



2010 Air Quality Progress Report

Newry & Mourne D.C.

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

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Executive Summary

This 2010 Progress Report for Newry and Mourne District Council provides a review and assessment of all new or existing potential sources of air quality pollutants and a summary of air quality monitoring results for the calendar year 2010.

2010 monitoring data identified exceedances of the annual mean objective for nitrogen dioxide (NO₂) (40µg/m³) for a number of streets within Newry City. These streets are within an existing Air Quality Management Area - Newry (Urban Centre) Air Quality Management Area for which there is an agreed Action Plan.

Air quality monitoring results for NO₂ and PM₁₀ for 2010 were elevated from 2009 and it is argued within this report that these increases were due mainly to the prevailing weather conditions during 2010 rather than as a result of new or increased sources of pollutants.

During 2010 air quality monitoring in Canal Street, Newry, monitored exceedances for the 1-hour mean objective (200µg/m³) for NO₂ at and for the 24-hour mean objective (50 mgm⁻³) for PM₁₀. Consequently Newry and Mourne District Council propose to proceed to a Detailed Assessment for the 1-hour mean objective for NO₂ and the 24-hour mean objective for PM₁₀ at Canal Street, Newry.

The Council continues to monitor progress in the implementation of the agreed Action Plan for the Newry Urban Centre) Air Quality Management Area and this is reported on within this report.

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1 Introduction

1.1 Description of Local Authority Area

Newry and Mourne District Council (NMDC) area lies on the east coast of Ireland with its southern boundary forming part of the border between Northern Ireland and the Republic of Ireland. Its neighbouring council areas in Northern Ireland are Down District Council (North East), Banbridge District Council (North) and Armagh City and District Council (North West). To the South it shares a boundary with Louth County Council and Monaghan County Council in the Republic of Ireland.

The existing council area had a population of 87,000 in the 2001 census. Newry, (from the Irish *Iuir Cinn Tra* meaning Head of the Strand), is the largest settlement in the council area. With a population of 27,430 in the 2001 census, the city accommodates approximately 32% of the total population of the district.

Newry City is set in the valley of Clanrye River between two mountain ranges, the Mourne Mountains in Northern Ireland and the Cooley Mountains in the Republic of Ireland. The Clanrye River empties into Carlingford lough. Running parallel with the Clanrye River through Newry City is Newry Canal. The canal is for much of its route unused today, although some leisure crafts travel from Carlingford Lough to the edge of Newry City using this route.

Newry City has a thriving commercial sector and with its proximity to the border with the Republic of Ireland it experiences fluctuations in cross border trade depending on the exchange rate between sterling and the euro. When the exchange rate is favourable shoppers from the Republic of Ireland visit Newry City with resultant increases in traffic volumes.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management process as set out in the Environment (Northern Ireland) Order 2002, the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an AQMA and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

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 microgram's per cubic metre $\mu\text{g}/\text{m}^3$ (milligram's 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 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	3.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

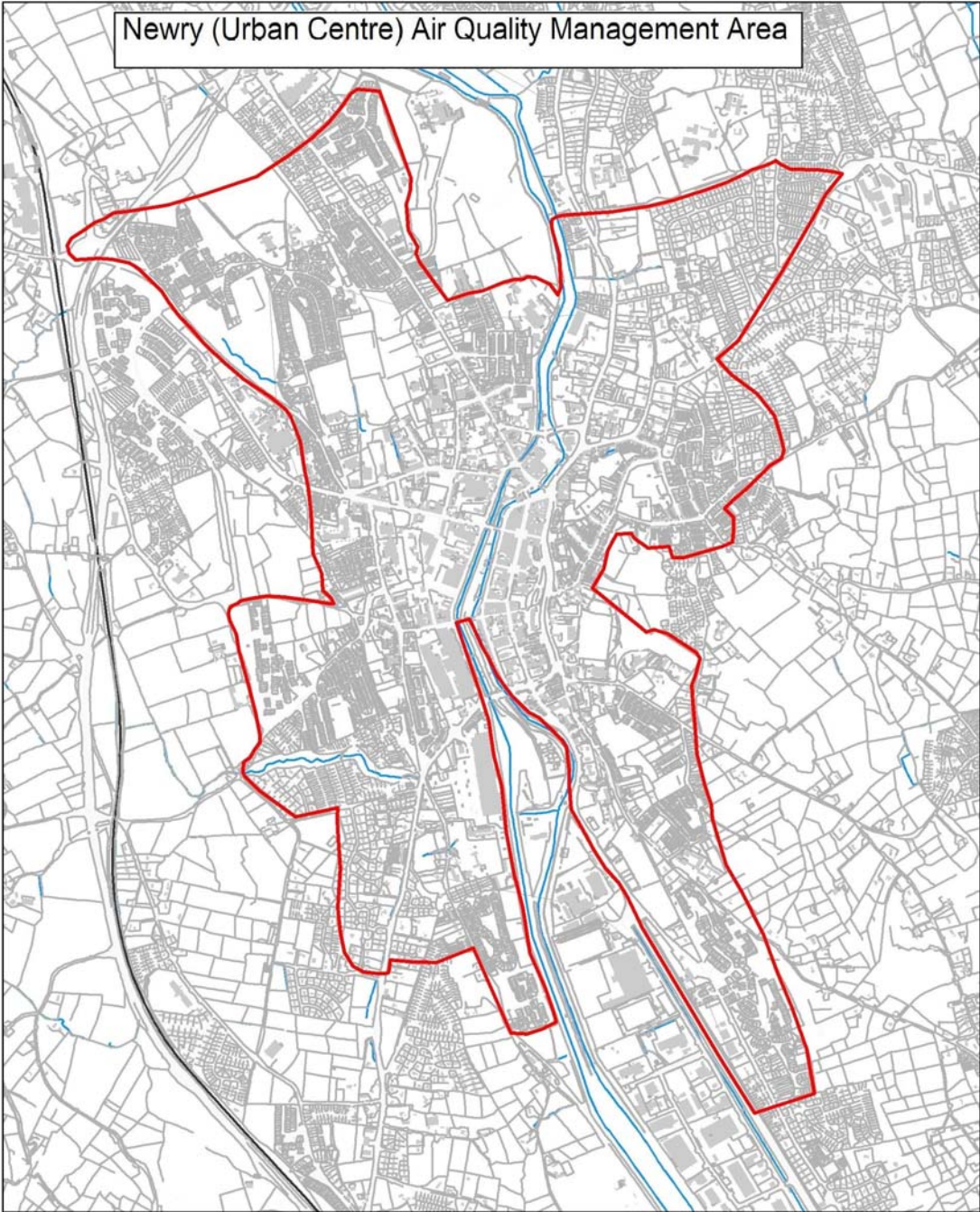
1.4 Summary of Previous Review and Assessments

Table 1.2 Summary Newry and Mourne Air Quality Review and Assessment

Title of Work	Summary of Report
USA (2004)	Potential exceedences of the NO₂ and PM₁₀ AQS objectives in the vicinity of several roads in Newry City centre
Detailed Assessment (2005)	Concluded a risk of exceeding air quality objectives for NO₂ and PM₁₀ in Newry city centre. There was a high degree of uncertainty in the modelling results. Following discussions with the Environment and Heritage Service of the Department of Environment (NI), NMDC resolved to declare five AQMA's for the annual mean NO₂ objective and the 24-hour PM₁₀ objective
USA (2006)	Concluded that the risk of the air quality objectives for NO₂ being exceeded outside existing AQMA's was negligible for all sources. In addition, the USA indicated that there was little likelihood of the 2004 air quality objectives for PM₁₀ being exceeded.
Further Assessment (2007)	The results showed that NO₂ annual average concentrations within the AQMA were still likely to exceed the AQS objective along Canal Street, Water Street and Kilmorey Street in Newry City. Given the uncertainties in modelling PM₁₀ , the focus of the further assessment and source apportionment study was therefore focused on NO_x and NO₂
Further Modelling (2009)	The model performance was improved from 2005 results. The results showed that NO₂ annual average concentrations within the AQMA were still likely to exceed the AQS objective along Canal Street, Water Street, Kilmorey Street, and a newly identified street, Sandy Street in Newry City. The model indicated that there was little likelihood of the 2004 air quality objectives for PM₁₀ being exceeded within Newry City. The Council resolved to revoke existing 5 AQMA's and to declare one AQMA for the annual mean NO₂ objective covering all areas of possible exceedance - Newry (Urban Centre) AQM.
USA (2009)	As no new or significantly changed sources of pollutants were identified a further detailed assessment was not required. Newry and Mourne Council finalised the Action Plan for the Newry (Urban Centre) AQMA.
Progress Report 2010	The PM10 AQ Objective was not breached during 2009. A new site was established at Canal Street in June 2009. This site recorded 21 exceedances of the daily mean objective for PM10 50mg/m ³ . The street had formally been declared an AQMA for PM10 but this was revoked following further dispersion modelling results (Further Assessment 2009), which indicated that exceedance of PM10 objective

	<p>was not likely within Newry City. Monitoring of PM10 has continued at this location. 2009 monitoring data found that a number of sites of relevant exposure breached the annual mean objective for nitrogen dioxide. All of these sites were within the existing AQMA.</p>
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Figure 1.1 Map showing boundary of Newry (Urban Centre) AQMA



0 130 260 520 780 1,040
Meters

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2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Table 2.1 provides details of the automatic monitoring sites within Newry and Mourne District Council area.

There are currently three automatic monitoring sites. The automatic monitoring stations within the district are National Environmental Technology Centre (NETCEN) type tested and approved analysers, which contain an air-conditioned unit to maintain the correct operating temperature. Newry and Mourne District Council currently have a QA/QC and Data Management contract with Netcen (AEA Technology Plc). QA/QC audits have been completed on the automatic monitoring equipment currently located within the Council area. A QA/QC contract has been running since 1st March 2002 and certified calibration results are available to cover this period.

All data from each station is downloaded daily by remote communication via modem to Council Offices.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring technique?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
Monaghan Row*	Background	X307855 Y 326749	PM ₁₀	Y	FDMS	N	50m	N
Trevor Hill	Roadside	X 308716 Y 326734	PM ₁₀ NO ₂	Y	FDMS	N	3m	Y
Canal Street**	Roadside	X308485 Y 326976	PM ₁₀ NO ₂	Y	N/A	Y (<1M)	3M	Y

* AQMA declared for NO₂

** Commencement of monitoring June 2009

Refer to Appendix 2 for Figure 8.2 Map of Automatic Monitoring Sites

2.1.2 Non-Automatic Monitoring

Newry and Mourne District Council currently deploy 35 No₂ diffusion tubes per month at 33 sites within its District (all within Newry City Centre). The NO₂ diffusion tubes used were prepared and analysed by Gradko Ltd using the 50% TEA in acetone method. The laboratory methods are currently UKAS accredited.

Refer to Appendix 3 for Figure 8.3 - Map of Non-Automatic Monitoring Sites

Table 2.2 Details of Non- Automatic Monitoring Sites

Location	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
1	Canal Street (Pub)	Roadside	308463	327003	NO ₂	Y	Y	1m	Y
2	13 Canal St	Roadside	308516	326909	NO ₂	Y	Y	1m	Y
3	Catherine Street	Roadside	308450	327007	NO ₂	Y	Y	2m	Y
4	Mourneview Park	Roadside	308484	327182	NO ₂	Y	Y	1m	Y
5	College Gardens	Roadside	308118	327445	NO ₂	Y	Y	2m	Y
6	25 Sandy Street	Roadside	308973	326873	NO ₂	Y	Y	1m	Y
7	59 Sandy Street	Roadside	308929	326861	NO ₂	Y	Y	1m	Y
8	Arthur Street	Roadside	309114	326947	NO ₂	Y	Y	1.5m	Y
9	Church Street	Roadside	309175	326583	NO ₂	Y	Y	1m	Y
10	Hennessy Park	Roadside	308929	325911	NO ₂	Y	Y	1m	Y
11	Water Street	Roadside	308688	326593	NO ₂	Y	Y	1m	Y
12	Trevor Hill 1, 2, 3	Roadside	308716	326734	NO ₂	Y	N	2m	Y
13	33 Kilmorey Street	Roadside	308668	325918	NO ₂	Y	Y	1m	Y
14	52 Kilmorey Street	Roadside	308727	325869	NO ₂	Y	Y	1m	Y
15	115 Chapel St	Roadside	308985	325510	NO ₂	Y	Y	1m	Y
16	4 Bridge Street	Roadside	308443	325896	NO ₂	Y	Y	2m	Y
17	60 Bridge Street	Roadside	308330	325789	NO ₂	Y	Y	1m	Y
18	Basin View Terrace	Roadside	308239	325607	NO ₂	Y	Y	1m	Y
19	Doran's Hill	Roadside	308033	326153	NO ₂	Y	Y	1m	Y
20	Dominic/Patrick Street	Roadside	308177	326170	NO ₂	Y	Y	1m	Y
21	Francis Street	Roadside	308205	326138	NO ₂	Y	Y	2m	Y
22	Market Office	Urban Background	308539	326129	NO ₂	Y	N	25m	Y

Location	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
23	St Mary Street	Roadside	308505	326097	NO ₂	Y	Y	1m	Y
24	Main Ave Derrybeg	Roadside	307429	327541	NO ₂	Y	Y	1m	Y
25	42 Patrick Street	Roadside	308072	326608	NO ₂	Y	Y	1m	Y
26	Monaghan Row	Urban Background	307855	326749	NO ₂	Y	N	50m	Y
27	Pine Grove	Roadside	308208	325259	NO ₂	Y	Y	1m	Y
28	4 Windsor Hill	Roadside	309007	326900	NO ₂	Y	Y	1m	Y
29	9 Kilmorey Terrace	Roadside	308078	326567	NO ₂	Y	Y	2m	Y
30	2 Chapel Street	Roadside	308829	325802	NO ₂	Y	Y	2m	Y
31	71 Kilmorey Street	Roadside	308775	325803	NO ₂	Y	Y	1m	Y
32	Camrough Road1	Near road	306909	327510	NO ₂	N	Y	10m	N
33	Camrough Road2	Near road	306765	327566	NO ₂	N	Y	5m	N

2.2 Comparison of Monitoring Results with Air Quality Objectives

The existing monitoring network consists of three continuous monitoring stations and 35 NO₂ diffusion tubes. There is one NO₂ diffusion tube co-location site at Trevor Hill Newry (33 sites).

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

In 2010 the Council monitored NO₂ at two sites in Newry City: Trevor Hill and Canal Street.

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

Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
				2008	2009	2010
Trevor Hill	Y	89.5%	89.5%	46.0	44	44
Canal Street	Y	94.5%	94.5%	N/A	N/A	44

Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Number of Exceedences of hourly mean ($200 \mu\text{g}/\text{m}^3$) If the period of valid data is less than 90% of a full year, include the 99.8 th percentile of hourly means in brackets.		
				2008	2009	2010
Trevor Hill	Y	89.5%	89.5%	5 (172)	0	8 (178)
Canal Street	Y	94.5%	94.5%	N/A	N/A	34

Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes

Location	Within AQMA	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$) Adjusted for bias		
				2008	2009	2010
Canal St (Pub)	Y	100	100	50	61	65
13 Canal Street	Y	67	67	N/A	N/A	57
Catherine Street	Y	92	92	36	42	52
Mourneview Park	Y	50	50	N/A	N/A	10
College Gardens	Y	75	75	N/A	N/A	24
25 Sandy Street	Y	92	92	41	49	58
59 Sandy Street	Y	100	100	56	56	51
Arthur Street	Y	92	92	N/A	N/A	25
Church Street	Y	100	100	N/A	N/A	31
Hennessy Park	Y	100	100	N/A	N/A	19
Water Street	Y	100	100	41	46	60
Trevor Hill 1	Y	92	92	35	44	45
Trevor Hill 2	Y	92	92	34	43	44
Trevor Hill 3	Y	92	92	33	45	44
33 Kilmorey St	Y	100	100	44	53	60
52 Kilmorey St	Y	100	100	39	48	54
Main Ave Derrybeg	N	92	92	N/A	N/A	20
4 Bridge St	Y	100	100	31	38	43
60 Bridge St	Y	100	100	N/A	N/A	33
Basin View Terrace	Y	100	100	32	41	45
Doran's Hill	Y	100	100	N/A	N/A	29
Dominic / Patrick St	Y	100	100	29	25	41
Francis Street	Y	100	100	33	42	46
Market Office	Y	100	100	18	22	24
St Mary Street	Y	100	100	24	32	34
115 Chapel St	Y	100	100	N/A	N/A	23
42 Patrick St	Y	100	100	36	46	52
Monaghan Row	Y	100	100	13	14	16
Pine Grove	Y	100	100	N/A	N/A	37
4 Windsor Hill	Y	92	92	26	39	25
9 Kilmorey Terrace	Y	100	100	25	31	40
2 Chapel Street	Y	100	100	N/A	28	34
71 Kilmorey Street	Y	100	100	N/A	51	69
Camrough Road1	N	100	100	N/A	16	22
Camrough Road2	N	100	100	N/A	20	25

2.2.2 PM₁₀

In 2010 the Council monitored PM₁₀ at three sites in Newry City: Monaghan Row, Trevor Hill and Canal Street. Monaghan Row and Trevor Hill use R&P TEOM (FDMS) instruments, Canal St use R & P Teom instrument.

Table 2.5a Results of PM₁₀ Automatic Monitoring: Comparison with Annual Mean Objective

Location	Within AQMA?	Data Capture for monitoring period ^a %	Data Capture for full calendar year 2010 %	Annual mean concentrations (µg/m ³)	
				2009	2010
Monaghan Row	Y*	87.9%	87.9%	14	21
Trevor Hill	Y	89.5%	89.5%	24	31
Canal Street	Y	98.6%	98.6%	31	37

* AQMA declared for NO₂

Table 2.5b Results of PM₁₀ Automatic Monitoring: Comparison with 24-hour Mean Objective

Location	Within AQMA?	Data Capture for monitoring period ^a %	Data Capture for full calendar year 2010 %	Number of Exceedences of daily mean objective (50 µg/m ³) If data capture < 90%, include the 90 th percentile of daily means in brackets.		
				2008	2009	2010
Monaghan Row	Y*	87.9%	87.9%	12(34)	6	16 (40)
Trevor Hill	Y	89.5%	89.5%	12(44)	6	46 (55)
Canal Street**	Y	98.6%	98.6%	N/A	21	73

* AQMA declared for NO₂

** Data has been corrected using Volatile Correction Model (VCM)

2.2.3 Sulphur Dioxide

In 2010 there was no monitoring of sulphur dioxide undertaken within the council area.

2.2.4 Benzene

In 2010 there was no monitoring of benzene undertaken within the council area.

2.2.5 Other pollutants monitored

In 2010 there was no other pollutants monitored within the council area.

2.3 Air Quality Trends

The Air Pollution in Northern Ireland 2009 Report published by the Department of the Environment (NI) reports that recent years have seen a marked improvement in Northern Ireland's overall air quality.

Figure 2.1 below shows annual mean concentrations of PM10 at Monaghan Row (Background site) and Trevor Hill (Roadside Site) during the period 1998 to 2010. For reference purposes the annual mean objective of 40 $\mu\text{g}/\text{m}^3$ is also provided. Figure 2.1 demonstrates that there has been a general reduction in urban background PM10 concentrations at Monaghan Row since 1998. For the Council's roadside site at Trevor Hill, which became operational in 2001, there is also an overall decreasing trend. However, for both sites 2010 shows an increase in levels monitored compared to the previous three years. The winter period of 2010 was characterised with periods of unusually cold weather and periods of time where it is likely that temperature inversions were being experienced within Newry City. This period of exceptionally cold weather has resulted in higher levels of PM 10 being monitored within the city.

Figure 2.2 below shows annual mean concentrations of NO2 concentrations at a number of diffusion tube sites throughout Newry City. Two of the sites, Monaghan Row and Market Office, are urban background sites with the remaining being roadside sites and considered to be sites of relevant exposure. For reference purposes the annual mean objective of 40 $\mu\text{g}/\text{m}^3$ is also provided. There are no clear trends in NO2 concentration for these sites although the results recorded at all sites for 2010 were higher than in the immediate preceding years. The high levels in 2010 would, in this Council's opinion, be related to the exceptionally cold weather during the winter of 2010.

2010 was a reminder to us all that annual mean pollutant concentrations will vary from year to year due to a number of factors, which may include changes to pollution sources in the local area in addition to factors outside the influence of Newry and Mourne District Council such as regional transboundary pollution issues and variations in weather conditions. The latter can have a significant influence on pollutant concentrations which is demonstrated from the monitoring results for 2010.

Figure 2.1: PM10 Annual Mean Value at Selected Newry City Sites, 1998 to 2010

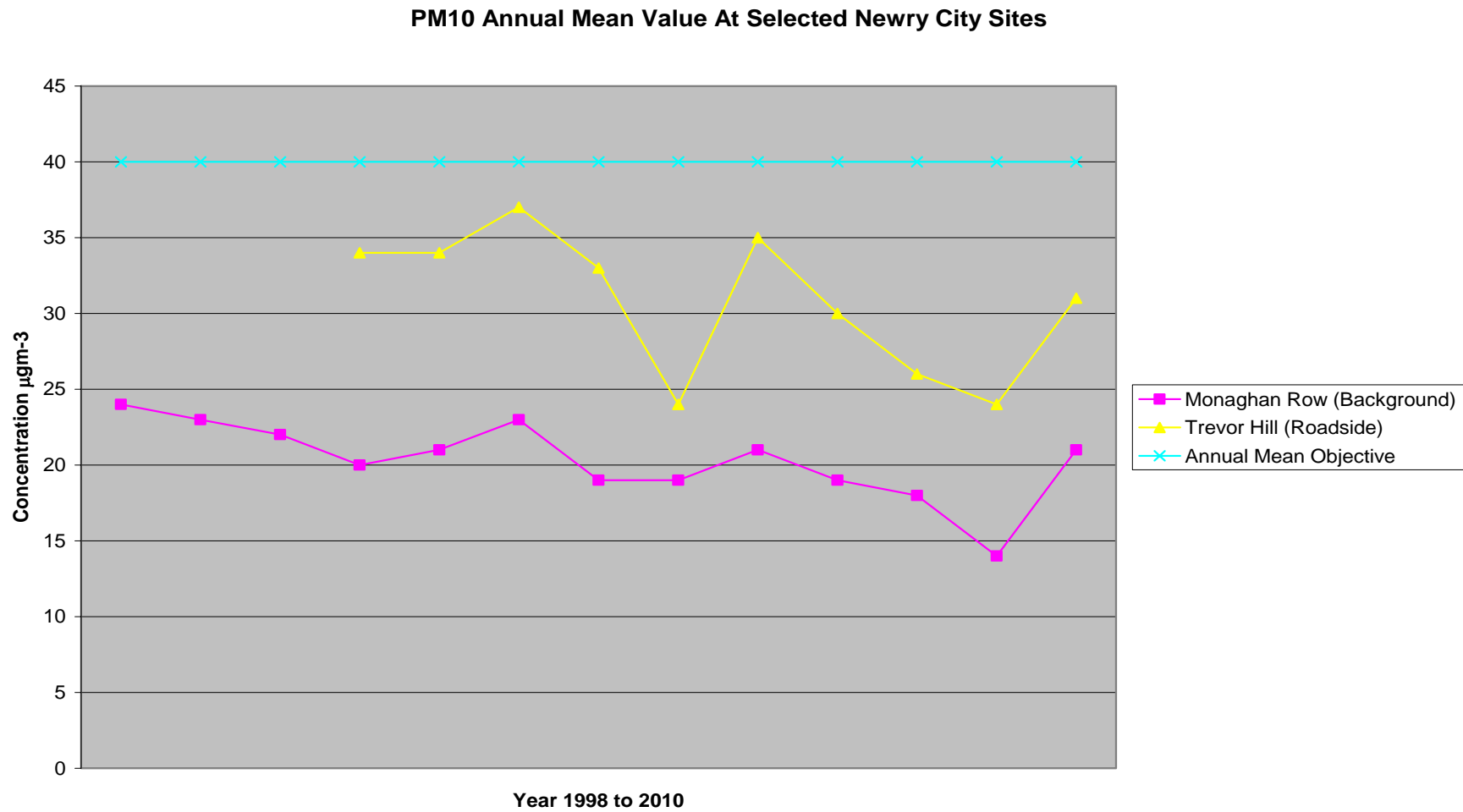
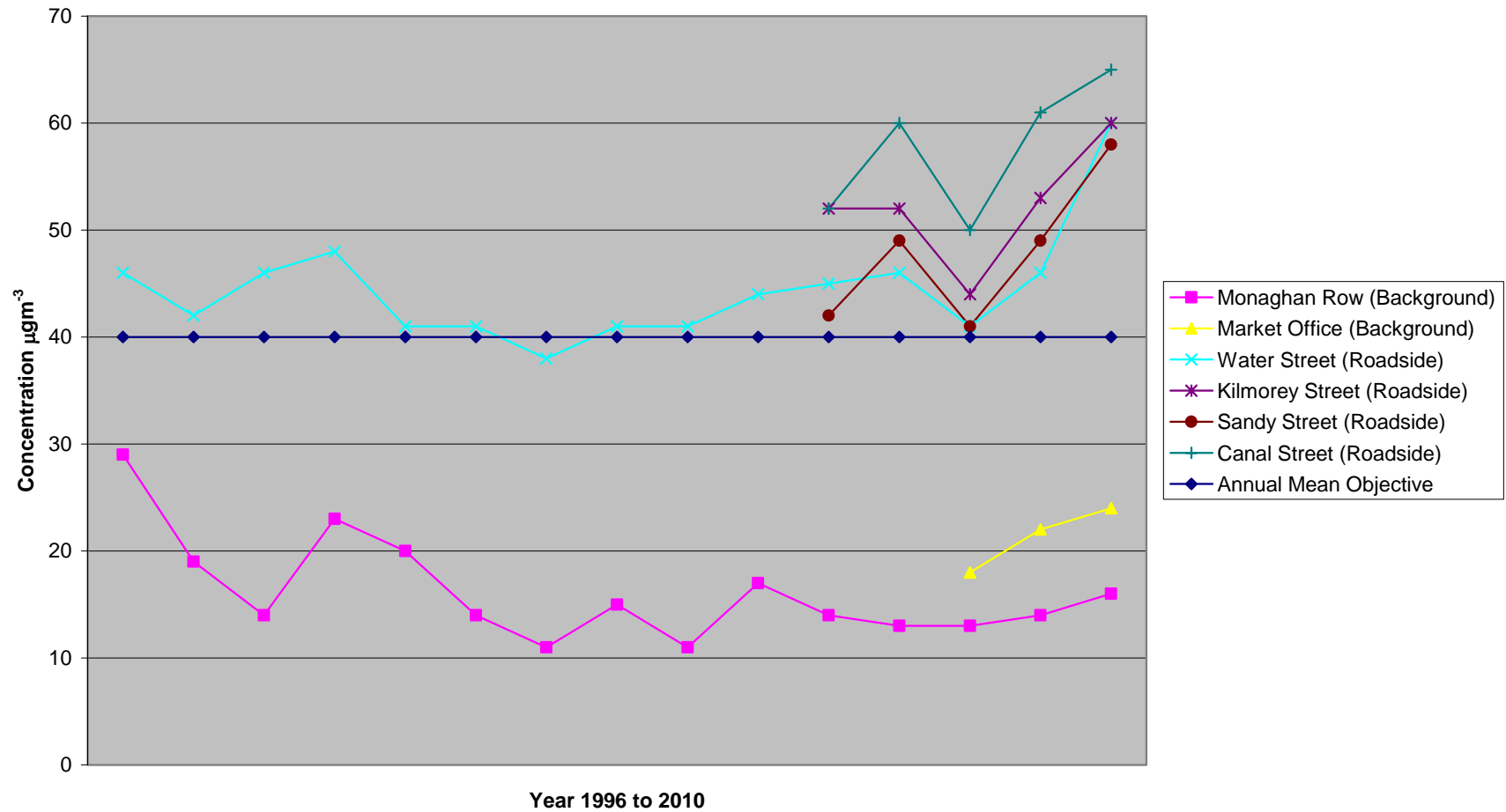


Figure 2.2 NO2 Annual Mean Value at Selected Newry City Sites, 1996 to 2010

NO2 Annual Mean Value At Selected Newry City Sites



2.3.1 Summary of Compliance with AQS Objectives

Newry & Mourne District Council has measured concentrations of Nitrogen Dioxide above the 1-hour mean objective and the PM10 24-hour mean objective at relevant locations and **will need to proceed to a Detailed Assessment** for Canal Street, Newry.

3 New Local Developments

3.1 Road Traffic Sources

Newry and Mourne District Council confirm that there are no new/newly identified congested streets with residential properties close to the kerb.

Newry and Mourne District Council confirm that there are no new/newly identified busy streets where people may spend one hour or more close to traffic.

Newry and Mourne District Council confirm that there are no new/newly-identified roads with a high flow of buses and/or HGVs.

Newry and Mourne District Council confirm that there are no new/newly identified busy junctions.

In July 2010 a 12km stretch of A1 between Beech Hill and Cloghogue was officially opened to traffic. The road carries over 20,000 vehicles per day and has the potential to reduce traffic entering Newry City.

Newry and Mourne District Council confirm that there are no new/newly-identified roads with significantly changed traffic flows.

Newry and Mourne District Council confirm that there are no relevant bus stations in the District.

3.2 Other Transport Sources

Newry and Mourne District Council confirm that there are no airports in the District or neighbouring authorities that have a throughput of 5 million passengers per year and/or 500,000 tonnes of freight.

Newry and Mourne District Council confirm there are no new, or newly identified, locations where diesel locomotives or steam trains are regularly stationary for fifteen minutes or more.

Newry and Mourne District Council confirm that there are no new/newly-identified locations with a large number of movements of diesel locomotives and potential long-term relevant exposure within 30m.

Newry and Mourne District Council confirm that there are no new/newly-identified ports.

3.3 Industrial Sources

Newry and Mourne District Council confirm that there have been no new or proposed industrial installations for which an air quality assessment has been required in the Newry and Mourne area since the last Progress Report.

Newry and Mourne District Council confirm that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area since the last Progress Report.

Newry and Mourne District Council confirm that there are no new or significantly changed installations with any previous air quality assessment since the last Progress Report.

Newry and Mourne District Council confirm that there are no major fuel (petrol) storage depots within the Local Authority area.

Newry and Mourne District Council confirm that there are no petrol stations meeting the specified criteria.

Newry and Mourne District Council confirm that there are no poultry farms meeting the specified criteria.

3.4 Commercial and Domestic Sources

Newry and Mourne District Council confirm that there are no new Biomass Combustion plants since the last Progress Report.

Newry and Mourne District Council confirm that there are no new areas where the combined impact of several biomass combustion sources may be relevant since the last Progress Report.

Newry and Mourne District Council confirm that there are no new areas of significant domestic fuel use in the district since the last Progress Report.

3.5 New Developments with Fugitive or Uncontrolled Sources

Newry and Mourne District Council confirm that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

4 Local / Regional Air Quality Strategy

Newry and Mourne District Council's Air Quality Management Strategy 2006-2010 has been completed. The strategy was launched in tandem with the 4 neighbouring councils (Armagh, Banbridge, Craigavon and Dungannon and South Tyrone) in 2006.

The strategy successes included:

- Promotion of the use of public transport, car sharing, walking and cycling as a means to get to school.
- Promotion of the use of public transport, car sharing, walking and cycling as a means to get to work.

Newry and Mourne District Council will continue with this work through the implementation of the Newry (Urban Centre) Air Quality Action Plan and other associated projects such as the Newry, Low Carbon City Project.

5 Planning Applications

Newry and Mourne District Council can confirm that there has been no planning applications approved which it is considered will have a significant detrimental impact on the air quality within the district.

6 Air Quality Planning Policies

Within Northern Ireland the Department of the Environment Planning Service has responsibility for implementing government planning policy and development plans.

With regard to this Council area, the Banbridge / Newry and Mourne Area Plan 2015 is a development plan being prepared under the provisions of Part III of the Planning (Northern Ireland) Order 1991 by the Planning Service.

The proposals for this council area consist of designations, policies, proposals and zonings specific to the administrative area of the council (including Newry city centre). The Plan recognises that the continuing growth in road transport has consequential impacts on air quality. If left unmanaged traffic growth has social and economic consequences, such as congestion and the effect on residents' quality of environment, and the reduced attractiveness of town centres as retail and service destinations.

In addition to the overall Plan Strategy, the Development Strategy for Newry identifies projects to relieve existing and potential congestion within the city centre by proposing a road-widening scheme at Bridge Street, a Southern bypass and a Rathfriland Road link. The latter two schemes will enable east-west cross-city traffic to avoid the city centre.

The assessment of applications for development within the council considers the extant plan and Draft Plan plus the Planning Strategy for rural Northern Ireland and a number of other Planning Policy Statements (PPSs) and Development Control Advice Notes (DCANs) issued by Planning Service. These will be material in the decision making process and a professional judgement is made as to the weight to be given to the various policies. While there is no actual policy relating to air quality, the issue can be considered under PPS1 General Principles (Para 59)

“The Department’s guiding principle in determining planning applications is that developments should be permitted, having regard to the development plan and all other material considerations, unless the proposed development will cause demonstrable harm to interests of acknowledged importance. In such cases the Department has the power to refuse planning permission. Grounds for refusal will be clear, precise and give a full explanation of why the proposal is unacceptable to the Department.”

Planning permission may be refused if the proposed development will cause demonstrable harm.

7 Local Transport Plans and Strategies

Public transport in Northern Ireland is delivered mainly through the actions of the Northern Ireland Transport Holding Company (NITHC) and its Translink operating subsidiaries; Metro, NI Railways and Ulsterbus. A key corporate aim is integration and co-ordination of services.

Through the Ulsterbus Strategic Review (USR), Ulsterbus and Translink seek to establish a platform for change, which will create in Northern Ireland a network of services that is comparable with any modern transport system. This will result in the development of modern, efficient, reliable services that rival the private car in convenience, accessibility and value for money.

Under the Newry USR, the reviewed and enhanced services were implemented from February 2007.

These following improvements have been achieved or are in the process of being achieved:

- simplified and standardised modern route network, designed to meet customers needs;
- low floor accessible vehicles;
- simplified clock face timetables to ease understanding;
- enhanced hourly services between Newry and Rathfriland;
- increased frequency and more regular services between Newry and Armagh;
- half hourly services between Newry and Belfast during peak times; and
- Provision of a new rail passenger terminal in Newry City.

8 Climate Change Strategies

Newry and Mourne District Council vision is to:

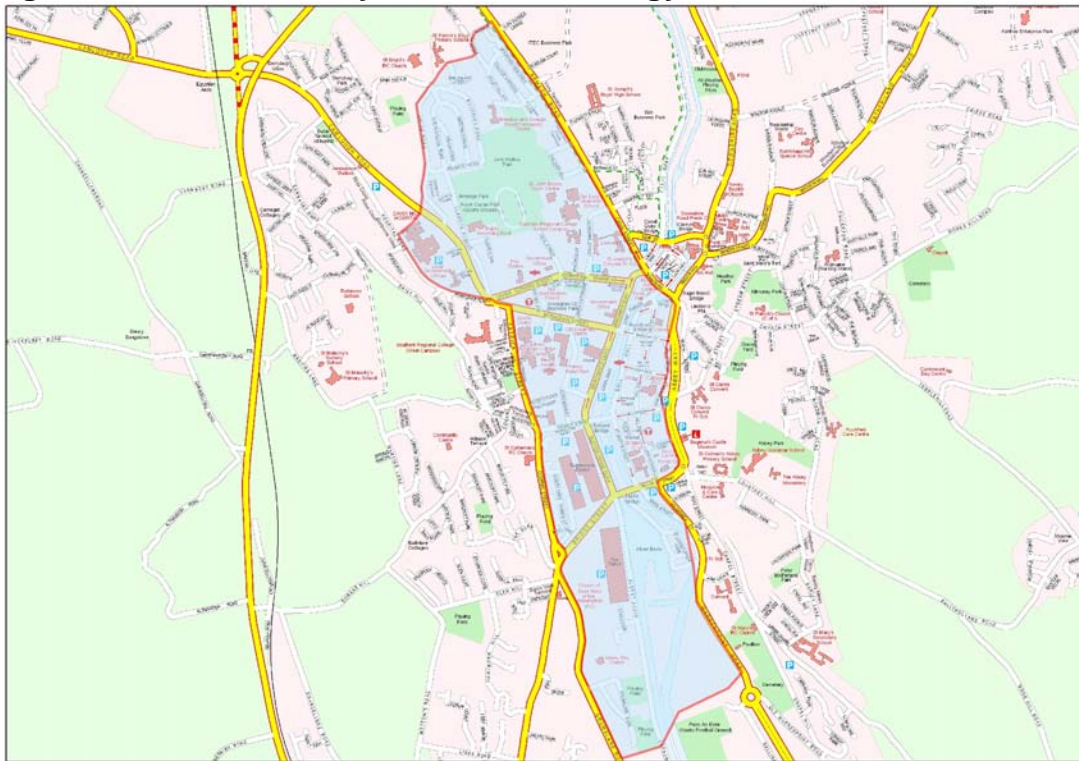
“create a Low Carbon City through the use of sustainable energy practice.”

Climate change is one of the greatest challenges facing mankind. Unchecked, no one will remain immune from its consequences, yet we each contribute to it. Every time we use electricity or gas at home or work, travel, or buy goods and services, we are responsible for emitting greenhouse gases that are warming the planet and changing our climate. If unchecked climate change is to be avoided, our contribution to it must be reduced dramatically

Newry aspires to be a showcase of partnership working in the use of technologies, policies and practices needed to develop sustainable communities. Carrying out these actions will take time and resources and apart from the contribution towards combating climate change there are many benefits

- Financial – Households, industry, businesses, public and voluntary sectors will all save money by increasing energy efficiency and reducing waste
- Improved Air Quality – many of the most effective ways to reduce carbon emissions also benefit air quality. The reduction of air pollutants will improve air quality and in turn reduce the instance of respiratory disease.
- Renewable energy systems will provide reliable and affordable clean energy and new employment opportunities.
- Enhanced community liveability – the combination of all the benefits resulting from activities to reduce greenhouse gas emissions and improve air quality will be translated into more environmentally friendly and habitable communities.

In 2009 Newry and Mourne District Council designated a sustainable energy zone in the heart of Newry City (see Figure 8.1 below) and is working together with central and local government departments, agencies, private businesses, commercial, voluntary sectors and local residents in a partnership approach to examine ways of creating a sustainable energy environment within the zone.

Figure 8.1: Newry Sustainable Energy Zone

The targets set for the Newry, Low Carbon City Project to be achieved by 2020 are:

- 20% of the heat required within the zone to be supplied from renewables
- 20% of the electricity required within the zone to be supplied from renewables.
- And 40% greater energy efficiency in designated buildings

The Greater Newry Vision – Sustainable Energy Group has been established to lead this project and comprises both statutory and non-statutory bodies. The participants are fully supportive of the aims and objectives of the Newry, Low Carbon City project and have each committed to:

- Use their best efforts to advance the project and all its constituent parts.
- Collaborate fully with the other participants in the project.
- Make appropriate resources available to support the project.
- Promote the project and the theme of sustainable energy that underlies it.

The Group is currently engaged in the following activities:

➤ Green New Deal

A pilot project is taking place within Newry City under the Green New Deal. This will involve carrying out energy surveys of 455 houses within two former NIHE (council) housing estates and for each of these properties a personalised Action Plan will be provided, detailing potential energy efficiency work, costs, funding options and potential fuel bill savings arising from the work.

The types of measures proposed will range from minor improvements, such as draught-proofing or increasing loft-insulation, through to more major measures such as replacing inefficient heating systems.

The project team will provide impartial energy advice to help householders make their own decision and will support them through the process of applying for grant aid and organising the completion of works.

For home-owners, grant support through existing schemes range from 5% to 100% of total cost depending on household income. It is recognised that this shortfall in funding can be a deterrent.

To address this, additional funding from government to cover the shortfall has been sought. If successful, it is proposed to offer householders an interest free loan on a "Pay As You Save" basis. This will allow householders to pay back the loan from money saved on energy bills.

➤ Plugged in places project

Plugged in Places is a government led initiative focused on encouraging a switch to electric vehicles through the provision of a £30m fund (administered through the Office for Low Emissions Vehicles (OLEV)) to establish electric vehicle infrastructure in cities across the UK and monitor, research and report on its success.

The first wave of applications resulted in London, Newcastle and Milton Keynes receiving funding to establish their infrastructure consisting of a number of charging points including a small number of rapid charging points.

The second pilot project involving Newry City has been approved which will see charging points installed in six towns and cities across the Northern Ireland - Belfast, Derry, Newry, Armagh, Enniskillen and Larne and on a number of major roads.

➤ Energy Efficiency and Micro Generation Project Project

Newry and Mourne District Council is one of nine other councils in the area who have jointly participated and supported an application to INTEREGG IVA to employ staff to undertake energy audits of council buildings. As part of this

project it is also intended to carry out exemplar sustainability improvement projects within a number of the buildings.

The project will involve:

- Detailed energy audit of 5 council buildings in each of the participating council areas, and from this draw up a report identifying where the optimum cost effective energy improvements can be achieved in each building.
- Participating councils will use these reports to implement a programme of improving the energy efficiency of these buildings over time (funding for which is outside the scope of this project).
- There will be eight exemplar sustainability improvement projects undertaken within the nine council areas.

9 Implementation of Action Plans

An Action Plan for the Newry (Urban Centre) AQMA was approved in April 2010. The Action Plan has twenty-four on going and planned actions which have the potential to reduce NO₂ levels from traffic and background emissions within the designated AQMA. It is recognised that many of these measures will also contribute towards the wider strategic objectives of sustainable development and tackling climate change.

Figure 2.2 provided an analysis of the NO₂ levels for the time period 1996 to 2010 for a number of NO₂ diffusion tube sites within Newry City, including background and roadside sites. There are no clear trends in NO₂ concentration for these sites although the results recorded at all sites for 2010 were higher than in the immediate preceding years. The high levels in 2010 would, in this Council's opinion, be related to the exceptionally cold weather during the winter of 2010.

Table 9.1 below summaries progress made over the past 12 months with implementation of the Action Plan measures.

Whilst at present there is no evidence to show a downward trend in the annual mean NO₂ level within those streets which currently exceed this air quality objective, it would be argued that the Action Plan measures, actual and proposed, have created the building blocks for reducing levels of NO₂ within these areas. It is therefore argued that the implementation of the Action Plan measures are in pursuit of ensuring that annual mean objective for NO₂ is met at all relative exposure locations within Newry (Urban Centre) AQMA.

It is important that the existing and proposed Action Plan measures within the plan are implemented and built upon so that continual improvements can be made. Critical to this is the modal shift from car to other more sustainable modes of transport. To achieve this we cannot rely on peoples altruistic behaviour; we must make that choice easier for them by providing modern efficient public transport facilities and services. For those who choose to walk or cycle we must ensure that their choice is safe and convenient. With recent reviews of spending being conducted by all public agencies there are increasing risks that previous commitments for actions which could improve local air quality within the Newry (Urban City) AQMA will not be carried out or will be delayed. The Council will monitor this over the coming period.

Newry and Mourne District Council and other stakeholders continue to make the case for the Newry Southern Relief Road, which if implemented, has the potential to provide traffic relief to Newry City centre with the consequent improvements in local air quality. However, even if a decision to undertake this scheme was approved today it would take several years before it would open to traffic and therefore we cannot rely on this as the ultimate solution.

Table 9.1 Action Plan Progress

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
1	DBFO 2 - A1 Beech Hill – Cloghogue. Project	Reduce traffic entering city centre thereby reducing emissions	Road Service	2007 - 2010	2008 - 2010	Completion of road	Not known	New road open to traffic July 2010	Complete	Complete	Not known
2	Expanded Strategic Road Improvement Programme 2015 – Southern Relief Road	Reduce traffic entering city centre thereby reducing emissions	Road Service	2011 onwards	Not determined	DRD Road Service to identify preferred route for the Southern Relief Road by 2011. Estimated Cost of scheme £100 - 210 million (depending on preferred route - Newry Southern Relief Road Feasibility Study Report August 2009)	Not known	Feasibility study completed in August 2009.	Ongoing	Not known	Not known

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
3	Review signage displayed under Traffic Weight Restriction (Newry) Order (NI) 1992 and to raise awareness of TRO among motorists	Enforce provisions of TRO in Canal Street thereby reducing emissions from HGV's using this street	PSNI	Ongoing	Ongoing	Compliance with TRO	Not known	Ongoing	Ongoing	Ongoing	Not known
4	Proposed improvements to walking facilities in Newry City, as detailed in the SRTP Technical Supplement for Newry, by 2015.	Improve walking facilities thereby encourage walking as an alternative mode of transport to private car	Road Service	2002 - 2015	2007 - 2015	Improved walking facilities	Not known	Ongoing. However, under current spending review budget for such works has been reduced	New footpaths established along with completion of DBFO 2 - A1 Beech Hill – Cloghogue. Project	Ongoing	Not known
5	Proposed improvements to cycling facilities in Newry City, as detailed in the SRTP Technical Supplement for	Improve cycling facilities thereby encourage cycling as an alternative mode of transport to	Road Service	2002 - 2015	2007 - 2015	Improved cycling facilities	Not known	Ongoing. However, under current spending review budget for such works has been reduced	New cycle paths established along with completion of DBFO 2 - A1 Beech Hill – Cloghogue. Project	Ongoing	Not known

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
	Newry, by 2015.	private car									
6	Park and Share Facilities to be provided at Beech Hill and Cloghogue of A1	Encourage car sharing thereby reducing number of single occupancy vehicles using city	Road Service	2002 - 2015	2007 - 2015	Establishing park and share facilities	Not known	As part of DBFO 2 - A1 Beech Hill – Cloghogue. Project Park and Share facilities established at Sheepbridge and Cloghogue (25 spaces each)	As part of DBFO 2 - A1 Beech Hill – Cloghogue. Project Park and Share facilities established at Sheepbridge and Cloghogue (25 spaces each)	Complete	Not known
7	Replace Ulsterbus Newry Fleet with new less polluting vehicles in accordance with Translink Environmental Statement	Reduce emissions from public transport in the AQMA	Translink	2007 - 2013	2007 - 2013	To achieve an average road fleet age of 8 years and a retirement age of 12 years for coaches and 18 years for buses by 2013.	Not known	As of April 2011, average road fleet age of 5.1 years and oldest vehicle still in use is 18.40 years.	Progress being made	Ongoing	Not known
8	Improved bus stops and customer information	Encourage greater use of public transport against use of	Translink	2002 - 2015	2007 - 2015	Improvement to existing bus stops and increase to number of	Not known	From 07/08 to 08/09 there was a 10% increase in passenger	No known improvements during last 12 months to existing bus	Ongoing	Not known

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
		private vehicles thereby reducing emissions from private vehicles				bus stops		numbers using Ulster bus, 08/09 to 09/10 saw a further 7% increase however, from 09/10 to 10/11 there has been an 8% reduction in passenger numbers. Ulster bus advise that the drop in passenger numbers is due to numbers of 'senior citizen' passengers reducing their number of journeys to city centre.	stops. Number of suburban bus routes from Newry Bus Centre has been reduced from 7 routes to 5 routes due to budget restrictions. Ulster bus has advised that they expect to have further reductions in service from July 2011. There has been an 8% reduction in passenger numbers from 2009/10 to 2010/11 period.		
9	Provision of network of natural gas in Newry City	Providing natural gas as an alternative fuel over other fuels such as oil	Firmus	Ongoing	Ongoing	Increased uptake of natural gas customers in Newry City	Not known	Network of natural gas supply expanded over past number of years	Network of natural gas supply expanded over past 12 months	Ongoing	Not known

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
		and coal which have higher emission rates of NO2									
10	NIHE Energy Efficiency Improvement Programme	Improve energy efficiency of NIHE homes in AQMA thereby reducing energy consumption & emissions	NIHE	2007-2013	2007- 2013. Advised by NIHE implementation date has extended to 2015/16 due to the current and anticipated levels of funding for the heating programme.	Increased number of housing stock with improved energy efficiency and cleaner heating systems	Not known	Of the 1295 NIHE properties within Newry City 107 properties have gas-heating system and 737 have oil-heating system.	65 properties converted to gas heating and 92 homes converted to oil heating in past 12 months.	Ongoing	Not known
11	Extension of Council ISO 14001 management system	Reduce the impact of Council services on the environment, including air quality. The Council, by leading by example, will encourage other businesses within the Council area	Council	2004 - 2011	2004 - 2011	Maintenance of ISO 14001 accreditation.	Not known	Scope of ISO 14001 accreditation extended within Council. Key improvements as they relate to air quality: Developing Council Travelplan, Further replacement of council fleet	Key improvements as they relate to air quality: Developing Council Travelplan, Further replacement of council fleet with less polluting vehicles, increased number of employee's	Ongoing	Not known

No.	Measure	Focus	Lead authority	Planning phase	Implementation phase	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
		to implement their own environmental management system						with less polluting vehicles, increased number of employees part of Cyclescheme	part of Cyclescheme.		
12	Establish a Workplace Travel Plan for NMDC	Reduce emissions from Council travel	Council	2009 - 2010	2010 - 2015	Achievement of targets set within Council Travel plan	Not known	Travel plan has been developed and approved by Council. Decision on implementation mechanism still to be taken	2005 - 2011	2015	Not known

10 Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

Monitoring data during 2010 relates to monitoring of nitrogen dioxide and PM10. There were a number of sites, of relevant exposure, which breached the annual mean objective for nitrogen dioxide but these are all within the existing AQMA for which there is an Air Quality Action Plan.

Canal Street is the main road used by vehicles accessing Newry city centre from Armagh City direction. In 2008 the council obtained a 12 hour traffic survey for Canal Street (7am -7pm) when 17,042 vehicles were counted using this road. It is a narrow street with a steep decline into the basin of the valley. It is one of the oldest parts of the city with three storey high residential dwelling on either side of the road creating a canyon effect. NO₂ is monitored in Canal Street using diffusion tubes and an automatic analyser. 2010 monitoring data at the automatic site found that the 1-hour mean objective (200µg/m³) for NO₂ was exceeded. This data included 34-recorded exceedances of the 1-hour mean objective (200µg/m³)

PM10 is monitored at three AQM Stations. The PM10 24 hour mean air quality objective has been breached during 2010 at the Canal Street site, as there were 73 recorded exceedances of the 24 hour mean objective (50 µgm⁻³). Canal Street had formally been a declared AQMA for PM10 but this was revoked following further dispersion modelling results (Further Assessment 2009), which indicated that exceedance of PM10 objective was not likely within Newry City. At the Trevor Hill sites there were 45 exceedances of the 24-hour mean objective for PM10. Although this figure indicates a breach of the Air Quality Objective for PM10, as this is not a relevant exposure site no further action is required.

10.2 Conclusions relating to New Local Developments

A new 12 km stretch of road was opened in July 2010 along the Belfast to Dublin A1. The road carries over 20,000 vehicles per day and has the potential to reduce the traffic entering Newry City as it allows traffic to bypass the city centre.

There have been no new industrial installations or new commercial or fugitive source emissions within the Newry and Mourne District Council area in 2010.

Newry City is a smoke control area. All new developments within the city centre are required to comply with the restrictions within the smoke control areas in relation to the use of authorised fuels.

10.3 Other Conclusions

Section 9 of this report provides a summary of the progress in completion of actions within the Air Quality Action Plan. With recent reviews of spending being conducted by all public agencies there are increasing risks that previous commitments for actions which could improve local air quality within the Newry (Urban City) AQMA will not be carried out or will be delayed. The Council will monitor this over the coming period.

10.4 Proposed Actions

2010 monitoring data has identified the need for a Detailed Assessment for the 1-hour mean objective ($200\mu\text{g}/\text{m}^3$) for NO₂ and the 24-hour mean objective ($50\text{mg}/\text{m}^3$) for PM₁₀ at Canal Street, Newry.

11 **References**

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

Newry & Mourne District Council LAQM Progress Report 2009

Local Authority Air Quality Support website
<http://laqm.defra.gov.uk/>

Appendices

Appendix 1: QA/QC Data - Bias Adjustment Factor Calculations.

Appendix 2: Map of Automatic Monitoring Sites

Appendix 3: Map of Non Automatic Monitoring Sites

Appendix 1: QA/QC Data

Diffusion Tube Bias Adjustment Factors

In 2010 the NO₂ diffusion tubes were prepared and analysed by Gradko International Limited. The tubes are prepared by coating the grids in a 50% v/v solution of the absorbent, triethanolamine (TEA) in water. Analysis is carried out using a segmented flow autoanalyser with ultraviolet detection. The laboratory methods are currently UKAS accredited. This laboratory takes part in the NO₂ Network QA/QC Field Intercomparison survey.

The National Bias Adjustment Factor for Gradko in 2010 was found to be 0.99 Cm/Dm.

Factor from Local Co-location Studies

There are three tubes co-located with the air quality monitoring station at Trevor Hill, Newry, to enable the bias factor to be calculated. All are classed as kerbside sites and are within 3m of the road.

Diffusion Tubes Measurements

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
1	31/12/2009	04/02/2010	51.0	48.0	47.0	49	2.1	4	5.2
2	04/02/2010	05/03/2010	40.0	45.0	47.0	44	3.6	8	9.0
3	05/03/2010	01/04/2010	39.0	38.0	38.0	38	0.6	2	1.4
4	01/04/2010	30/04/2010	40.0	38.0	37.0	38	1.5	4	3.8
5	30/04/2010	03/06/2010	35.0	32.0	32.0	33	1.7	5	4.3
6	03/06/2010	02/07/2010							
7	02/07/2010	04/08/2010	27.0	31.0	31.0	30	2.3	8	5.7
8	04/08/2010	02/09/2010	33.0	31.0	26.0	30	3.6	12	9.0
9	02/09/2010	30/09/2010	43.0	39.0	40.0	41	2.1	5	5.2
10	30/09/2010	04/11/2010	45.0	38.0	41.0	41	3.5	8	8.7
11	04/11/2010	02/12/2010	41.0	42.0	40.0	41	1.0	2	2.5
12	02/12/2010	07/01/2011	43.0	47.0	45.0	45	2.0	4	5.0
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data Capture Check
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5		Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5	Good	Good
44	89.5		Good
Overall survey -->		Good precision	Poor Overall DC

Summary of Trevor Hill

Bias factor A	1.13 (1.02 – 1.26)
Bias B	-11% (-20% - 2%)
Diffusion Tube Mean:	39µg/m ³
Mean CV (Precision):	6
Automatic Mean:	44µg/m ³
Data Capture for Periods used:	90%
Adjusted Tubes Mean	44 (40-49) µg/m ³

Discussion of Choice of Factor to Use

Both local and national bias adjustment factors were available, however, it was decided to use the bias adjustment factor obtained from our local co-location study. Reasons for choosing local co-location factor were:

- Co-location sites were found to have 'good' precision for diffusion tubes.
- Co-location study period is greater than 9 months.
- Automatic Analyser is subject to Netcen QA/QC Checks.

Using the local co-location factor of 1.13 Cm/Dm found that 18 diffusion tube sites breached the annual mean air quality objective for NO₂ of 40µg/m³. If the national bias adjustment factor of 0.99 Cm/Dm had been used then 11 sites would have been found to breach the annual mean air quality objective for NO₂ of 40µg/m³. Using the local co-location factor has ensured that the worst-case scenario has been considered.

PM Monitoring Adjustment

The data from all three PM₁₀ monitors were subject to QA/QC inspection by Netcen during 2009-2011. Instruments at Trevor Hill and Monaghan Row are R & P Teom (FDMS) and therefore monitoring data from these instruments has not required any correction. The Canal Street site has an R&P Teom and data has been corrected using the Volatile Correction Method (VCM).

Short-term to Long-term Data adjustment

No short-term to long term data adjustments are required.

QA/QC of automatic monitoring

During 2010 Newry and Mourne District Council had a QA/QC and Data Management contract with Netcen (AEA Technology Plc). QA/QC audits have been completed on the automatic monitoring equipment currently located within the Council area.

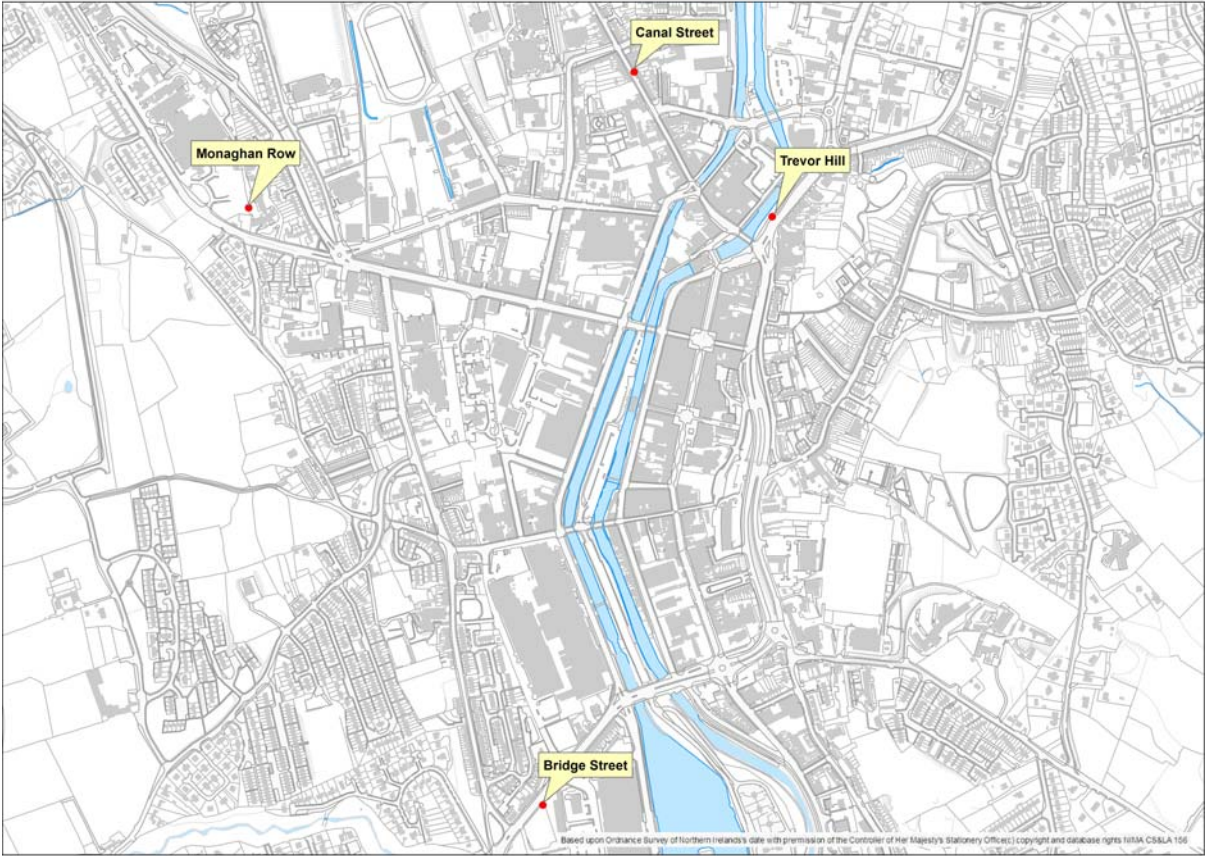
During 2010 automatic calibration of NO₂ automatic monitors was undertaken at Trevor Hill every three days. Manual calibration was undertaken at Canal Street periodically by Newry and Mourne District Council officers. This has allowed instrument drifts to be documented using traceable calibration gas standards and the results are used to scale data. All calibration records are sent to Netcen who conduct QA/QC checks.

QA/QC of diffusion tube monitoring

Gradko laboratory is assessed annually by UKAS to establish conformance of the Laboratory Quality Procedures and have demonstrated a good performance in the latest round of WASP assessment for nitrogen dioxide diffusion tubes.

Newry and Mourne District Council QA/QC procedure ensures that the diffusion tubes are handled and stored in accordance with Gradko's Diffusion Tube Instruction Manual for exposure and location.

Appendix 2: Figure 8.2 Map of Automatic Monitoring Sites



Appendix 3: Figure 8.3 Map of Non Automatic Monitoring Sites

