10} and Sulphur Dioxide

PM_{10}

During 2010 the PM10 data capture at the Ballykeel site was 31.7%. The 90th percentile is 50 µgm-3 which indicates the monitoring station was likely to exceed the daily mean objective for PM10 (50µgm^{-3} not to be exceeded more than 35 times a year), as there was 11 exceedences within the data captured. The data loss was due to a combination of both logger faults between 28/1/2010-24/3/2010 and instrument faults caused by a faulty drier between 1/3/2010 until its replacement on the 14/9/2010. The annual mean of 24µgm^{-3} was well below the annual objective of 40µgm^{-3}

Sulphur Dioxide.

During the 2010 monitoring period there was no exceedences of the 15- minute, hourly, daily or the annual means, as appropriate and as shown in the table below.

Table 2.5 Results of PM_{10} and Sulphur Dioxide Automatic Monitoring: Comparison with Annual Mean 15-minute, hourly and 24-hour Mean Objectives.

BALLYMENA BALLYKEEL
01 January to 31 December 2010

These data have been fully ratified by AEA

POLLUTANT	PM_{10}*+
Number Very High	0
Number High	21
Number Moderate	38
Number Low	2707
Maximum 15-minute mean	241 µg m^{-3}
Maximum hourly mean	241 µg m^{-3}
Maximum running 8-hour mean	159 µg m^{-3}
Maximum running 24-hour mean	112 µg m^{-3}
Maximum daily mean	107 µg m^{-3}
90th percentile of daily means	50 µg m^{-3}
Average	24 µg m^{-3}
Data capture	31.7 %

+ PM_{10} as measured by a FDMS
All gaseous pollutant mass units are at 20'C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	11	11
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 40 µg m^{-3}	0	-

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

BALLYMENA BALLYKEEL
01 January to 31 December 2010

These data have been fully ratified by AEA

POLLUTANT	SO_2
Number Very High	0
Number High	0
Number Moderate	0
Number Low	30822
Maximum 15-minute mean	120 µg m^{-3}
Maximum hourly mean	77 µg m^{-3}
Maximum running 8-hour mean	57 µg m^{-3}
Maximum running 24-hour mean	34 µg m^{-3}
Maximum daily mean	30 µg m^{-3}
Average	6 µg m^{-3}
Data capture	89.9 %

All gaseous pollutant mass units are at 20'C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
Sulphur Dioxide	15-minute mean > 266 µg m^{-3}	0	0
Sulphur Dioxide	Hourly mean > 350 µg m^{-3}	0	0
Sulphur Dioxide	Daily mean > 125 µg m^{-3}	0	0
Sulphur Dioxide	Annual mean > 20 µg m^{-3}	0	-

Summary of Compliance with AQS Objectives

Particulate matter - The 90th percentile is 50 µgm-3 which indicates the monitoring station was likely to exceed the daily mean objective for PM10 (50µgm^{-3} not to be exceeded more than 35 times a year), as there was 11 exceedences within the data captured. The annual mean of 24µgm^{-3} was well below the annual objective of 40µgm^{-3}

Sulphur dioxide - During the 2010 monitoring period there was no exceedences of the 15- minute, hourly, daily or the annual means, as appropriate and as shown in the table below.

Summary of Detailed Assessment

The detailed assessment modelling study, completed in consultation with 2009 monitoring and meteorological data for the Ballymena area, suggests that the current AQMAs could be revoked as there are no predicted exceedences of the daily mean PM10 objective.

However, as the Ballykeel AQMA still experiences concentrations that are quite close to the objective. Given the unavoidable uncertainty in assessments of this nature, it is therefore considered more prudent to revoke the Dunclug AQMA in the first instance, and retain the Ballykeel AQMA to reflect the most recent predictions. If monitoring data in Ballykeel continues to show further improvements in PM10 then the AQMA could be completely revoked at a later date. After ratification the 2010 capture of the data set for PM10 was 31.7%, therefore a decision to revoke or not will be based on the 2011 data set and reviewed in April 2012. Note the data capture for 2009 monitoring data which the detailed assessment was based on, was 89.6%. In addition as fuel switching is still on-going in the worst case location within Ballykeel, it is hoped Winter 2011/12 will reflect an improved situation and enable a 'sound' basis for revocation.

Appendix Six presents an outline of the Detailed Assessment modelling results.

The following action is proposed:

- **Revocation of the Dunclug AQMA for PM10.**
- **Retaining the Ballykeel AQMA for PM10 and review local monitoring data once on-going fuel switch has been completed and we have benefit of 2011 data set. Proposed review in April 2012 Update and Screening Report**
- **Continue with Action Planning for Linenhall Street AQMA.**

3 New Local Developments

The following are new local developments since completion of the Review and Assessment Progress Report (April 2010). Further information is given below.

Part A, B and C Processes

There are no new Part A, B or C processes within the borough since the completion of the Review and Assessment Progress Report (April 2010). This department continues to survey premises that activities remain below the relevant threshold.

Variations to existing permits have taken place due to changes in practices.

New Retail Developments

There have been no new retail developments that may impact on air quality.

New Road Schemes

Consultation exercises are completed / ongoing regarding new road schemes at the following locations. These were all considered at the Review and Assessment Progress Report (April 2010)..

- Ballee Road East dual carriageway – new design / road layout to include additional slip roads and underpass. Minimal impact on residential properties predicted.
- A26 dual carriageway at Frosses – an extension of dual carriageway towards Ballymoney, will bring existing residential properties closer to kerbside.
- Realignment of single carriageway on Sourhill / Tullygarley Road - will bring existing residential properties closer to kerbside.

Landfill Developments

The Council owned and managed Ballymacvea Landfill, off the A26 dual carriageway closed at the end of March 2007. The temporary waste transfer site at this location has now closed. Council has recently (June 2011) opened a permanent transfer facility in a disused quarry.

All planning applications are considered by the Environmental Health Department and, where necessary, air quality will be reviewed as part of that consultation process.

There is no licensed landfill operating within the Borough. Domestic waste collections by Council are to the waste transfer station prior to being taken outside of the Borough.

Residential Developments

In addition, there have been a number of large residential developments within the Borough with the potential to increase traffic flow, including:

- Leighinmohr Avenue
- Galgorm Road, Ahoghill (3 additional development sites on the boundary of the village).

Due to the current economic climate some smaller residential developments with planning approval have not been commenced.

Ballymena Borough Council confirms that there are no new or newly identified local developments that may have an impact on air quality within the Local Authority area.

4 Planning Applications

Residential Developments

Ballymena Borough Council was consulted on a number of planning applications through the planning process on a number of large residential developments, including;

- Ballymoney Road, Ballymena (2 separate large development sites)
- Lands off Main Street, Cullybackey
- Larne Road, Harryville, Ballymena (3 separate large development sites)
- Knockan Road, Broughshane
- Sourhill Road / Dan's Road, Galgorm, Ballymena
- Galgorm Road, Ballymena
- Royal Court, Gracehill, Galgorm, Ballymena
- Caherty Road, Broughshane.
- Linenhall Street, Ballymena*

*One proposed development of a block of apartments of Linenhall Street. Air Quality i.e. impact on future occupants of the apartments, has been raised as a concern at the early planning consultation stage, as the location would be partly within the declared AQMA. Please note the proposed location formed part of the further assessment and this 'receptor' not identified as being at a concentration in excess of the objective.

Recently there has been a substantial decrease throughout the Borough in the build of properties. Therefore many of the aforementioned developments have not commenced construction and were reported in the R&A Progress Report in 2010.

Other Developments.

The following developments have been / are being considered at a planning consultation stage and, where necessary, air quality has been / is being reviewed as part of that consultation process.

- Lateral extension to Craig's Quarry, Glenwherry
- Lateral extension to Ballylig Quarry, Broughshane
- Biomass unit for domestic heating system, Harryville, Ballymena.
- Landfilling, Craig's Quarry, Glenwherry.

5 Conclusions and Proposed Actions

5.1 Conclusions from New Monitoring Data

- **Nitrogen Dioxide**

An air quality management was declared in March 2010 in the Linenhall / George Street area due to modelled nitrogen dioxide exceedences of the objective of 40 ug/m3.

Automatic Monitoring Data

The mean nitrogen dioxide concentrations for the period 1 January 2010 to 31 December 2010 at the North Road site was 32 μgm^{-3} therefore below the Annual Mean Air Quality Objective of 40 μgm^{-3}. Further two marginal exceedences occurred of the hourly mean, 202μgm^{-3} , the Hourly mean objective being 200 μgm^{-3}. There was no exceedence of the Daily mean objective, with the maximum daily mean of 126. μgm^{-3}. (Air Quality Regulations (Northern Ireland) 2003)

Diffusion Tube Monitoring

National Bias adjustment figure:

An exceedence of the nitrogen dioxide annual mean remains at Linenhall Street, with George Street, being marginally below the air quality objective when applying the national bias adjustment figure. Both these locations are within the AQMA for nitrogen dioxide.

Local Bias Adjustment figure:

On using the locally derived figure in addition to the above locations, a further three locations which fall outside the AQMA for nitrogen dioxide, exceed the annual mean objective. All three of these locations were considered in the further assessment for nitrogen dioxide, undertaken by AEA on behalf of Ballymena Borough Council in 2011.

On balance and consideration of Box 3.3 of the technical guidance, in making a choice of bias adjustment factor (locally derived versus national database) for use the nationally derived factor is chosen. Reasons for choice include;

1. Tube exposure is monthly
2. Data capture for the automatic site was 83.6% and is not an AURN site.
3. Tubes on monitoring station are in a ‘open’ environment, those tubes in the AQMA are in a ‘canyon’, thus better to use the results from a variety of studies.
4. Diffusion tube study was over one year.

5. Study was based on 41 sites using Gradko tubes.

As a precautionary note, the three additional locations were re-considered in the further assessment. The further assessment **confirmed that although conservative, the existing AQMA boundary is appropriate for the monitored and modelled exceedances of NO2 along Linenhall Street.**

- **PM_{10} and Sulphur Dioxide**

Particulate matter - The 90th percentile is 50 µgm-3 which indicates the monitoring station was likely to exceed the daily mean objective for PM10 (50µgm^{-3} not to be exceeded more than 35 times a year), as there was 11 exceedences within the data captured. The annual mean of 24µgm^{-3} was well below the annual objective of 40µgm^{-3}

Sulphur dioxide - During the 2010 monitoring period there was no exceedences of the 15- minute, hourly, daily or the annual means, as appropriate and as shown in the table below.

The detailed assessment modelling study, completed in consultation with 2009 monitoring and meteorological data for the Ballymena area, suggests that the current AQMAs could be revoked as there are no predicted exceedences of the daily mean PM10 objective.

However, the Ballykeel AQMA still experiences concentrations that are quite close to the objective. Given the unavoidable uncertainty in assessments of this nature, it is therefore considered more prudent to revoke the Dunclug AQMA in the first instance, and retain the Ballykeel AQMA to reflect the most recent predictions and on-going fuel switching.

5.2 Conclusions relating to New Local Developments

There are no new local developments that will require more detailed consideration in the next Updating and Screening Assessment.

There is one proposed development in Linenhall Street for an apartment block which will require due consideration in respect of air quality through the planning regime.

5.3 Other Conclusions

Planning application consultations will continue to be assessed with regard to potential impact on local air quality.

5.4 Proposed Actions

Proposed actions are detailed in the following table;

Action	Date
Consultation and action planning in respect of the declared AQMA for nitrogen dioxide.	Continuing
Revocation of the Dunclug AQMA	September 2011
Review Ballykeel AQMA after benefit of Winter 2011/12 data and completion on on-going fuel switching.	April 2012
Submit 2012 Update and Screening Report	April 2012

116 References

1. Local Air Quality Management Technical Guidance LAQM.TG (09), February 2009, DEFRA.

2. Air Quality Review and Assessment – Detailed Assessment, March 2009, AEA Technology.

3. A26 Dualling, Environmental Statement, Scoping Report, March 2009, ARUP, Road Service.

Appendices

Appendix One - AQMA Order for Nitrogen Dioxide

6.1 Air Quality Management Area Order No. 3

Environment (Northern Ireland) Order 2002, Part III, Article 12 (1)

Ballymena Borough Council, in exercise of the powers conferred upon it by Part III, Article 12 (1) of the Environment (Northern Ireland) Order 2002, hereby makes the following Order:-

1. This Order may be cited as the Ballymena Borough Council Air Quality Management Area Order No. 3, Linenhall Street.

2. This Order and the Linenhall Street Air Quality Management Area designated there under shall come into effect on 8th February 2010.

3. The area shown on the map detailed in Appendix 'A', outlined in red, is to be designated as an air quality management area for Linenhall Street.

4. The Area to be designated as an Air Quality Management Area is displayed in map form and can be viewed by visiting the main council offices, 'Ardeevin' 80 Galgorm Road during the period from 9th February 2010 to 30th March 2010. Further information is available by contacting staff of the Environmental Services Department on Tel 028 25 660 300.

The Area is designated in relation to a likely breach of the nitrogen dioxide (annual mean) objective as specified in the Air Quality Regulations (Northern Ireland) 2003.

This Order shall remain in force until it is varied or revoked by a subsequent Order.

Given under the Corporate Seal of Ballymena Borough Council on the 9th day of February 2010.

Present when the Corporate Seal of the Ballymena Borough Council was affixed

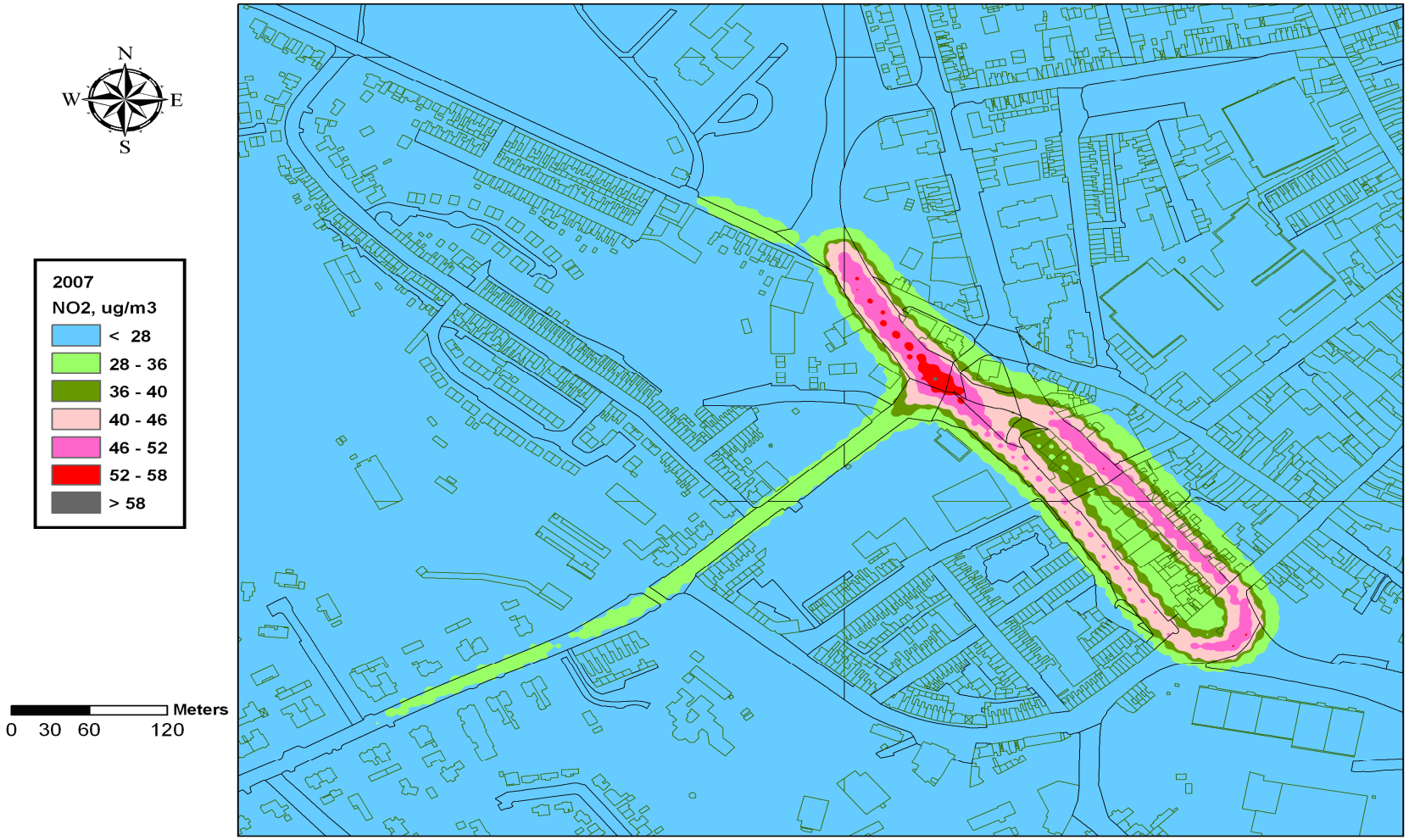
hereto:-

_____

Mayor
Councillor James Currie MBE

_____

Town Clerk and Chief Executive
Mrs Anne Donaghy


N
W
E
S
2007
NO2, ug/m3
< 28
28 - 36
36 - 40
40 - 46
46 - 52
52 - 58
> 58
Meters
0 30 60 120

AQMA Orders for Particulate Matter.

Air Quality Management Area Order No. 1

Environment (Northern Ireland) Order 2002, Part III, Article 12 (1)

Ballymena Borough Council, in exercise of the powers conferred upon it by Part III, Article 12 (1) of the Environment (Northern Ireland) Order 2002, hereby makes the following Order:-

4. This Order may be cited as the Ballymena Borough Council Air Quality Management Area Order No. 1 Ballykeel Area.

5. This Order and the Ballykeel Area Air Quality Management Area designated there under shall come into effect on 1st November 2004.

6. The areas shown on the map detailed in appendix one, outlined in black, are to be designated as an air quality management area for the Ballykeel area.

4. The Area to be designated as an Air Quality Management Area is displayed in map form and can be viewed by visiting the main council offices, 'Ardeevin' 80 Galgorm Road during the period from 2nd November 2004 to 29th December 2004. Further information is available by contacting staff of the Environmental Health Department on Tel 028 25 660 300.

5. The designated air quality management areas incorporate dwellings in the following housing estates:

Ballykeel AQMA

Dwellings in the Ballykeel 1, Ballykeel 2, Chichester Park Central, Chichester Park East and Chichester Park West estates together with certain houses on Crebilly Road, Larne Road, Meadowvale, Moat Road, River View and Knockeen Cresent.

A full list of incorporated streets or parts there of is contained in Appendix Two.

The Area is designated in relation to a likely breach of the Particulate Matter (PM_{10}) (annual and daily mean) objectives as specified in the Air Quality Regulations (Northern Ireland) 2003.

This Order shall remain in force until it is varied or revoked by a subsequent Order.

Given under the Corporate Seal of Ballymena Borough Council on the 1st day of November 2004.

Present when the Corporate Seal of the Ballymena Borough Council was affixed

hereto:-

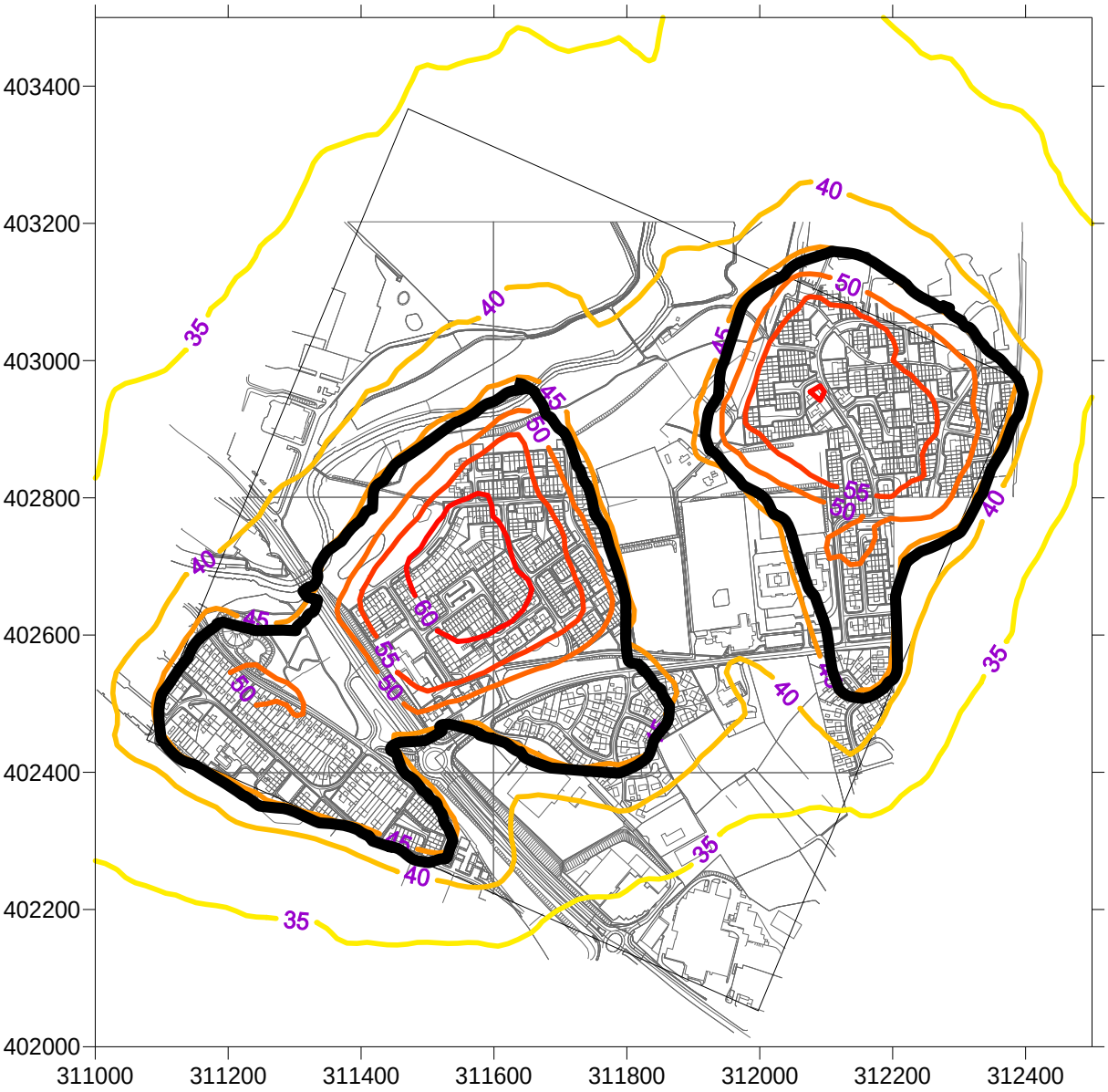
_____

Mayor
Councillor Hubert Nicholl

_____

Town Clerk and Chief Executive
Mervyn G Rankin

Air Quality Management Areas (AQMA) boundaries within Air Quality Management Area Order No.1.



Air Quality Management Area Order No.1 Ballykeel.

Appendix 2

Dwellings in the Ballykeel 1, Ballykeel 2, Chichester Park Central, Chichester Park East and Chichester Park West estates together with certain houses on Crebilly Road, Larne Road, Meadowvale, Moat Road, River View and Knockeen Cresent or Part there of.

Arran Avenue
Barra Drive
Chichester Park Central
Chichester Park East
Chichester Park West
Crebilly Road
Inchkeith Road
Incholm Avenue
Iona Gardens
Kintyre Park
Larne Road
Meadowvale
Moat Road
River View
Shona Green
Colonsay Park
Dalriada Walk
Knockeen Cresent
Knockeen Road
Lewis Park
Orkney Drive
Shetland Gardens
Shetland Park
Skye Park
Staffa Drive

Air Quality Management Area Order No. 2

Environment (Northern Ireland) Order 2002, Part III, Article 12 (1)

Ballymena Borough Council, in exercise of the powers conferred upon it by Part III, Article 12 (1) of the Environment (Northern Ireland) Order 2002, hereby makes the following Order:-

1. This Order may be cited as the Ballymena Borough Council Air Quality Management Area Order No. 2 Dunclug Area.

2. This Order and the Dunclug Area Air Quality Management Area designated there under shall come into effect on 1st November 2004.

3. The areas shown on the map detailed in appendix one, outlined in black, are to be designated as an air quality management area for the Dunclug area.

4. The Area to be designated as an Air Quality Management Area is displayed in map form and can be viewed by visiting the main council offices, 'Ardeevin' 80 Galgorm Road during the period from 2nd November 2004 to 29th December 2004. Further information is available by contacting staff of the Environmental Health Department on Tel 028 25 660 300.

4. The designated air quality management areas incorporate dwellings in the following housing estates:

Dunclug AQMA

Dwellings in the Dunclug Gardens, Dunclug Park, Dunvale, and Millfield estates together with certain houses within Blacksgrove, Cushendall Road, Doury Road, Garvey Wood, Grove Road, Johnston Close, Moorland Close and Parklands.

A full list of incorporated streets or parts thereof is contained in Appendix Two.

The Area is designated in relation to a likely breach of the Particulate Matter (PM_{10}) (annual and daily mean) objectives as specified in the Air Quality Regulations (Northern Ireland) 2003.

This Order shall remain in force until it is varied or revoked by a subsequent Order.

Given under the Corporate Seal of Ballymena Borough Council on the 1st day of November 2004.

Present when the Corporate Seal of the Ballymena Borough Council was affixed hereto:-

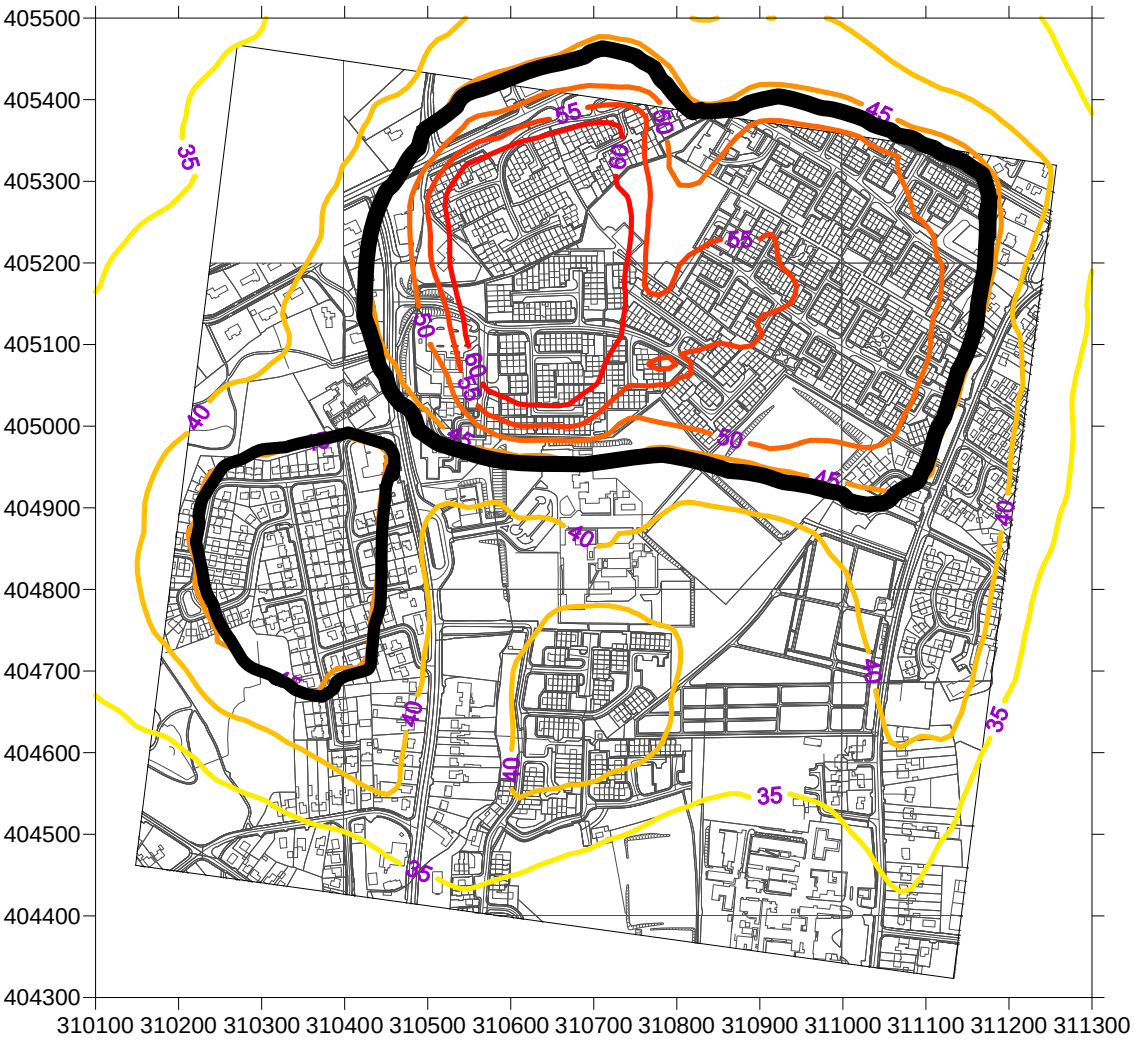
_____

Mayor
Councillor Hubert Nicholl

_____

Town Clerk and Chief Executive
Mervyn G Rankin

Air Quality Management Areas (AQMA) boundaries within Air Quality Management Area Order No.2.



Air Quality Management Area Order No.2 Dunclug.

Appendix Two

Dwellings in the Dunclug Gardens, Dunclug Park, Dunvale, and Millfield, estates together with certain houses within Blacksgrove, Cushendall Road, Doury Road, Garvey Wood, Grove Road, Johnston Close, Moorland Close, Murob Park, Rowallane Drive and Parklands or part there of.

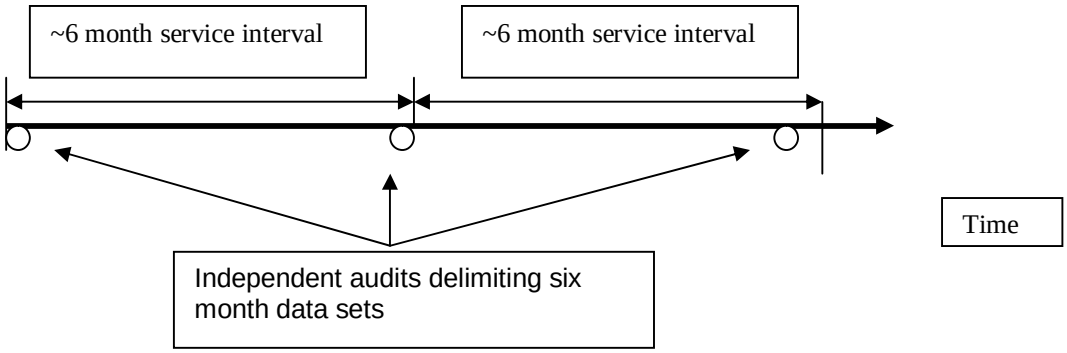
Alveston House
Blacksgrove
Brampton House
Cherrington House
Cushendall Road
Doury Road
Dunclug Gardens
Dunclug Park
Dunvale
Durleston House
Erlington House
Flaxton House
Garvey Wood
Grove Road
Johnston Close
Millfield
Mooreland Close
Murob Park
Parklands
Rowallane Drive

Appendix Two: Quality Assurance/Quality Control for Automatic Continuous Analysers

The purpose of quality control audits is to rigorously test air pollution analysers in order to obtain an assessment of the analyser performance on the day of test. This information, in conjunction with the full analyser data set and additional calibration and service records, helps ensure data quality specifications are being met during the preceding data period. Additionally, six-monthly assessment of the station calibration cylinder concentration ensures that the cylinder concentration, used to scale ambient data, remains stable and thus suitable for scaling purposes.

In April 2007 Ballymena Borough Council commenced a 3 year QA/QC contract with AEA. During the three year contract period, the station will receive seven audits, one took place shortly after commencement of the contract and further scheduled six-monthly audits will be conducted to delimit the station data sets. To aid the data management process for the stations, all equipment support service schedules have been brought into line with the audit schedules as illustrated below:

Figure 13.4 showing support service schedule –v- site audits



Station Audits.

All station audits are undertaken using the procedures described in AEA's internal quality assurance document, Group Working Instruction AEAT/GW1/05/RAMP/43.01 and the audit results recorded on form AEAT/GF/05/RAMP/43.F1. This GWI and associated documents form AEA's extension to UKAS accreditation as Calibration Laboratory 0401 for field calibrations of air quality monitoring stations. AEA currently audits over 1000 air pollution analysers each year.

Analyser performance/parameters tested are:

- **Accuracy** – this is a measure of how closely the measurement system can estimate the concentration of a test sample compared to the "true value" of the concentration. The gaseous analysers are calibrated using UKAS accredited calibration standards and the resulting calibration factors are reported on the UKAS certificate of calibration.

- **Response Time** – this is the time taken for the system to respond to a step change in concentration at its inlet. Response time is defined as the time taken for the system to achieve 90% of its maximum value. Both rise and fall times are checked.

- **Site Calibration Standard Concentration Check** – Site calibration cylinders form the basis of the gaseous calibration systems at the stations and hence make scaling of data from the SO2 and NOx analyser possible. It is therefore important to know the concentration of the gas mixture accurately. An assessment of the concentration of the on-site gas mixtures will be made – based upon the response to gas from the AEA audit transfer standard. This assessment will highlight if a calibration cylinder concentration is drifting and therefore requires replacing. These assessments are undertaken using audit calibration standards certified within AEA's own UKAS accredited calibration laboratory.

- **Linearity** – this is a measure of the relationship of analyser response with changing concentration. For conventional analysers, the relationship should be linear, i.e. twice the concentration will produce twice the output signal etc.

- **Noise Levels** – this is a measure of the change in system output when the pollutant concentration remains constant. Both zero noise, when the concentration is zero, and span noise, when the concentration is held at a particular value, are examined.

- **SO_2 Analyser Hydrocarbon Interference Test** – this test checks the efficiency of the hydrocarbon removal system used on the SO_2 analysers. The purpose of the hydrocarbon removal system is to ensure that hydrocarbon species do not interfere with the measurement of SO_2.

  As well as these tests, other assessments of the sampling and pneumatic systems are carried out. These include system leak checks, and, where possible, manifold pressure drop and flow rate measurements (useful to assess the residence time of sample gas within the manifold system, which should be minimised).

General Principles Adhered to During Station Audits

- Where practicable, test gases are introduced to the analysers via the sample lines that connect the analysers/instrument rack to the sampling manifold. This is to ensure that as much of the ambient sampling line as possible, including the sample inlet filter, is tested.

- While analysers are under test, data should be flagged as audit data as opposed to ambient data. This will utilise the appropriate method for the stations (either "out of service" switches where fitted or by instruction to the data management unit for the stations). This will ensure that data during the audit is not disseminated as ambient data.

- A resettling period of 5 minutes is allowed after completion of the test before the "out of service" switch is reset to signal the collection of ambient data. This period allows the analysers to stabilise on ambient sampling.

- All analyser outputs (with the exception of particulate analyser tests) are taken from the relevant data collection system as un-scaled raw data.

- The pressure in all calibration gas cylinders is checked to ensure it is greater than 300 psi.

UKAS Certificate of Calibration

The output from each audit is in the form of a letter report outlining the results of each six-month audit and a UKAS Certificate of Calibration. The Certificate of Calibration provides a method by which the data management process for the respective stations can be checked (via comparison of the certificate calibration factors with those used to scale the station data). Where **AEA** undertake the stations data management, the letter report will be combined with the output from the stations data management process (described below).

The UKAS Certificate of Calibration provides the following information:

- The calibration and zero response factors for the analysers under test on the day of the audit.
- Uncertainties associated with the above values.

Data Management

The following sections describe the data management package that is provided under the Calibration Club. This includes data acquisition, validation and ratification of the inorganic and particulate pollutants measured by the two monitoring stations.

The **AEA** data acquisition and management system consists of a central computer and telemetry facility that has been developed specifically for the UK's air quality monitoring programmes. Particular benefits of this system include:

- **Flexibility** – it can be easily modified to incorporate the measurement of new species, or the introduction of new data-logging or communications technology.
- **Efficiency** – the system is resident on the AEA Technology Computer Network, enabling a number of processing functions to be carried out rapidly and simultaneously.
- **Proven capability** – the system has been used to provide rapid high quality data from national monitoring programmes for many years.
- **Modular** – the system uses standard PCs and accessories. These can be simply replaced in the event of failure or run in parallel to boost performance.

The AEA system is housed within a specifically designed air-conditioned network control centre at AEA, Culham. All critical computer systems have uninterruptible power supplies installed to minimise downtime in the event of power cuts. AEA uses state of the art computer systems to automatically retrieve raw 15-minute (or hourly data depending of the station equipment) averaged measurements from monitoring stations on a daily basis.

A wide range of data management activities are routinely performed by AEA and these are integrated into the streamlined automatic data management system. Each day, measurement data is retrieved automatically from the monitoring stations (*data acquisition*). The data is then rapidly processed by applying the latest available calibration factors (*data scaling*) and carefully screened using specifically developed computer algorithms to identify suspect data or equipment faults (*data validation*). The provisional data is then appended to the site database (*data archiving*). These operations are carried out automatically by computer systems, with the output manually checked by AEA.

Once validated in this way, the previous day's results can be made available for dissemination to the respective Councils and other interested parties (as advised by the owning Council) on a daily basis via e-mail.

Data Acquisition and Processing

The monitoring site is polled daily to retrieve averaged raw output from station instruments. This data is transmitted via MODEM and automatically appended to the **AEA** air quality site database. The results of automatic overnight auto-calibration checks are also retrived and data based.

Scaling factors, based on the most recent manual calibrations undertaken by this department are applied to the pollutant measurements to produce concentrations in the relevant units. The scaled data is stored as a separate database file, the original raw data is retained at all times.

From the raw values, the hourly averaged results are then calculated. These are the averaging period used for the reporting of both validated and ratified data for all pollutants. Additionally 15-minute data files are provided for SO2 to allow direct comparison with the legislative 15-minute objective.

Initial Validation of Data

To ensure high quality data is obtained with correspondingly high data capture rates, initial data screening is essential. AEA manually reviews data from the stations every day (in addition to their automatic software diagnostics) ensuring that problems are identified as soon as they occur.

All incoming data from the monitoring stations will be screened prior to the release of validated data sets. Experienced staff are on hand to investigate instances of suspect data.

- AEA has developed a number of specially developed algorithms for identifying flagging and editing suspect data.

The automatic screening procedures provide data of the highest quality and lead to the rapid diagnosis of any instrument malfunctions.

Should equipment or site problems be identified, it is possible for data management staff to contact the monitoring station by MODEM manually, in order to access further information. If necessary, this department will be contacted in order to invoke emergency call-out procedures for their equipment support unit.

Final Ratification of Data

A number of essential quality assurance/control details are collated in order to produce a final ratified data set every six months. These are as follows:

- Results of the routine instrument calibrations (undertaken by the relevant local authority)
- Instrument and site infrastructure service records
- Meteorological data (AEA receives daily met reports from the Met Office)
- Results of six-monthly station audits

At the end of each six monthly period, AEA uses this information for each of the stations, together with the following procedures, in order to formulate the final ratified data sets.

- A time series graph and calibration control chart of the validated data for the six months is plotted and reviewed.

- Data is automatically loaded one month at a time into the AEA data-handling package. This will enable 15-minute averaged raw data, scaled concentration data and calibration results to be examined. A site information database containing all comments entered as a result of call out visits or fault investigations, it also opened on screen.

- Concentration values will be deleted where appropriate e.g. during site visits or instrument failures. Raw data will however always be preserved.

- Some adjustments to the data may be necessary for a variety of reasons including:
    - Spikes in the processed zeros or scaling factors
    - Inconsistencies in the site calibrations
    - Inclusion of spurious auto-calibration data
    - Smoothing of calibration and zero drifts

- Daily zero or sensitivity factors may be modified to produce a smooth progression throughout the month, consistent with the auto-calibration response and/or manual calibrations.

- Site operation and data ratification notes are prepared for each instrument. These notes are used for discussion of data quality issues in the six-monthly report.

- Once all modifications to the monthly files have been made, time-series and calibration control charts for the entire six months are again plotted, annotated and examined.

- Following any final corrections, the ratified six-monthly data sets are available to this department.

Data Throughput Activity

A full table of operating tasks to be carried out by the project team is detailed below.

Figure 13.5 showing operating tasks conducted by AEA

	Automated Systems	**Data Management**	**Project Manager**
Daily	Collect raw 15-minute averaged results Collect daily autocalibration results Apply calibration factors to calculate hourly averaged results Apply algorithms to screen data Database hourly results Collate provisional results for daily report	Investigate any suspicious data View previous 48 hours data & latest autocal and calibration factors Enter calibration results from routine and call out visits Send daily e-mail report	Contact Council to investigate instrument problems flagged by data manager
6-Monthly	List out files of RATIFIED results Calculate statistics	Ratify data Supply printouts of data on request Provide data analysis	Review site performance Write report to Council

Appendix Three – Deriving local bias adjustment figure.

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/01/2010	04/02/2010	39.07	46.6	41.58	42	3.8	9	9.5	41	82.9	Good	Good
2	04/02/2010	04/03/2010	42.63	32.55	45.54	40	6.8	17	16.9	43	77	Good	Good
3	04/03/2010	01/04/2010	34.03	33.23	31.14	33	1.5	5	3.7	30	85	Good	Good
4	01/04/2010	30/04/2010	32.44	30.74	32.2	32	0.9	3	2.3	28	86.9	Good	Good
5	30/04/2010	04/06/2010	20.87	20.02	23.05	21	1.6	7	3.9	26	89.9	Good	Good
6	04/06/2010	02/07/2010	21.42	22.65	23.18	22	0.9	4	2.2	21	96	Good	Good
7	02/07/2010	05/08/2010	16.27	15.83	14.94	16	0.7	4	1.7	16	91.9	Good	Good
8	05/08/2010	01/09/2010	16.14	16.5	15.65	16	0.4	3	1.1	20	83.7	Good	Good
9	01/09/2010	01/10/2010	31.19	30.84	32.87	32	1.1	3	2.7	27	72	Good	or Data Capture
10	01/10/2010	04/11/2010	28.5	27.15	26.44	27	1.0	4	2.6	31	82.3	Good	Good
11	04/11/2010	02/12/2010	30.59	33.13	32.94	32	1.4	4	3.5	44	78.3	Good	Good
12	02/12/2010	06/01/2011	49.06	46.03	47.5	48	1.5	3	3.8	63	74.9	Good	Good
13													
												Good precision	Poor Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey -->

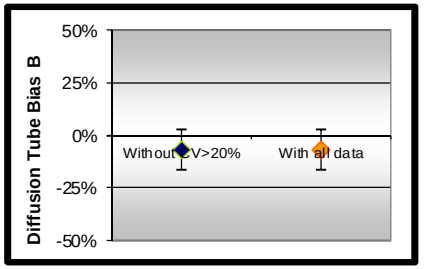
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	

Precision	12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	1.1 (1 - 1.23)
Bias B	-9% (-19% - 0%)
Diffusion Tubes Mean:	30 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	84%
Adjusted Tubes Mean:	33 (30 - 37) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	1.1 (1 - 1.23)
Bias B	-9% (-19% - 0%)
Diffusion Tubes Mean:	30 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	84%
Adjusted Tubes Mean:	33 (30 - 37) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Appendix Four – Deriving the National Diffusion Tube Bias Adjustment Figure

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 06/11

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated in late September 2011 on the LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

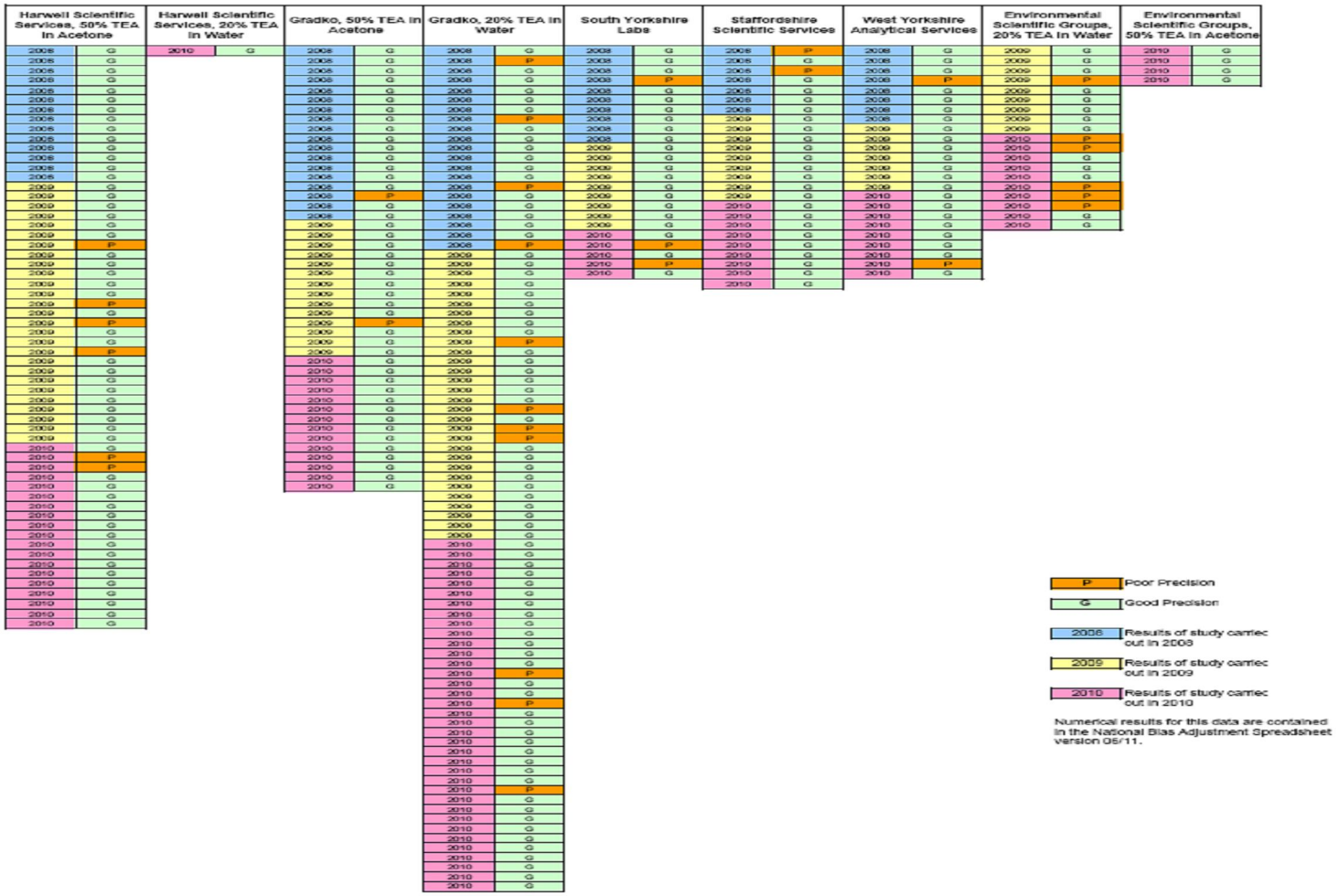
If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in Water	2010	UC	Nottingham CC	12	40	40	-1.0%	G	**1.01**
Gradko	20% TEA in Water	2010	R	Nottingham CC	12	45	43	4.9%	G	**0.95**
Gradko	20% TEA in Water	2010	R	Nottingham CC	12	44	41	6.3%	G	**0.94**
Gradko	20% TEA in Water	2010	K	South Lakeland DC	12	46	42	8.1%	G	**0.92**
Gradko	20% TEA in Water	2010	R	Gedling BC	12	43	39	9.1%	G	**0.92**
Gradko	20% TEA in Water	2010	B	East Hertfordshire DC	12	21	16	31.2%	G	**0.76**
Gradko	20% TEA in Water	2010	R	Dudley MBC	12	42	45	-5.9%	G	**1.06**
Gradko	20% TEA in Water	2010	B	Dudley MBC	12	30	30	0.0%	G	**1.00**
Gradko	20% TEA in Water	2010	R	Dudley MBC	10	47	46	2.4%	G	**0.98**
Gradko	20% TEA in Water	2010	R	Carlisle CC	12	41	33	25.5%	G	**0.80**
Gradko	20% TEA in Water	2010	UC	Nottingham CC	12	40	40	-1.0%	G	**1.01**
Gradko	20% TEA in Water	2010	R	Nottingham CC	12	45	43	4.9%	G	**0.95**
Gradko	20% TEA in Water	2010	R	Nottingham CC	12	44	41	6.3%	G	**0.94**
Gradko	20% TEA in Water	2010	UC	Belfast CC	11	38	35	8.4%	P	**0.92**
Gradko	20% TEA in Water	2010	UB	Luton Borough Council	12	37	34	9.8%	G	**0.91**
Gradko	20% TEA in Water	2010	K	Wandsworth Council	11	136	162	-16.4%	G	**1.20**
Gradko	20% Tea in Water	2010	UB	Wandsworth Council	12	47	53	-9.9%	P	**1.11**
Gradko	20% TEA in Water	2010	R	Newtownabbey BC	11	36	35	4.3%	G	**0.96**
Gradko	20% TEA in Water	2010	R	Cheshire East Council	12	58	45	29.2%	G	**0.77**
Gradko	20% TEA in Water	2010	R	Cheshire East Council	11	30	30	-1.8%	G	**1.02**
Gradko	20% TEA in Water	2010	R	Gateshead Council	9	38	34	10.4%	G	**0.91**
Gradko	20% TEA in Water	2010	R	Gateshead Council	9	35	33	6.0%	G	**0.94**
Gradko	20% TEA in Water	2010	R	Gateshead Council	9	34	34	-0.6%	G	**1.01**
Gradko	20% TEA in Water	2010	R	Gateshead Council	9	32	35	-9.9%	G	**1.11**
Gradko	20% TEA in Water	2010	R	Gosport BC	10	31	23	35.3%	na	**0.74**
Gradko	20% TEA in Water	2010	R	Rhondda Cynon Taf CBC	10	35	35	0.4%	G	**1.00**
Gradko	20% TEA in Water	2010	O	North Warwickshire BC	9	48	42	13.6%	P	**0.88**
Gradko	20% TEA in Water	2010	UB	LB Ealing	10	39	41	-3.8%	G	**1.04**
Gradko	20% TEA in Water	2010	R	South Norfolk Council	9	28	17	63.7%	G	**0.61**
Gradko	20% TEA in Water	2010	B	Chelmsford BC	11	16	17	-5.3%	G	**1.06**
Gradko	20% TEA in Water	2010	R	Chelmsford BC	12	33	21	55.0%	G	**0.65**
Gradko	20% TEA in Water	2010	R	Chelmsford BC	10	37	32	14.6%	G	**0.87**
Gradko	20% TEA in Water	2010	R	Wokingham BC	10	37	36	4.1%	G	**0.96**
Gradko	20% TEA in Water	2010	R	West Dunbartonshire Council	9	22	22	0.1%	G	**1.00**
Gradko	20% TEA in Water	2010	R	Scarborough BC	12	35	29	18.2%	G	**0.85**
Gradko	20% TEA in Water	2010	UB	Sandwell MBC	11	31	28	11.4%	na	**0.90**
Gradko	20% TEA in Water	2010	R	Sandwell MBC	11	45	45	-0.9%	na	**1.01**
Gradko	20% TEA in Water	2010	R	Sandwell MBC	11	37	36	2.0%	na	**0.98**
Gradko	20% TEA in Water	2010	UB	Sandwell MBC	10	22	21	8.1%	na	**0.93**
Gradko	20% TEA in Water	2010	R	Shropshire Council	11	45	38	18.5%	G	**0.84**
Gradko	20% TEA in Water	2010	R	Bromsgrove DC	12	54	53	3.4%	G	**0.97**
Gradko	20% TEA in Water	2010		**Overall Factor[3] (41 studies)**				**Use**		**0.92**

Appendix Five – Diffusion Tube Precision

http://laqm.defra.gov.uk/documents/Tube_Precision2010_v06_11.pdf

Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies, by Laboratory



Appendix Six – Detailed Assessment Monitoring Results.

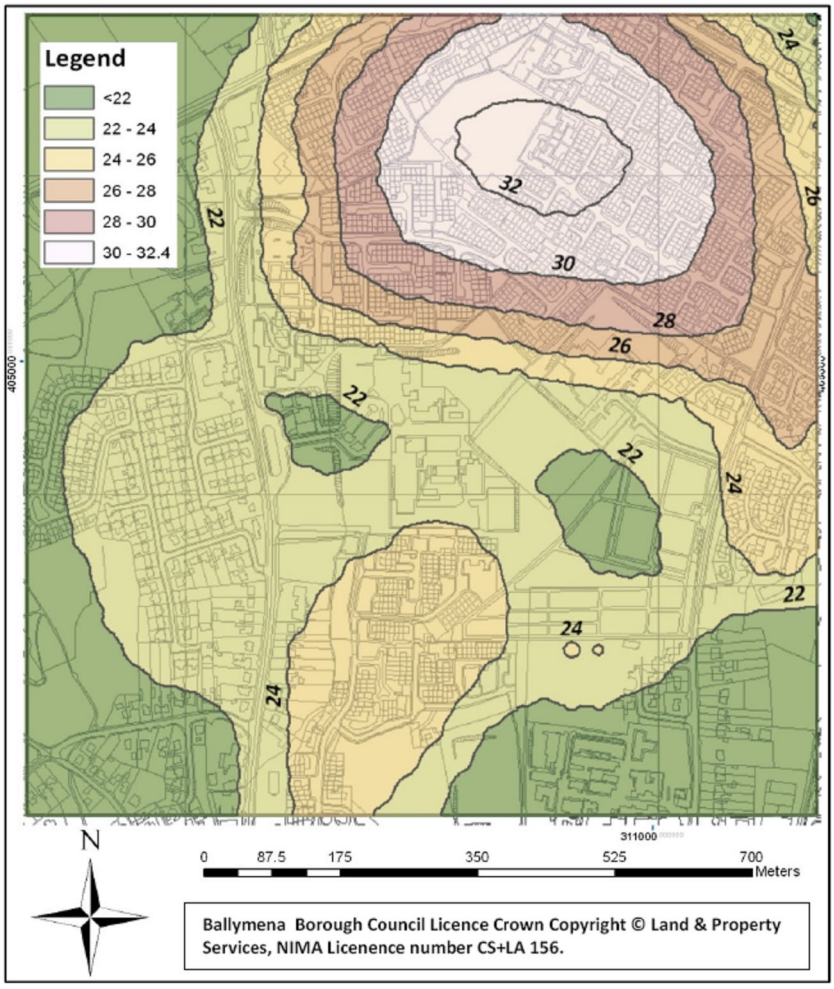
4 PM_{10} modelling results

The modelled concentrations of PM_{10} in 2009 in both AQMA locations are provided below. The modelling indicates that there are no exceedences of the daily mean PM_{10} objective (Figures 4.1 and 4.3- concentration isopleths of 50µg/m^3 would be suggestive of exceedences). Given that the daily objective is probably being achieved; it is very unlikely that the annual mean objective for PM_{10} is at risk of being exceeded.

That said, the daily mean objective is still approached in a small area in Ballykeel so it would be prudent to encourage further switching away from solid fuel use to further drive down PM_{10} concentrations. The dispersion modelling exercise indicates that BBC should consider revoking the current AQMAs, though concentrations in Ballykeel are still quite close to the objective in one small area.

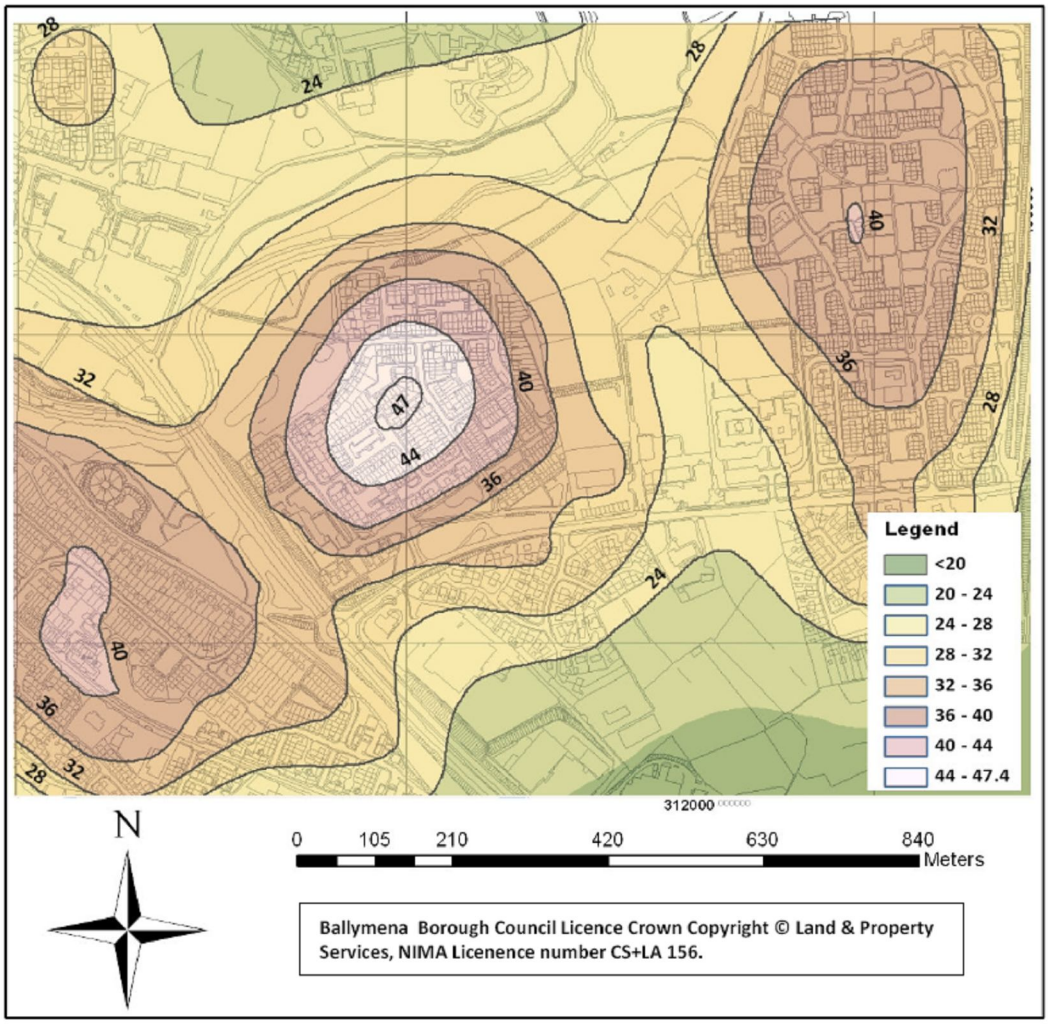
4.1 Dunclug

Figure 4.1 Dunclug 90th percentile of PM_{10} daily means 2009 (µg/m^3)



4.2 Ballykeel

Figure 4.2 Ballykeel_90th percentile of PM_{10} daily means 2009 (µg/m^3)



Appendix 7 – Contour plots from the further assessment study for nitrogen dioxide.

Contour plots

Figure 5-3 shows a scaled contour plot of the estimated NO_2 annual average concentrations during January 2009 to December 2009 within the study area. As shown, it has been confirmed by the monitoring and subsequent modelling that the NO_2 40 $\mu g\ m^{-3}$ annual average objective has been exceeded during the study period at locations with relevant exposure (R4 and R5) within the study area below.

Figure 5-3 Annual mean NO_2 concentrations Linenhall Street 2009

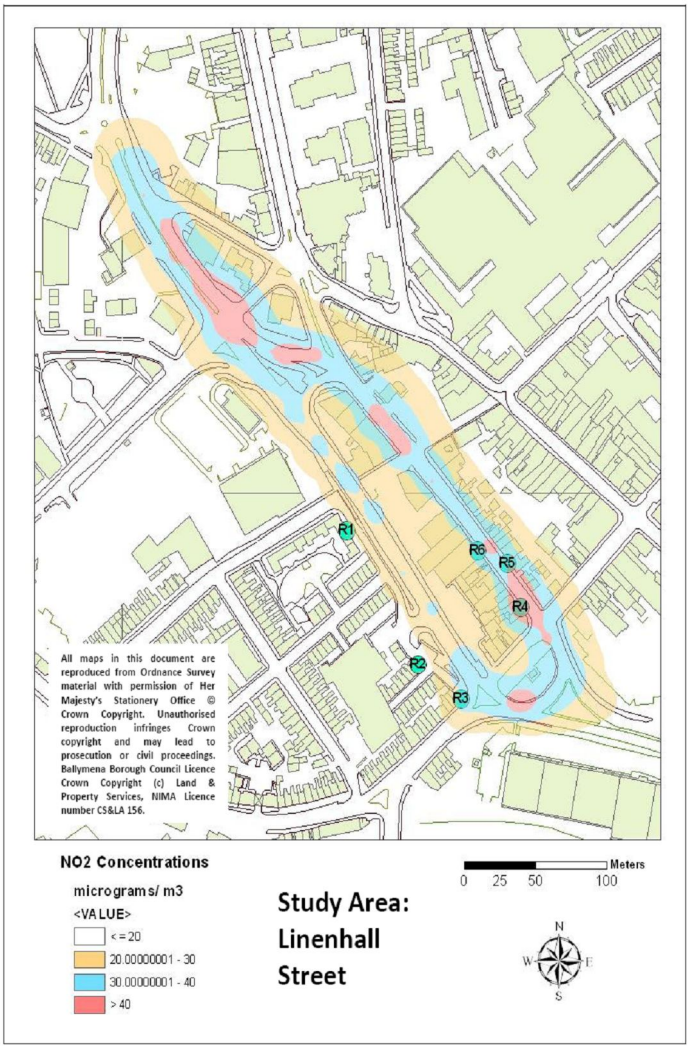
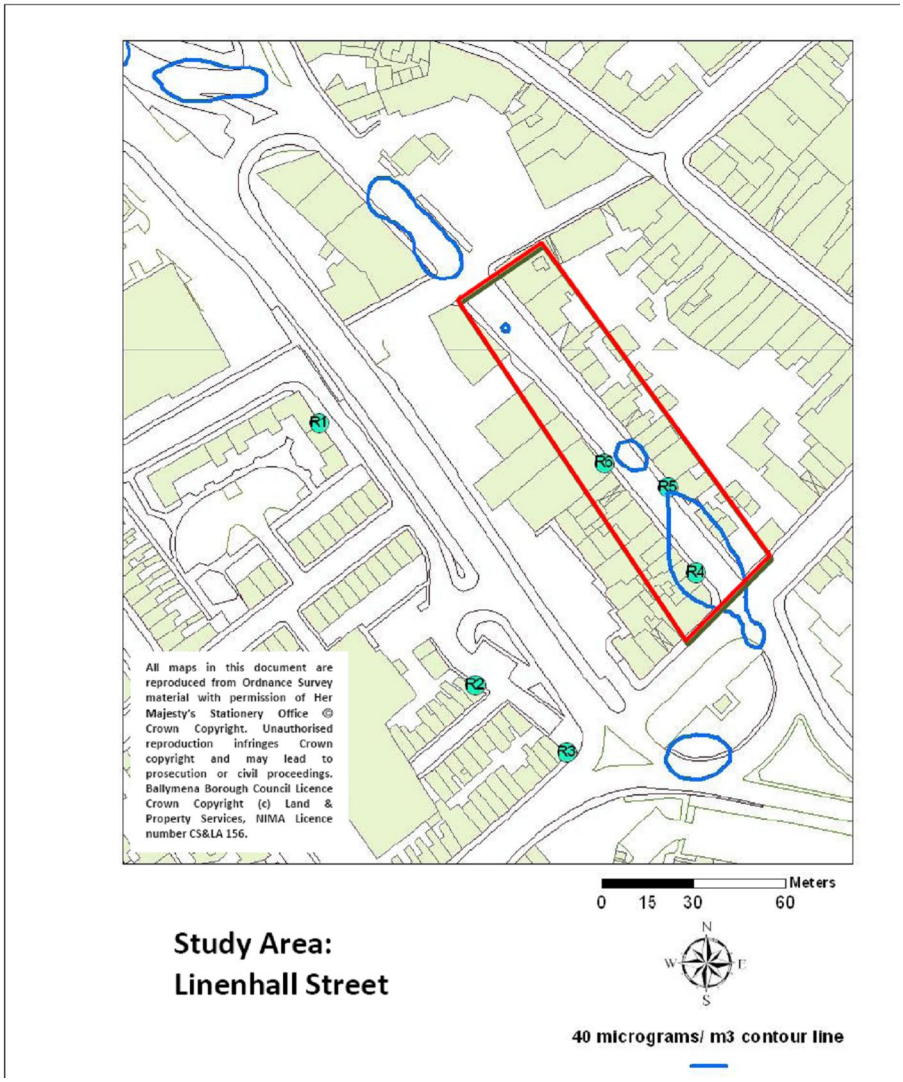


Figure 5-4 shows a contour line of the estimated NO_2 40 µg/m^3 exceedance line concentrations du the 2009 study period within the study area. This shows that the current AQMA boundary, shown red, is appropriate.

Figure 5-4 40$\mu g\ m^{-3}$ Contour Line for Linenhall Street 2009



5.2.1 People exposed to exceedences of the annual mean NO_2 objective

Based on available information it is estimated that approximately two residential buildings (R4 and R5) lie within the exceedance area on Linenhall Street, equating to an exposed population of around five (based on census data which suggests an average occupancy per household of 2.36 in England and Wales[6]).

5.2.2 Source Apportionment

Source apportionment is the process whereby the sources of pollutants can be assessed so that the Local Authority can proceed with an action plan to attempt to address the air quality problems in the area of interest.

The source apportionment should:

- Confirm that exceedences of NO_2 are due to road traffic;
- Determine the extent to which different vehicle types are responsible for the emission contributions to NO_x and hence NO_2; and
- Quantify what proportion of total NO_x is due to background emissions, or local emissions from busy roads in the local area. This will help determine whether local traffic management measures could have a significant impact on reducing emissions in the area of exceedance, or, whether national measures would be a suitable approach to achieving the air quality objectives.

5.2.3 Base case

The "Base Case" is the modelling of annual mean NO_x concentrations without any measures to reduce these concentrations by Ballymena Borough Council. In this case the "base case" is the previously calculated NO_x concentrations for the 2009 calendar year for the study area.

The EfT was used within which emission sources were effectively switched off or on accordingly e.g. for calculating the contribution from HGVs all other sources were set to zero. This allowed derivation of new emission factors for the road segments which were then modelled in ADMS-Roads to obtain the contribution of each source to ambient NO_x.

5.2.4 Locations and sources considered

The locations considered within this Further Assessment were taken as the receptor locations (and diffusion tube locations) previously specified by Ballymena Borough Council within the model domain.

The following sources have been considered:

- Background concentrations;
- Moving vehicles;
- Queuing vehicles;
- Light duty vehicles (LDV- comprising cars, vans, motorcycles); and
- Heavy duty vehicles (buses, articulated and rigid HGVs).

Table 5-3, Figures 5-5 and Figure 5-6 summarise the relevant NO_x contributions from the above sources at each of the monitoring locations.

In general, measures aimed at reducing the amount of moving traffic will have a beneficial effect at the locations described above. Stationary traffic is also an important source (particularly near the Linenhall Street receptors where traffic queuing occurs) that should be addressed. It is likely much of the queuing relates to the roads being used beyond their capacity so measures to improve the

[6] http://www.statistics.gov.uk/census2001/profiles/commentaries/housing.asp

former will benefit the latter. Also, buses and other types of heavy vehicle transiting the AQMA have quite similar impacts on local air quality.

Table 5-3 NOx source apportionment for R4 and R5

Site	Contribution to annual mean NOx (µg.m^{-3})					
	Total NOx	Background	Moving traffic	Queuing Traffic	Light vehicles	Heavy vehicles
R4	139.4	15.4	101.3	22.7	28.0	96.0
R5	89.1	15.4	56.8	16.9	21.1	52.6
Site	% contribution to total					
	Total %	Background	Moving traffic	Queuing Traffic	Light vehicles	Heavy vehicles
R4	100	11	73	16	20	69
R5	100	17	64	19	24	59

Figure 5-5 Contribution **(µg.m^{-3} and %)** ***to total NOx from background and moving/queuing traffic at R4***

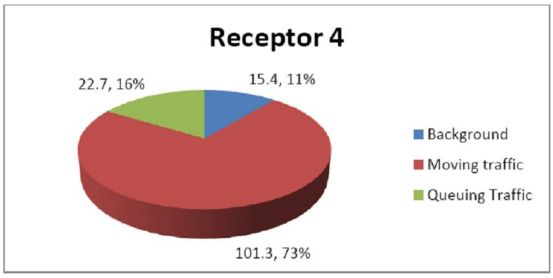
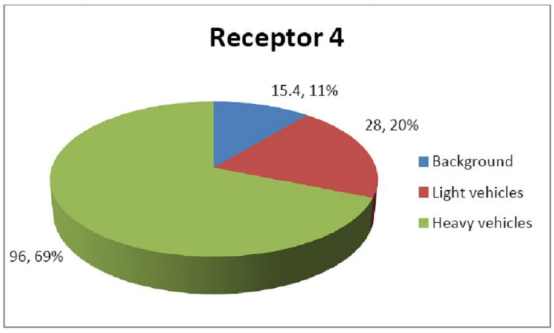


Figure 5-6 Contribution **(µg.m^{-3} and %)** ***to total NOx from background and LDV/HDV at R4***



6 Required reduction in ambient NO_x concentrations

The required reduction in Road-NO_x concentrations to attain the objectives allows the Local Authority to judge the scale of the effort required to comply with the NO_2 objective. For NO_2, the required reduction in road contribution to ambient concentrations should be expressed in terms of NO_x as this is the primary emission and a non-linear relationship exists between NO_x and NO_2 concentrations. The ambient concentrations of NO_x required to achieve the annual mean objective for NO_2 at the locations of worst case relevant exposure have been derived using the NO_x/NO_2 model described previously.

Linenhall Street

The largest reduction is required at Receptor 4 (R4) with a required Road-NO_x concentration reduction of 43.7%. Calculation of the required Road-NO_x reduction at the relevant worst case receptor is shown in Table 6-1 below.

Table 6-1 Reductions required in NO_x concentrations to achieve the 2005 NO_2 annual mean objective

Location	Current Road-NO_x ($\mu g.m^{-3}$)	Required Road-NO_x ($\mu g.m^{-3}$)	Road NO_x- Reduction required (%)
R4	124.0	69.8	43.7

7 Expected date of achievement of the NO_2 objectives

LAQM TG(09) introduced a new requirement for further assessments, namely that the Local Authority should predict the date of achievement of the air quality objectives were no mitigation action to be taken. The approach to making this prediction can either be based on modelling of future years, or by simply projecting monitoring data forward using the factors outlined in Box 2.1 of the guidance. Box 2.1 was updated in a recent LAQM FAQ and the most recent adjustment factors have been used.

Linenhall Street

Table 7-1 Predicted NO_2 concentrations at Receptor 4, Linenhall Street for 2009-2015 ($\mu g.m^{-3}$)

Year	R4
2009	55.8
2010	53.3
2011	51.3
2012	49.3
2013	47.3
2014	45.2
2015	43.2
Compliance with NO_2 annual mean objective in ***bold***	

These predictions are **indicative** only, and take no account of local conditions such as traffic growth or contraction (perhaps resulting from planning decisions or congestion management interventions) or changes in fleet composition and should therefore be considered with care. This prediction should not be viewed as justification for not progressing fully with Action Plan measures as projection of NO_2 data to future years has, in the past proven to be subject to significant uncertainty, and projected improvements have proven to be optimistic as monitoring data has become available for direct comparison.

Appendix 8 – Scenarios for action planning

8 Mitigation Scenarios

The findings of this Further Assessment will provide additional scientific justification for the development of an Air Quality Action Plan (AQAP) in order that Ballymena Borough Council can demonstrate that they are fulfilling their statutory duty to work towards achievement of the NO_2 objectives. A number of hypothetical scenarios have been proposed by Ballymena Borough Council in order to assess the level of intervention that would be required to meet the objectives. These have been modelled in ADMS-Roads using the same methodology but with updated traffic data to reflect the potential effect of the proposed intervention. The effect on ambient concentrations of NO_2 of three scenarios has been modelled at the worst-case relevant exposure locations (R4 and R5).

8.1 Scenarios

8.1.1 Scenario 1- 10% reduction of AADT

This scenario involves reducing the number of total number of vehicles travelling throughout the study area by 10%.

Table 8-1 NO_2 concentrations at receptors for the do-nothing and Scenario 1

Location	Modelled NO_2 2009 *do-nothing* ($\mu g.m^{-3}$)	Modelled NO_2 2009 *do-something* ($\mu g.m^{-3}$)
R4	**55.8**	**52.6**
R5	**41.3**	39.0
Exceedences of the annual mean NO_2 objective in **bold**		

8.1.2 Scenario 2- 50% reduction of HDVs

This scenario involves reducing the number of HDVs throughout the study area by 50%.

Table 8-2 NO_2 concentrations at receptors for the do-nothing and Scenario 2

Location	Modelled NO_2 2009 *do-nothing* ($\mu g.m^{-3}$)	Modelled NO_2 2009 *do-something* ($\mu g.m^{-3}$)
R4	**55.8**	**43.7**
R5	**41.3**	32.1
Exceedences of the annual mean NO_2 objective in **bold**		

8.1.3 Scenario 3- 10% reduction of AADT, 25% reduction of HGVs

This scenario involves reducing the number of HDVs throughout the study area

Table 8-3 NO_2 concentrations at receptors for the do-nothing and Scenario 3

Location	Modelled NO_2 2009 *do-nothing* ($\mu g.m^{-3}$)	Mode *do-son*
R4	**55.8**	
R5	**41.3**	
Exceedences of the annual mean NO_2 objective in **bold**		

As would be expected, the scenarios above improve the likelihood of com annual mean objective. If more general reductions in traffic could also be a reductions occur as predicted then the annual mean objective for NO_2 could be Street within the next several years. If a combination of HDV reductions (provi between about 5-10 $\mu g.m^{-3}$) could be achieved in the short term, there is poten could be achieved much sooner.