



# **CASTLEREAGH BOROUGH COUNCIL**

## **AIR QUALITY REVIEW AND ASSESSMENT PROGRESS REPORT 2005**

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SENIOR ENVIRONMENTAL HEALTH OFFICER**



# **TITLE PAGE**

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## ABSTRACT

The Progress Report 2004 forms an integral part of Castlereagh Borough Council's Air Quality Management. The overall aim is to report progress on implementing local air quality management and progress in achieving, or maintaining, concentrations below air quality objectives. Progress reports also help ensure continuity in resourcing air quality within Local Authorities and provide a means for communicating air quality information to members of the public.

The Progress Report 2005 focuses on information that might affect the air quality of Castlereagh and provides information that will assist in other policy areas such as transport and land use planning. This will allow Castlereagh Borough Council to be able to require the potential impacts on air quality to be investigated and to identify areas to focus upon when the next round of updating and screening assessments are due.

This report can be viewed at [www.castlereagh.gov.uk](http://www.castlereagh.gov.uk) once the Department has approved it. Should you wish to discuss the content of this report, please do not hesitate to contact Richard Harvey (028 9049 4646).



## EXECUTIVE SUMMARY

The UK Government published its Strategic Policy Framework for Air Quality Management in 1995 establishing national strategies and policies on air quality. The Northern Ireland Environment Order came into operation in January 2003 and implements both the European Air Framework Directive 96/62EC and the UK Air Quality Strategy. The Air Quality Strategy provides a framework for air quality control through air quality management and air quality objectives.

Under the Air Quality Strategy all Local Authorities are required to undertake an air quality review. In areas where air quality objectives are not anticipated to be met by the specified date, Local Authorities are required to establish Air Quality Management Areas to improve air quality.

Local Air Quality Management Policy Guidance (LAQM.PGNI (03)) is designed to help relevant authorities with their Local Air Quality Management (LAQM) duties under Part III of the Environment (NI) Order 2002. The Environment (NI) Order 2002 provides the framework for LAQM across Northern Ireland. The Air Quality Objectives set out in the Air Quality Regulations (NI) 2003 provide the statutory basis for the system of LAQM.

This report forms the **Progress Report** and the purpose of the report is to identify those matters that have changed since the last review and assessment, which might lead to a risk of an air quality objective being exceeded, the conclusions of the last review and assessment report are:

### **Nitrogen Dioxide (NO<sub>2</sub>)**

The modelling shows that levels of NO<sub>2</sub> are likely to be below the annual mean objective for 2005 at relevant receptors at the assessed major links/roads. Therefore, an Air Quality Management Area (AMQA) should not be declared on NO<sub>2</sub>.

### **Particulate Matter (PM<sub>10</sub> gravimetric)**

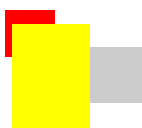
The modelling shows that an exceedence of the PM<sub>10</sub> annual mean objective for 2004 is unlikely at relevant receptors on the assessed major links/roads. The daily mean objective will not be exceeded. Therefore, an Air Quality Management Area (AMQA) should not be declared on PM<sub>10</sub>.

### **Sulphur Dioxide (SO<sub>2</sub>)**

The detailed modelling has shown that SO<sub>2</sub> emissions arising from domestic fuel combustion in the Castlereagh Borough Council area are not predicted to cause an exceedence of the air quality objectives. Therefore, an Air Quality Management Area (AMQA) should not be declared on SO<sub>2</sub>.

The table below shows the National Air Quality Standard Objectives for the 3 pollutants, which were assessed at the 3<sup>rd</sup> Stage Review completed in July 2004

<b><u>Pollutant</u></b>	<b><u>Air Quality Objective</u></b>		<b><u>Date to be achieved by</u></b>
	<b><u>Concentration</u></b>	<b><u>Measured as</u></b>	
<b>Nitrogen Dioxide<sup>1</sup></b>	200 $\mu\text{g m}^{-3}$ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	40 $\mu\text{g m}^{-3}$	annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>)<sup>2</sup></b> <b>Gravimetric<sup>3</sup></b>	50 $\mu\text{g m}^{-3}$ not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 $\mu\text{g m}^{-3}$	annual mean	31.12.2004
<b>Sulphur Dioxide</b>	350 $\mu\text{g m}^{-3}$ not to be exceeded more than 24 times per year	1 hour mean	31.12.2004
	125 $\mu\text{g m}^{-3}$ not to be exceeded more than 3 times per year	24 hour mean	31.12.2004
	266 $\mu\text{g m}^{-3}$ not to be exceeded more than 35 times per year	15 minute mean	31.12.2005



# 1 INTRODUCTION

The progress report forms part of the Local Air Quality Management System (LAQM) introduced in the Environment Northern Ireland Order and subsequent Regulations. The progress report would help ensure continuity in resourcing air quality within local authorities so as to maintain the capacity and skills required to manage LAQM.

Table 1 shows the different ways that progress reports will assist the local authorities with the LAQM process.

**Table 1 - How progress reports can assist local authorities**

By helping retain a profile for LAQM within the authority, including the retention of staff with knowledge of air quality issues
By providing a means for communicating air quality information to members and the public.
By maximising the usefulness and interpretation of the monitoring effort being carried out by the local authority.
By maximising the value of the investment in monitoring equipment.
By making the next round of review and assessment that much easier, as there will be a ready available up-to-date source of information.
By helping authorities respond to requests for up-to-date information on air quality.
By providing information to assist in other policy areas, such as transport and land use planning.
By providing a ready source of information on air quality for developers carrying out environmental assessments for new schemes.
By demonstrating progress with implementation of air quality Action Plans and/or air quality strategies.
By providing a timely indication of the need for further measures to improve air quality, rather than delaying until the next full round of review and assessment.

Source: Progress Report Guidance LAQM.PRGNI (04)

The overall aims of the progress report are to report progress on implementing local air quality management and report progress in achieving or maintaining concentrations below the air quality objectives. It is considered that these aims can be best achieved by addressing new monitoring results and new local developments that might affect local air quality. The last round of Review and Assessment was in July 2004. The Review and Assessment concluded that there was not any air quality exceedences in Castlereagh Borough Council for all seven pollutants. As a result there has not been any Air Quality Management Areas declared in Castlereagh.



## 2 MONITORING RESULTS

### 2.1 Passive Monitoring

Castlereagh Borough Council currently monitors Nitrogen Dioxide (NO<sub>2</sub>) at 5 sites (through passive diffusion tubes) within the Local Authority Area. These sites are a mixture of urban background, roadside and kerbside. Table 2.1 shows the different site types and a brief description. The location plans for the different tubes can be found in Annex 1.

**Table 2.1 - NO<sub>2</sub> Tube Site Locations**

<u>Site number</u>	<u>Site address</u>	<u>Site type</u>	<u>Description</u>
3	Everton Drive	Urban Background	An urban location distanced from sources and therefore broadly representative of citywide background concentrations
4	Downshire Park	Urban Background	
1	Cregagh Road	Kerbside	Site sampling within 1m of the kerb of a busy road. The nearest relevant exposures are residential properties set back approximately 1 - 5 metres from the kerb.
5	Upper Newtownards Road	Kerbside	
6	Newtownbreda Road	Kerbside	

Table 2.2 below shows the average nitrogen dioxide levels in micrograms per cubic metre (ug/m<sup>3</sup>) for Castlereagh sites for the year 2002, 2003 and 2004, as well as the estimated values for 2005 and 2010 using the conversion factor supplied in the technical guidance (LAQM.TG (03)).

**Table 2.2 - Annual Nitrogen Dioxide levels for 2002/2003/2004/2005/and 2010**

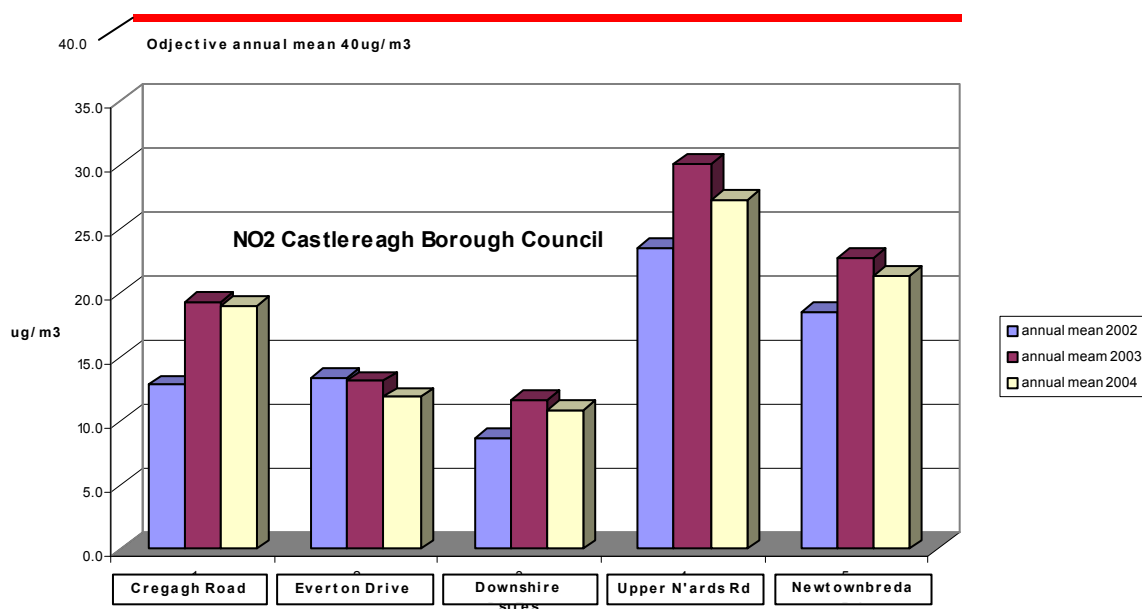
<u>Site</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2010</u>
1	12.8	19.3	19.0	18.5	15.2
3	13.4	13.1	11.9	11.6	9.5
4	8.6	11.7	10.8	10.5	8.6
5	23.5	30.1	27.2	26.5	21.8
6	18.5	22.8	21.3	20.8	17.1

The UK objectives give the annual mean for Nitrogen Dioxide to be at 40 ug/m<sup>3</sup> at relevant locations. Out of the sites in Castlereagh using the passive method of monitoring the last three years of analysis have confirmed that the levels are significantly beneath that of the threshold, this has been further illustrated in figure 2.1 highlighting that the greatest annual mean is that of site 5 (Upper Newtownards Road) for 2003 which is 9.9 ug/m<sup>3</sup> below that of the objective.

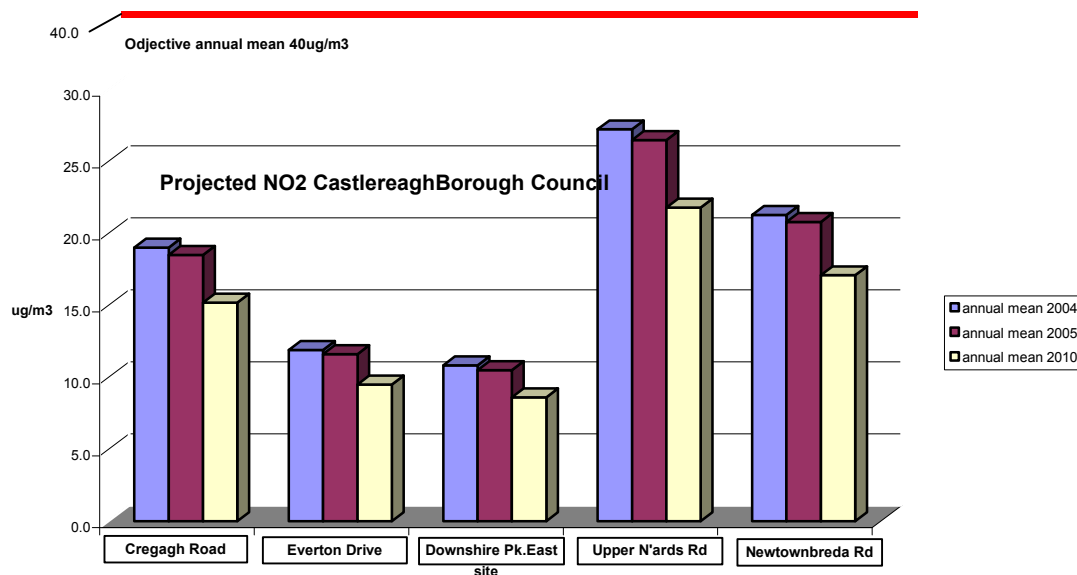
As can be seen from the estimated values for 2005 and 2010 there is a steady reduction in the annual levels of NO<sub>2</sub> over the 5 sites taking the monitored levels further away from the national objective, this can be visualised in Fig 2.2 indicating that with regard to Nitrogen Dioxide air quality is not deteriorating, even though traffic levels are increasing.

Laboratory bias has not been determined, as the tubes have been analysed in two different test houses. There are insufficient results from co location tubes to determine bias. Castlereagh Borough Council from May 2005 will implement three co location tubes at our automated Air Quality Analyser to determine specific bias for our local air quality.

**Figure 2.1 - Annual Nitrogen Dioxide Levels for 2002/2003/2004**



**Figure 2.2 - Annual Nitrogen Dioxide Levels for 2004/2005/2010**



## 2.2 Automated monitoring

Castlereagh Borough Council also monitors local air quality through 2 automated air stations - a roadside station which monitors for Nitrogen Dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub>) and an urban station which monitors for Sulphur Dioxide (SO<sub>2</sub>) and particulate matter (PM<sub>10</sub>). The location plans for the 2 different stations can be found in Annex 1.

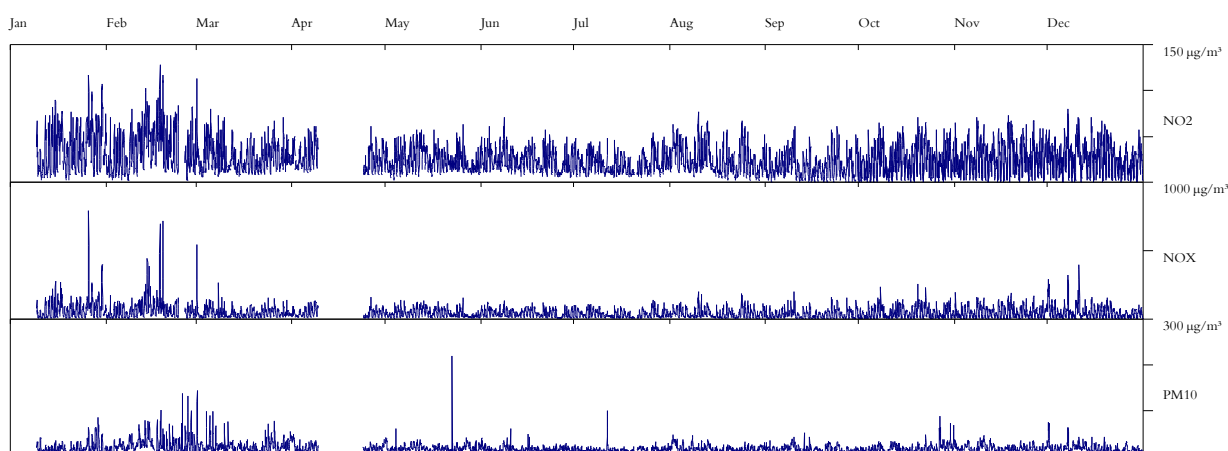
**Table 2.3 - Lough View Drive 2004**

(This data is provisional from 01/09/2004 and as such is subject to further quality control)

POLLUTANT	NO <sub>2</sub>	NO <sub>x</sub>	PM <sub>10</sub>
Number Very High	0	-	0
Number High	0	-	0
Number Moderate	0	-	5
Number Low	7877	-	8138
Maximum 15-minute mean	222 µg m <sup>-3</sup>	898 µg m <sup>-3</sup>	623 µg m <sup>-3</sup>
Maximum hourly mean	128 µg m <sup>-3</sup>	789 µg m <sup>-3</sup>	219 µg m <sup>-3</sup>
Maximum running 8-hour mean	100 µg m <sup>-3</sup>	346 µg m <sup>-3</sup>	68 µg m <sup>-3</sup>
Maximum running 24-hour mean	71 µg m <sup>-3</sup>	210 µg m <sup>-3</sup>	51 µg m <sup>-3</sup>
Maximum daily mean	64 µg m <sup>-3</sup>	197 µg m <sup>-3</sup>	44 µg m <sup>-3</sup>
Average	25 µg m <sup>-3</sup>	48 µg m <sup>-3</sup>	17 µg m <sup>-3</sup>
Data capture	89.7 %	89.7 %	93.1 %

**Table 2.4**

<b><u>POLLUTANT</u></b>	<b><u>AIR QUALITY REGULATIONS (NORTHERN IRELAND) 2003</u></b>	<b><u>EXCEEDENCES</u></b>	<b><u>DAYS</u></b>
Nitrogen Dioxide	Annual mean > 40 $\mu\text{g m}^{-3}$	0	-
Nitrogen Dioxide	Hourly mean > 200 $\mu\text{g m}^{-3}$	0	0
Nitrogen Oxides (NO <sub>2</sub> )	Annual mean > 30 $\mu\text{g m}^{-3}$	1	-
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 $\mu\text{g m}^{-3}$	1	1
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 40 $\mu\text{g m}^{-3}$	0	-

**Figure 2.3 - Lough View Drive Air Monitoring Hourly Mean Data for 2004****Table 2.5 - Espie Way 2004**

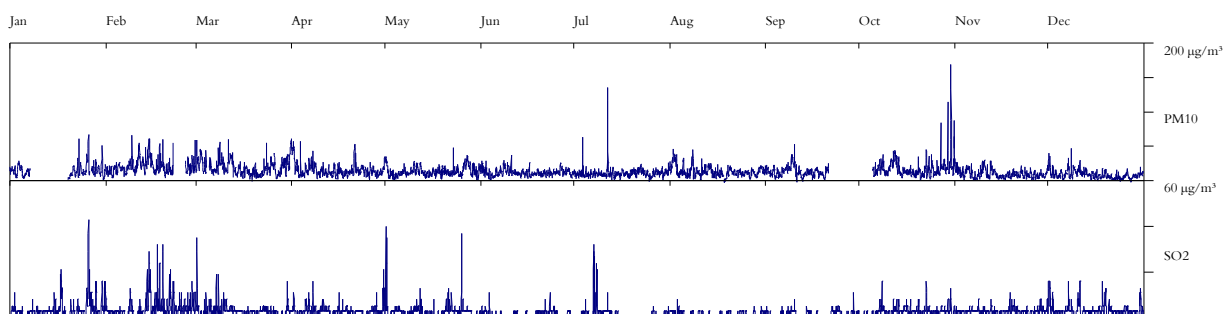
(This data is provisional from 01/09/2004 and as such is subject to further quality control)

<b><u>POLLUTANT</u></b>	<b><u>PM<sub>10</sub></u></b>	<b><u>SO<sub>2</sub></u></b>
Number Very High	0	0
Number High	0	0
Number Moderate	0	0
Number Low	7966	34369
Maximum 15-minute mean	267 $\mu\text{g m}^{-3}$	64 $\mu\text{g m}^{-3}$
Maximum hourly mean	169 $\mu\text{g m}^{-3}$	43 $\mu\text{g m}^{-3}$
Maximum running 8-hour mean	78 $\mu\text{g m}^{-3}$	23 $\mu\text{g m}^{-3}$
Maximum running 24-hour mean	49 $\mu\text{g m}^{-3}$	14 $\mu\text{g m}^{-3}$
Maximum daily mean	43 $\mu\text{g m}^{-3}$	13 $\mu\text{g m}^{-3}$
Average	14 $\mu\text{g m}^{-3}$	2 $\mu\text{g m}^{-3}$
Data capture	91.0 %	99.9 %

**Table 2.6**

<b><u>POLLUTANT</u></b>	<b><u>AIR QUALITY REGULATIONS (NORTHERN IRELAND) 2003</u></b>	<b><u>EXCEEDENCES</u></b>	<b><u>DAYS</u></b>
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	2	2
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 40 µg m <sup>-3</sup>	0	-
Sulphur Dioxide	15-minute mean > 266 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Hourly mean > 350 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Daily mean > 125 µg m <sup>-3</sup>	0	0

**Figure 2.4 - Espie Way Air Monitoring Hourly Mean Data for 2004**



As can be seen from Table 2.3 and Table 2.4 the percentage of data retrieved for 2004 from the Automated site located at Loughview Drive was between 90% and 93%, which provides confidence in the information obtained with regard to concentration levels are the Nitrogen Dioxide (NO<sub>2</sub>) and Particulate matter (PM<sub>10</sub>).

Table 2.4 shows that there was one exceedence of PM<sub>10</sub> for the year with a maximum level of 51ug m<sup>-3</sup> this is well below the permitted 35 exceedence per year, and the annual mean of 17 ug m<sup>-3</sup> is significantly beneath the annual mean of 40 ug m<sup>-3</sup>. ). Table 2.4 shows that there was one exceedence of NO<sub>2</sub> for the year with a maximum level of 71ug m<sup>-3</sup>, and the annual mean of 25 ug m<sup>-3</sup> is significantly beneath the annual mean of 40 ug m<sup>-3</sup>. These results are illustrated in Figure 2.3.

(more)

From Table 2.5 and Table 2.6 the percentage of data retrieved for 2004 from the Automated site located at Espie Way was between 91% and 99.9%, which provides confidence in the information obtained with regard to concentration levels are the Sulphur Dioxide (SO<sub>2</sub>) and Particulate matter (PM<sub>10</sub>).

Table 2.6 shows that there were two exceedences of PM<sub>10</sub> for the year with a maximum level of 49ug m<sup>-3</sup>, these two exceedences are well below the permitted 35 exceedence per year, and the annual mean of 14 ug m<sup>-3</sup> is significantly beneath the annual mean of 40 ug m<sup>-3</sup>. ). Table 2.6 shows that there was no exceedences of SO<sub>2</sub> for the year with a maximum level of 13ug m<sup>-3</sup>, and the annual mean of 2 ug m<sup>-3</sup>. These results are illustrated in Figure 2.4. (more)

In consultation with the helpdesk projecting the figures forward to 2005 and 2010 for PM<sub>10</sub> would not be required as we are beneath the 2010 objective already, Sulphur Dioxide is site specific and therefore can not be estimated, however as our annual mean is so low, it is unlikely to be a significant pollutant. The estimated values for Nitrogen Dioxide for 2005 and 2010 are 24.3 and 20.1 respectively, both of which are below the objective and show the trend in reduction similarly to the passive monitoring.

### 2.3 Other Air Quality Data

Table 2.7 shows a list of air quality complaints that Castlereagh Borough Council's Environmental Health team investigated in 2004, along with the number of abatement notices served.

**Table 2.7 - Breakdown of Air Quality Nuisance Investigations**

TYPE	NO OF COMPLAINTS	NOTICES SERVED
Domestic Smoke Complaints	13	0
Commercial Smoke Complaints	7	0
Dust Complaints	0	0
Odour Industrial/ Commercial	4	0
Odour Domestic	4	0
Odour Agricultural	7	0
Odour cause unknown	3	0
<b>Total</b>	<b>38</b>	<b>0</b>

As can be seen from above air quality is generally perceived as good with in Castlereagh Borough Council with few complaints received, and no notices having to have been served to abate nuisance.

### 3 NEW LOCAL DEVELOPMENTS

There are certain new developments that may affect the local air quality. Table 3.1 shows a list of these developments. Some of these new sites are previously operational sites that have either moved into the new PPC permitting regime or have recently been discovered, or by their sheer size may impact on air quality.

**Table 3.1 - New Developments with the potential to affect air quality**

NEW LOCAL DEVELOPMENTS	SITE LOCATION	OTHER INFORMATION
Part A process (none)		
Part B processes (2) Car sprayers	Dundonald	Site was previously authorised, closed and was then reopened by a new operator.
Petrol Station	Belvoir	Site was previously authorised, closed and was then reopened by a new operator.
New retail development	Belvoir	Proposed
New road Scheme (none)		
New mineral development (none)		
New landfill development (none)		
Major New housing developments (4)	Carryduff	Proposed
	Dundonald	Work has started
	Castlereagh	Continuation of existing site
	Castlereagh	Proposed



## **4 ACTION PLANS**

There are currently no action plans in Castlereagh Borough Council.





## AIR QUALITY STRATEGY

Castlereagh Air Quality Strategy is currently going through its final draft and will be formally released during the summer of 2004. Table 5.1 shows the summary section.

As the strategy is a working document for Castlereagh Borough Council consultation has been limited to departments in Castlereagh Borough Council whose duties can affect air quality and the elected members. The final version will be available on the Internet, and will be open for public consultation.

### **Table 5.1 - Summary section of Castlereagh's Air Quality Strategy 2005**

Castlereagh's air quality is currently within its target limits set by central government in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000. Therefore there have been no Air Quality Management Areas designated in Castlereagh.

The aim of the Air Quality Strategy aim is therefore to keep air quality in Castlereagh below these levels and to try to reduce the levels even further, whenever this is reasonably practical.

### **Table 5.1 - Main Aspects of the Air Quality strategy**

<ul style="list-style-type: none"><li>▪ The industrial processes authorised will continue to be regularly inspected and their authorizations/ permits will be reviewed and varied as necessary. These premises continue to operate within the limits set by their authorisation/permit and in line with current Best Available Techniques (BAT).</li></ul>
<ul style="list-style-type: none"><li>• Nitrogen dioxide monitoring by diffusion tubes will continue to be used in Castlereagh and this monitoring will be extended to areas where further monitoring will be beneficial.</li></ul>
<ul style="list-style-type: none"><li>• Automated air monitoring shall continue at the existing sites, co location tubes will also be erected to confirm diffusion results.</li></ul>
<ul style="list-style-type: none"><li>• Castlereagh Borough Council will continue to consult with the planning service and other external agencies with regards to planning applications for potentially pollution processes.</li></ul>

<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council's Environmental Health Department will continue to investigate complaints of smoke nuisances from both domestic and commercial properties. Should they witness any smoke nuisances they will take action as approved by Council.</li> </ul>
<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council will periodically review and update its smoke control zones should this prove necessary.</li> </ul>
<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council Environmental Health Department will continue to support and be an active member of the inter council and inter agencies for the routine consideration of current and potential air quality issues.</li> </ul>
<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council will continue to promote and encourage people to reduce air pollution and develop ways to reduce traffic pollution.</li> </ul>
<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council will continue to educate its citizens, stakeholders and businesses about air quality issues by different means including campaigns, leaflets and the Council Website.</li> </ul>
<ul style="list-style-type: none"> <li>• Castlereaugh Borough Council will continue to be involved in partnerships with other local authorities and agencies. Should any areas in Castlereaugh require to be designated an Air Quality Management Area then a partnership shall be set up to include relevant local business, industry and the community.</li> </ul>

## 6 PLANNING AND POLICIES

Certain planning applications require further information supplied to the Environmental Health Department in relation to their potential effect on the air quality before a consultation and comments can be returned to the Planning Service before a decision is made. Table 6.1 shows a list of recent applications that have had some air quality issues addressed in the application, the list also identifies new developments at the planning stage that may have an impact on air quality.

Since the completion of the 3<sup>rd</sup> Stage Review this Department has addressed 39 different planning applications highlighting the concerns regarding air quality. The concerns are forwarded to the Planning Service at the time of consultation.

**Table 6.1 - Planning Applications for which Air Quality Assessment is required**

<b><u>PLANNING APPLICATION</u></b>	<b><u>LOCATION</u></b>
Housing	Carryduff
Housing	Castlereagh
Housing	Dundonald
New Shopping Centre	Newtownbreda

Castlereagh Borough Council has various policies and have regard to policies, which all include ways to help improve air quality. Table 6.2 shows a list of these policies and a brief description of how they can improve air quality.

**Table 6.2 - Policies Designed to Help Improve Air Quality**

Local Agenda 21 Strategy	To promote sustainable development. Currently it may be integrated into the Community
Castlereagh Local Plan	To minimise adverse impacts of proposed development on the amenity.
Environment Strategy	To reduce to a minimum, emissions to air, water and land and reduce noise within the district.
Castlereagh Planning Strategy	To ensure that new development does not exacerbate air quality in existing and potential Air Quality Management Areas (AQMAs); To seek to mitigate existing and potential air quality pollution problems
Belfast Metropolitan Area Plan	The regeneration of areas of social need. Better integration between land use and transportation. Provide confidence for those wishing to develop.
Belfast Transport Area Plan	To reduce the need to travel. To encourage the use of alternatives to the private car. To provide an efficient, safe and accessible transportation system.



## 7 SUMMARY

The monitoring of Nitrogen Dioxide (NO<sub>2</sub>) in Castlereagh show that the levels of NO<sub>2</sub> are estimated that they will be below the limits set by Government for both 2005 and 2010.

Castlereagh Borough Councils Air Quality Strategy is currently under draft form and is programmed for release in the summer of 2005. While this strategy is only in draft form most of the strategies aims are in progress. A multi-disciplined forum for air quality is currently being developed as part of the Strategy.

There have been no new industrial processes opened in Castlereagh that may effect the air quality. There have been some minor processes that have been discovered and are in the process of obtaining permits. There are some processes that are moving into the Pollution Prevention Control regime and this will be progressed as detailed in the guidance. There has not been any significant increase in road traffic or any major new roads proposed. Planning applications are consulted and if deemed necessary an air quality assessment is produced. Applications where air quality has been considered all showed that air quality standards would not be exceeded.

There are various policies and strategies that have varying impacts on air quality. These policies and strategies are updated periodically. Part of the multi-disciplined forum will be to help prepare information for these reports, and this matter will be progressed once action plans are being proposed.

**MORE RQD**



## APPENDIX

# Appendices

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<b>APPENDIX 1</b>	<b>AUTOMATIC MONITORING STATION DATA</b>
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<b>APPENDIX 3</b>	<b>TRAFFIC DATA FROM OTHER LINKS/ROADS IN CASTLEREAGH/BELFAST</b>
<b>APPENDIX 4</b>	<b>MODEL VERIFICATION AND ADJUSTMENT</b>

# **Appendix 1**

## **Automatic Monitoring Station Data**

## **CASTLEREAGH AMBIENT AIR MONITORING PROGRAMME**

Castlereagh Borough Council has undertaken automatic ambient air monitoring of NO<sub>2</sub>, SO<sub>2</sub> and PM<sub>10</sub> since September 2002. Monitoring is carried out at two different locations: a roadside station measuring NO<sub>2</sub> and PM<sub>10</sub> (Castlereagh Lough View Drive – 335749, 370711) and a suburban background station measuring SO<sub>2</sub> and PM<sub>10</sub> (Castlereagh Espie Way – 337347, 371991). The instrumentation employed uses UV fluorescence for the measurement of SO<sub>2</sub>, the TEOM technique for PM<sub>10</sub>, and chemiluminescence for the measurement of NO<sub>2</sub>; these methods are appropriate for Detailed Assessment under LAQM (LAQM TG(03)). All TEOM data are quoted as gravimetric equivalent in accordance with the guidance.



**Location of the Automatic Monitoring Stations in Castlereagh**

Some data uncertainties and gaps have been overcome by comparing the data with AURN stations located in Northern Ireland (Belfast Centre, Belfast East and Derry) or by using an early period. Table A1.1 summarises the different cases:

**Table A1.1 Summary of data verification and amendment**

<b>DATA</b>	<b>REASON</b>	<b>SOLUTION</b>
Espie Way PM <sub>10</sub>	Low data capture (66.8%)	Follow LAQM guidelines to obtain annual average from a period of estimated mean
Espie Way SO <sub>2</sub>	Uncertainty on data	Data from Sept 02 to August 03 used as representative of 2003 data.
Lough View Drive PM <sub>10</sub> and NO <sub>2</sub>	Low data capture (75 and 63%)	Follow LAQM guidelines to obtain annual average from a period mean



## CASTLEREAGH ESPIE WAY AIR MONITORING

**Table A1.2 - Air Quality Summary Statistics, Espie Way in 2003**

POLLUTANT	PM <sub>10</sub> teom	PM <sub>10</sub> GRAVIMETRIC	SO <sub>2</sub>
Number Very High	0		0
Number High	0		0
Number Moderate	0		0
Number Low	5840		32877
Maximum 15-minute mean	165 µg m <sup>-3</sup>		112 µg m <sup>-3</sup>
Maximum hourly mean	68 µg m <sup>-3</sup>		93 µg m <sup>-3</sup>
Maximum running 8-hour mean	57 µg m <sup>-3</sup>		60 µg m <sup>-3</sup>
Maximum running 24-hour mean	44 µg m <sup>-3</sup>		44 µg m <sup>-3</sup>
Maximum daily mean	41 µg m <sup>-3</sup>		43 µg m <sup>-3</sup>
Average	14.5 µg m <sup>-3</sup>	19 µg m <sup>-3</sup>	4 µg m <sup>-3</sup>
Data capture	66.8 %		95.8 %

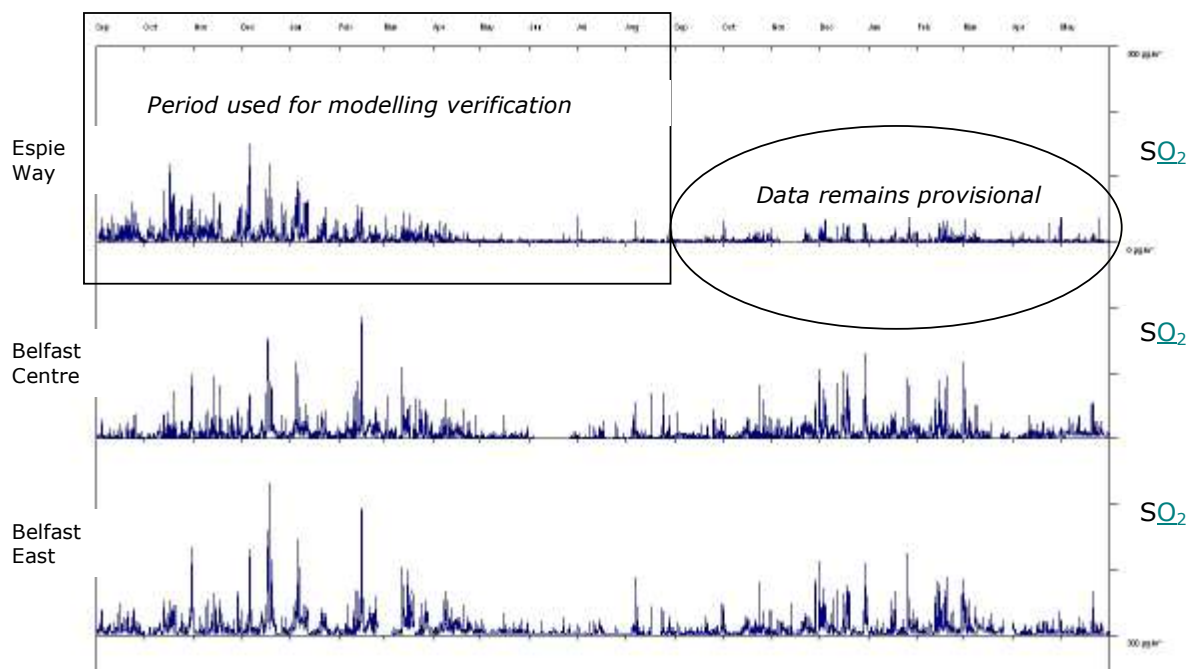
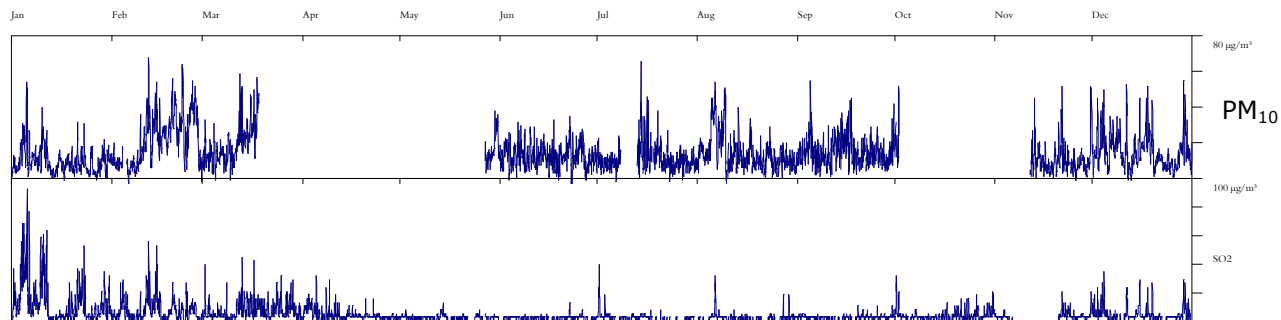
Note: A factor of 1.3 has been used to correct TEOM PM<sub>10</sub> to gravimetric equivalent PM<sub>10</sub>  
All mass units are at 20°C and 1013mb

**Table A1.3 - Air Quality Exceedence Statistics, Espie Way in 2003**

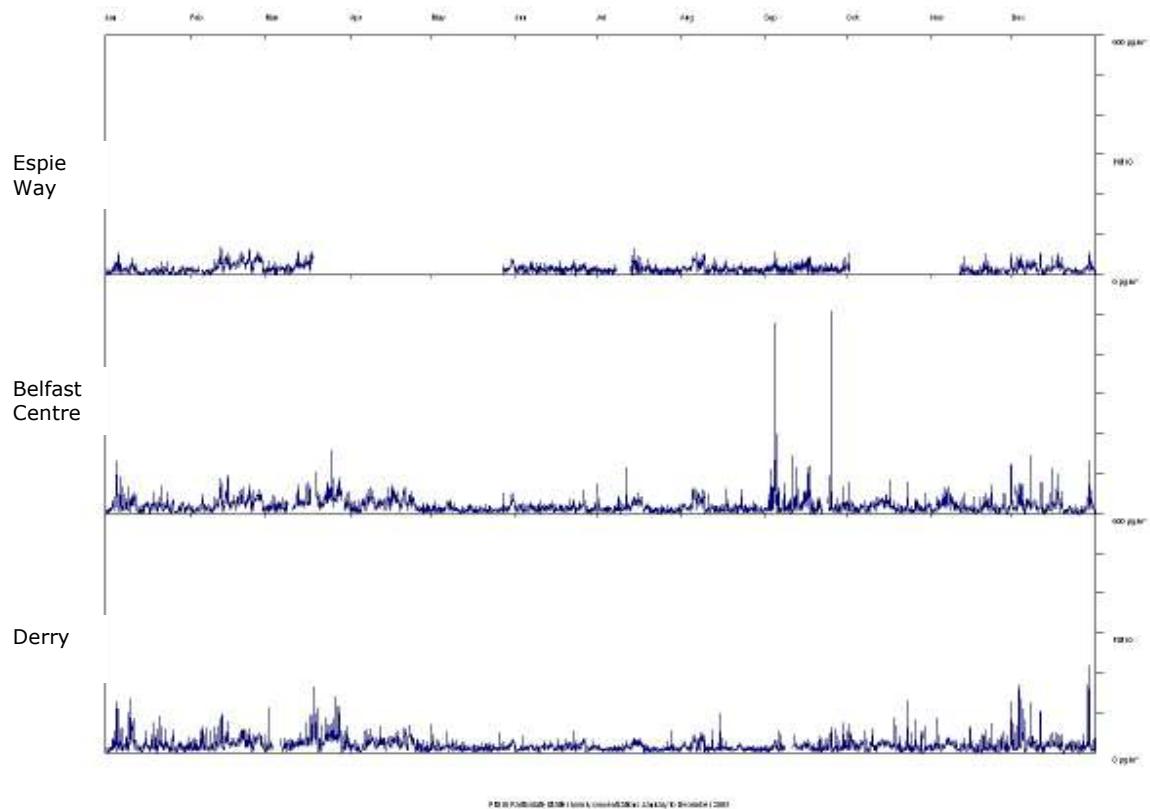
POLLUTANT	AIR QUALITY REGULATIONS (NORTHERN IRELAND) 2003	EXCEEDENCES	DAYS
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	4	4
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 40 µg m <sup>-3</sup>	0	-
Sulphur Dioxide	15-minute mean > 266 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Hourly mean > 350 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Daily mean > 125 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Annual mean > 20 µg m <sup>-3</sup>	0	-

Note: A factor of 1.3 has been used to correct TEOM PM<sub>10</sub> to gravimetric equivalent PM<sub>10</sub> (GR<sub>10</sub> in Table A1.2)

**HOURLY MEAN DATA FOR 01 JANUARY TO 31 DECEMBER 2003**



**SO<sub>2</sub> data from Espie Way compared to AURN Stations in Belfast**



**PM<sub>10</sub> data from Espie Way compared to AURN Station in Belfast and Derry**

# CASTLEREAGH LOUGH VIEW DRIVE AIR MONITORING

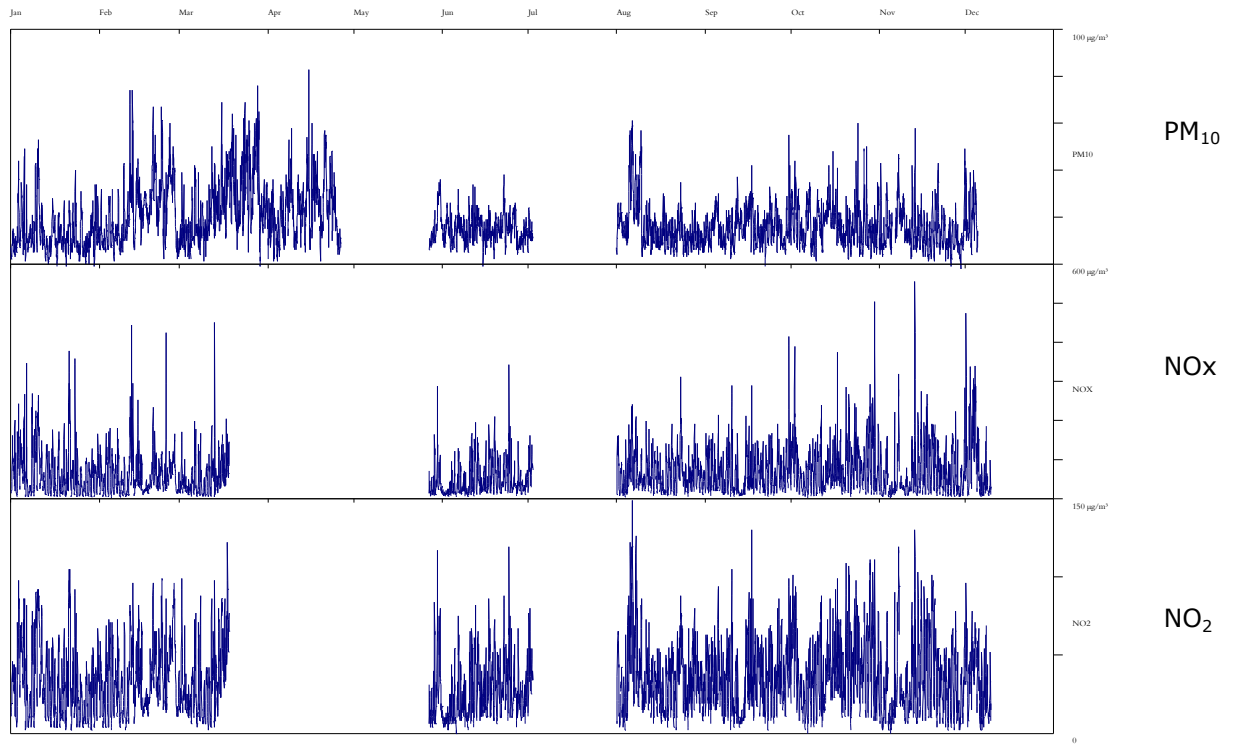
**Table A1.4 - Air Quality Summary Statistics, Lough View Drive in 2003**

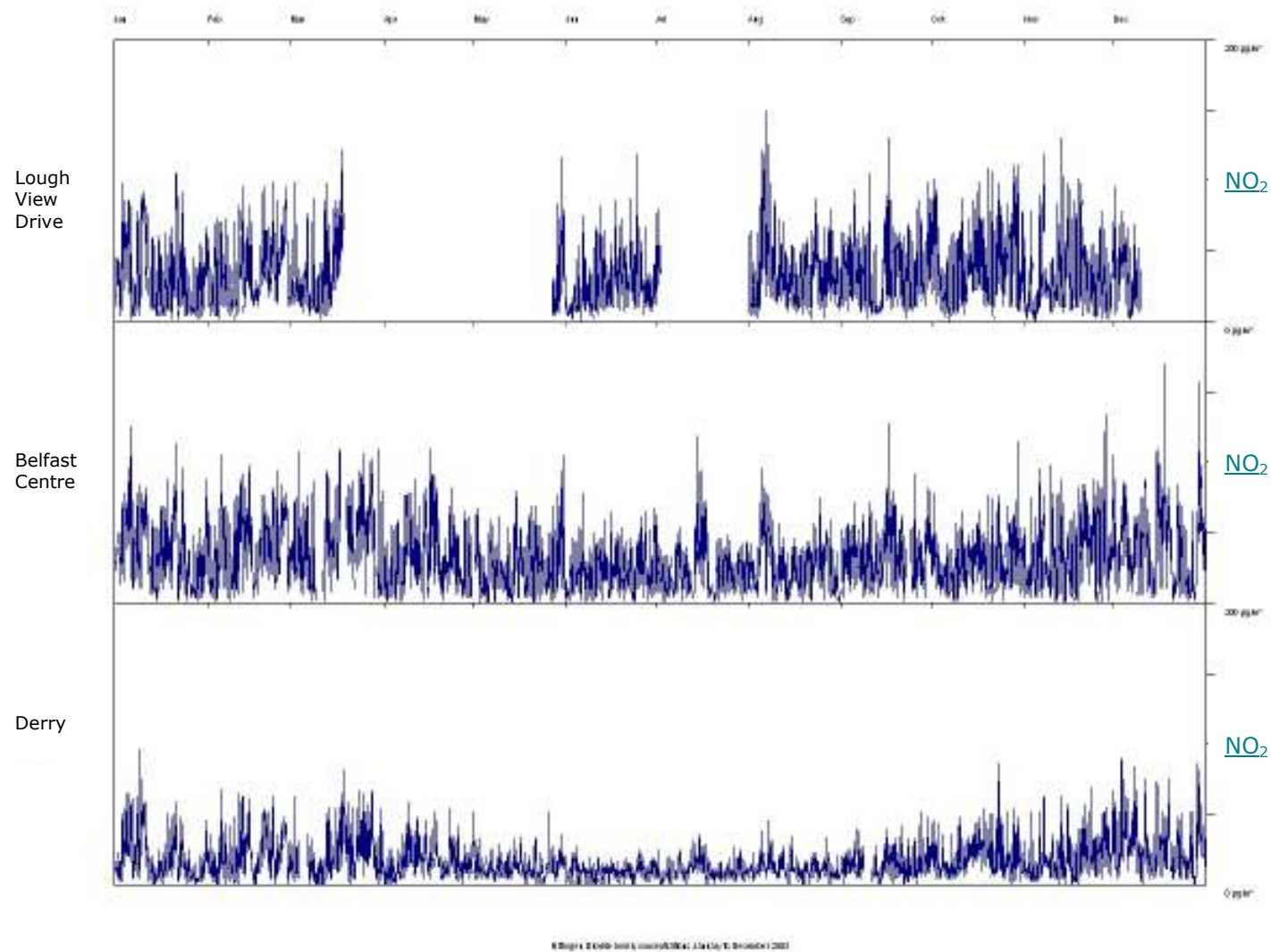
POLLUTANT	PM <sub>10</sub>	NO <sub>x</sub>	NO <sub>2</sub>
Number Very High	0	-	0
Number High	0	-	0
Number Moderate	4	-	0
Number Low	6619	-	5507
Maximum 15-minute mean	144 µg m <sup>-3</sup>	651 µg m <sup>-3</sup>	163 µg m <sup>-3</sup>
Maximum hourly mean	83 µg m <sup>-3</sup>	556 µg m <sup>-3</sup>	149 µg m <sup>-3</sup>
Maximum running 8-hour mean	57 µg m <sup>-3</sup>	273 µg m <sup>-3</sup>	119 µg m <sup>-3</sup>
Maximum running 24-hour mean	51 µg m <sup>-3</sup>	225 µg m <sup>-3</sup>	92 µg m <sup>-3</sup>
Maximum daily mean	47 µg m <sup>-3</sup>	205 µg m <sup>-3</sup>	80 µg m <sup>-3</sup>
Average	18 µg m <sup>-3</sup>	64 µg m <sup>-3</sup>	34 µg m <sup>-3</sup>
Data capture	75.7 %	62.9 %	62.9 %

Note: A factor of 1.3 should be used to correct TEOM PM<sub>10</sub> to gravimetric equivalent PM<sub>10</sub>  
All mass units are at 20°C and 1013mb

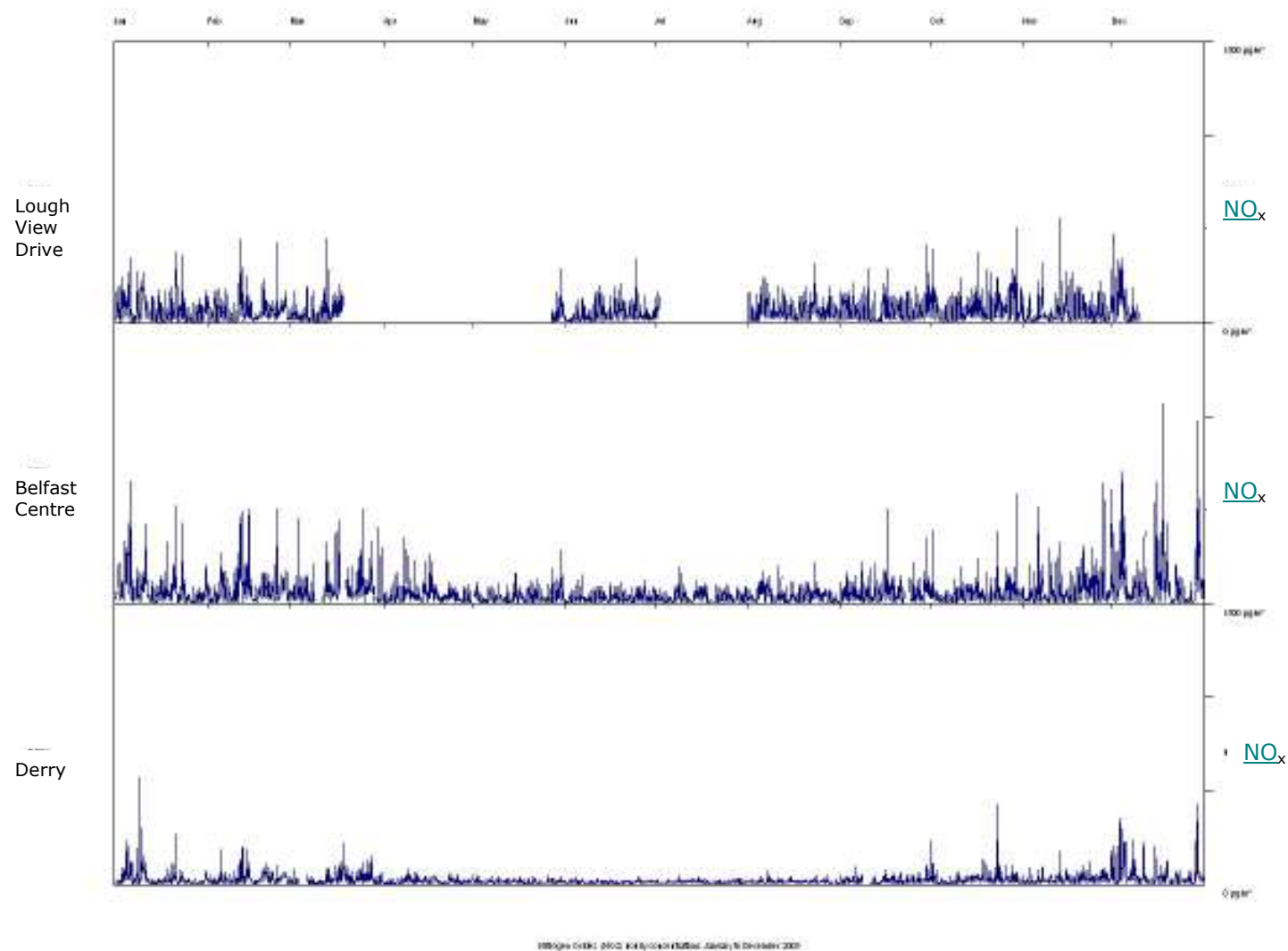
**Table A1.5 - Air Quality Exceedence Statistics, Lough View Drive in 2003**

POLLUTANT	AIR QUALITY REGULATIONS (NORTHERN IRELAND) 2003	EXCEEDENCES	DAYS
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	9	9
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Oxides (NO <sub>2</sub> )	Annual mean > 30 µg m <sup>-3</sup>	1	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

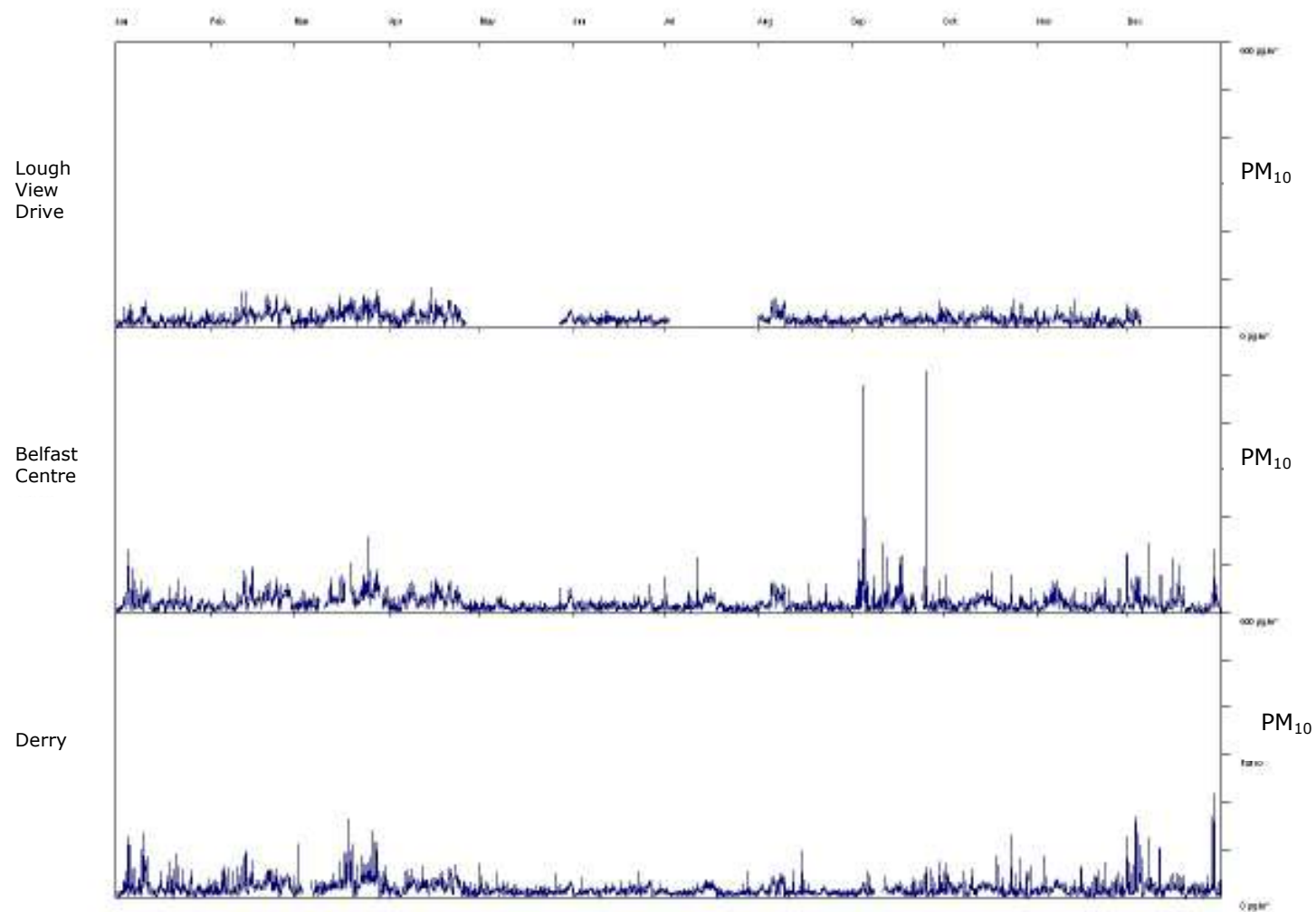




**$\text{NO}_2$  Data at Lough View Drive compared to data at Belfast Centre and Derry**



**$\text{NO}_x$  Data at Lough View Drive compared to data at Belfast Centre and Derry**



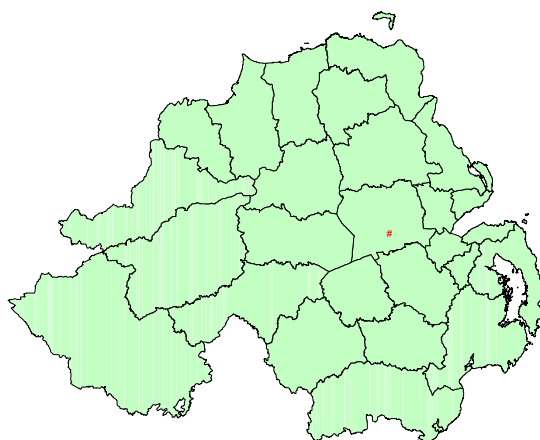
PM10 Data at Lough View Drive compared to data at Belfast Centre and Derry

**PM<sub>10</sub> Data at Lough View Drive compared to data at Belfast Centre and Derry**



# **Appendix 2**

## **Aldergrove Met Station Data**

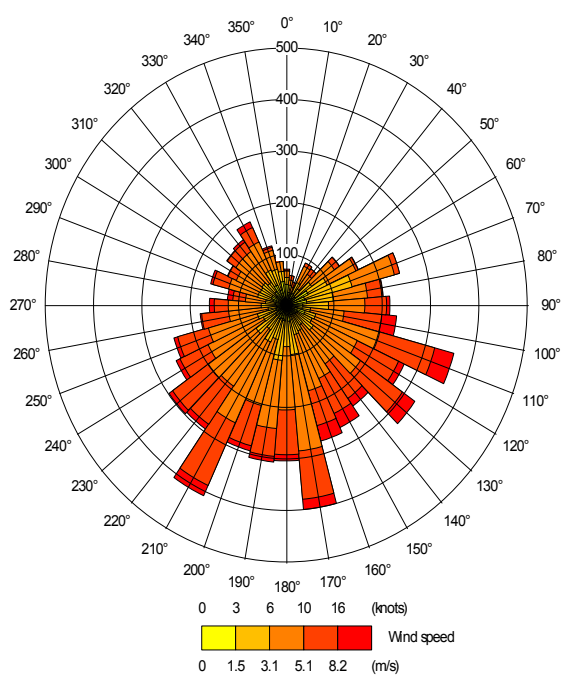


**Figure A2- Location of Aldergrove Station**

**Table A2 - Characteristics of Aldergrove Station**

Description – Aldergrove International airport	
DCNN	9142
Eastings	314700
Northings	379800
Latitude Deg Min	54 39 N
Longitude Deg Min	06 13 W
Station height AMSL (m)	68
Effective height of anemograph (m)	10

**Wind rose for the Aldergrove 2003 met data**



# **Appendix 3**

**Traffic Data from other Links/  
Roads in Castlereagh and Belfast**

Grid Ref No	Road	Location	Direction	24 Hr 2-Way Flow	Year
32973697	M1	Blacks Road On Slip	To Belfast	15065	2002
32983696	M1	Blacks Road Off Slip	To Blacks Road	14119	2003
33083713	M1	At Stockmans Lane Bridge	To Belfast	52390	2001
33173725	M1	Stockmans Lane to Broadway	To Belfast	65152	2002
33263735	Westlink	At Roden Street	To City Centre	60308	2001
33353751	Westlink	At Clifton Street (Southbound)	Towards M1	33894	2002
33353752	Westlink	At Clifton Street (Northbound)	Towards M2	41140	2002
33153708	Lisburn Road	At Kings Hall	To City Centre	12381	2002
33733756	Sydenham By-Pass	East of Airport Entrance	To Belfast	53956	2002
33823726	Knock Road	At Shell Service Station	To Upper Knockbreda	38812	2002
33893743	Hawthornden Way	At Campbell College	To Parkway	27772	2002
33503725	Ravenhill Rd	South of Broughton Gardens	To Belfast	20717	2003
33333732	Donegall Road	West of Sandy Row	To City Centre	12371	2002
33723741	Upper Newtownards Rd	Opposite Fire Station	To City Centre	22275	2001
33443726	Ormeau Road	North of Ormeau Bridge	To City Centre	29602	2000
33443743	Oxford Street	Opposite Court House	To East Bridge Street	33998	2000
33423744	Victoria Street	At Marlborough Street	To Dunbar Link	38401	2000
33413739	May Street	West of Montgomery Street	To City Hall	21820	1999
33453744	Queen's Bridge	Bridge End (In)	To City Centre	18225	2000
33453744	Station Street Flyover	Bridge End	To Bridge End	10380	2000
33473739	East Bridge Street	Albert Bridge	To City Centre	29844	2002
33413741	Chichester Street	At Multi Storey Car park	To Victoria Street	14009	2000
33293738	Grosvenor Road	West of Westlink	To City Centre	17655	2002
33323744	Westlink	At Divis Street (To M2)	Towards M1	42111	2000
33323744	Westlink	At Divis Street (To M1)	Towards M2	45547	2000
33693744	Hollywood Road	West of Pomona Avenue	To City Centre	17449	2002
33413750	Nelson Street	At Little Patrick Street	To City Centre	6655	2001
33453755	Garmoyle Street	North of Dock Street	To Corporation Street	14366	2001
33563744	Newtownards Road	At Belvoir Street	To City Centre	18483	2002
33593740	Albertbridge Road	East of Templemore Street	To City Centre	22163	2002
33423711	Annadale Embankment	At Deramore High School	To Kings Bridge	14820	2002
33543689	Saintfield Road	South of Lenaghan Avenue	To City Centre	24885	2002
33503706	Saintfield Road	North of Church Drive	To City Centre	23831	2001
33913739	Upper Newtownards Rd	Near Cabinhill Park	To City Centre	34468	2000
33153708	Lisburn Road	At Kings Hall South Slip	To Balmoral Avenue	12664	2002
33163709	Lisburn Road	At Kings Hall North Slip	To City Centre	12730	2002
34073739	Upper Newtownards Rd	At Dundonald Cemetery	To Belfast	37530	2002
32803675	Queensway	At Derriaghy Cricket Club	To Belfast	11128	2002
33443759	Duncrue Street	South of Milewater Road	To Garmoyle Street	5212	2002
33733737	North Road	South of Kirkliston Drive	To Grand Parade	14603	2002
33403723	Stranmillis Embankment	Kings Bridge to Ormeau Bridge	To Ormeau Bridge	7701	2002
33413721	Annadale Embankment	Kings Bridge to Ormeau Bridge	To Ormeau Bridge	10257	2002
33463729	Ormeau Embankment	Ravenhill Road to Ormeau Road	To Ormeau Road	12111	2002
33423754	York Street	South of Brougham Street	To York Road	18861	2002
33063696	Finaghy Road South	-	To Upper Malone Road	12918	2002
33023703	Finaghy Road North	-	To Upper Lisburn Road	11208	2001
33643680	Knockbracken Road	-	To Saintfield Road	3297	2002
33503743	Short Strand	South of Mountpottinger Link	To City Centre	27054	2002
33503743	Mountpottinger Link	At Bus Depot	To City Centre	7600	1999
33,423,753	York Street	(Off)	To Nelson Street	47158	2002
33423753	M3	M2 ONSLIP	-	63453	2003
33623674	Saintfield Road	At Ivanhoe Inn	To City Centre	32886	2002

# **Appendix 4**

## **Model Verification and Adjustment**

Data from the two monitoring stations in Castlereagh BC has been used to verify and adjust the output results from DISP and LADSRurban models. The data used are:

- Castlereagh Espie Way (PM<sub>10</sub> and SO<sub>2</sub>)
- Castlereagh Lough View Drive (PM<sub>10</sub> and NO<sub>2</sub>)

### **NOX/NO<sub>2</sub> VERIFICATION AND ADJUSTMENT**

NOx-NO<sub>2</sub> data from Lough View Drive roadside has been use to verify and adjust the model results at Castlereagh Lough View Drive. As covered in Appendix 1, the NOx-NO<sub>2</sub> data capture for 2003 in Lough View Drive was of 60%. In order to verify whether this result could be applied as representative of the full dataset for 2003, the data was compared to Belfast Centre and Derry. As specified in LAQM.TG(03), NOx-NO<sub>2</sub> period averages from the two AURN station have been compared to NOx-NO<sub>2</sub> annual averages. Table A4.1 shows the corrected NOx-NO<sub>2</sub> annual average (NOx annual = 61 and NO<sub>2</sub> annual = 33).

**Table A4.1 - Corrected NO<sub>x</sub>-NO<sub>2</sub> Annual Averages at Lough View Drive**

PERIOD/ANNUAL	BELFAST CENTRE	AM/PM	DERRY	AM/PM	LOUGH VIEW DRIVE	RA	LOUGH VIEW DRIVE ANNUAL 2003
NO <sub>2</sub> period (Pm)	33		17		34		
NO <sub>2</sub> 2003 (Am)	32	0.970	17	1.000		<b>0.985</b>	<b>33</b>
NOx period (Pm)	61		27		64		
NOx 2003 (Am)	59	0.967	25	0.0926		<b>0.946</b>	<b>61</b>

(see LAQM.TG(03))

### **NOX**

Rural background NOx levels of 25ugm-3 has been added to a modelled NOx (38ugm-3) given a value of total NOx of 63ugm-3. This is very close result compared to the annual measured result at Lough View Drive of 61 ugm-3.

### **NO<sub>2</sub>**

NO<sub>2</sub> road contribution has been calculated from the modelled NOx (38umg-3) road contribution following recommendations in LAQM.TG(03). NO<sub>2</sub> road contribution is of 9 umg-3. This added to a background annual mean of 20ugm-3 gives a total modelled NO<sub>2</sub> result of 29ugm-3. Therefore, the following correction factor has been used:

$$\frac{NO_2 \text{ monitoring data}}{[Annual \text{ mean}]} = background_{NO_2} + Modelled \text{ result} + 4$$

### **SO<sub>2</sub> VERIFICATION AND ADJUSTMENT**

Annual average rural SO<sub>2</sub> background was obtained from 1kmx1km maps (4 ugm-3). The modelled contribution at the Espie Way monitoring station was of 3 ugm-3. Therefore, the modelled results at Espie Way was of 7 ugm-3<sup>1</sup>.

<sup>1</sup> Please note that the monitoring data of SO<sub>2</sub> for 2003 runs from September 2002 to August 2003. This is due to the 2003 data remains provisional pending engineers reports on the data compared to other SO<sub>2</sub> concentrations across Northern Ireland

**Table A4.2 - SO<sub>2</sub> Model Verification**

BACKGROUND		MODELLED CONTRIBUTION		FINAL MODELLED
4	+	3	=	7

$$SO_2 \text{ monitoring data} = \text{background}_{SO_2} + \text{Modelled result}$$

[Annual mean]

Pye and Vincent (2003) relationships from short-term concentration and annual mean were obtained (see table A4.3). These following multipliers have been applied to adjust modelled concentrations 15 minutes, hourly and daily with monitoring results

$$SO_2 \text{ monitoring data} = \text{Modelled result} \times 1.18$$

[15min 99.9%ile]

$$SO_2 \text{ monitoring data} = \text{Modelled result} \times 1.07$$

[1-hour 99.7%ile]

$$SO_2 \text{ monitoring data} = \text{Modelled result} \times 1.80$$

[24-hour 99.189%ile]

:

**Table A4.3 - SO<sub>2</sub> Model Verification for short term concentrations**

SHORT TERM CONCENTRATION	MODELLED (USING PYE AND VINCENT, 2003)	MEASURED AT ESPIE WAY	MULTIPLIER
15 minute mean - 99.9 <sup>th</sup> percentile	<b>85.6</b>	<b>101</b>	<b>1.18</b>
1 hour mean - 99.7 <sup>th</sup> percentile	<b>64.6</b>	<b>69</b>	<b>1.07</b>
24 hour mean - 99.18 <sup>th</sup> percentile	<b>23.3</b>	<b>42</b>	<b>1.80</b>

### **PM<sub>10</sub>**

PM<sub>10</sub> data from both monitoring stations have been used to verify and adjust model results. As the data capture was below 90%, the data obtained from a period of monitoring, has been converted to full 2003 following recommendations in the LAQM.TG(03). Table Table A2.1 show the results obtained at both monitoring stations. The PM10 results from DISP do not have to be adjusted as background plus DISP is equal to the monitoring data. However, the LADSUrban results have to be adjusted by a factor of 2.25. This factor of 2.25 is probably due to resuspension of dust which is not taken into account in LADSUrban.

**Table A4.1 - Corrected NO<sub>x</sub>-NO<sub>2</sub> Annual Averages at Lough View Drive**

PERIOD/ANNUAL	BELFAST CENTRE	AM/PM	DERRY	AM/PM	LOUGH VIEW DRIVE	RA	LOUGH VIEW DRIVE ANNUAL 2003
PM <sub>10</sub> period (Pm)	19.0		19.1		17.7		
PM <sub>10</sub> 2003 (Am)	18.5	0.974	18.1	0.948	-	0.961	17 (22.1 in grav)
Perid/Annual	Belfast Centre	Am/Pm	Derry	Am/Pm	Espie Way	Ra	Lough View Drive Annual 2003
PM <sub>10</sub> period (Pm)	18		17.3		14.2		
PM <sub>10</sub> 2003 (Am)	18.5	1.027	18.1	1.046		1.036	14.7 (19.1 in grav)

\*Teom data (need to multiply it by a factor of 1.3 to obtain gravimetric)

**Table 3.1 - Summary of model bias correction**

	<b>MONITORING DATA 2003</b>	<b>BACKGROUND (FROM NAEI)</b>	<b>DISP (DOMESTIC FUEL)</b>	<b>LADSRBAN (ROAD EMISSIONS)</b>	<b>ADJUSTMENT FACTOR</b>
<b>Espie Way</b> BACKGROUND	19.1 $\mu\text{g m}^{-3}$	18 $\mu\text{g m}^{-3}$	1.1 $\mu\text{g m}^{-3}$	0 $\mu\text{g m}^{-3}$	<i>No factor necessary</i>
<b>Lough View Drive</b> ROADSIDE	22.1 $\mu\text{g m}^{-3}$	18 $\mu\text{g m}^{-3}$	0.5 $\mu\text{g m}^{-3}$	1.6 $\mu\text{g m}^{-3}$	21.3=18+0.5+ (1.6* <b>2.25</b> )