Department of the Environment

Air Quality Monitoring in Northern Ireland 2004

December 2005

Environment & Heritage Service
www.ehsni.gov.uk

Air Quality Monitoring in Northern Ireland, 2004

1. Introduction

The quality of the air we breathe is important to all of us. Improving air quality, as well as meeting national and European air quality targets and objectives, are key targets for Government. District Councils and other relevant authorities have a key role to play in contributing towards the achievement of these objectives. This brochure, produced by the **Environment and Heritage Service**, provides a summary of air quality monitoring carried out in Northern Ireland on behalf of Government and by District Councils during 2004.

2. Which Pollutants are monitored in Northern Ireland?

The following pollutants were monitored in Northern Ireland during 2004:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NO_x) and Nitrogen Dioxide (NO_2)
- Sulphur Dioxide (SO_2)
- Particles (as PM_{10})
- Particles (as Black Smoke)
- Ozone
- Benzene
- 1,3-Butadiene
- Polycyclic Aromatic Hydrocarbons (PAH)

Metals were not monitored in Northern Ireland during 2004. However, ambient concentrations of lead, cadmium, arsenic, nickel, and mercury, were monitored at three sites in industrial areas over the period December 1999 to November 2000. This study established that, even in industrial areas of Northern Ireland, neither lead or any other of the metallic pollutants monitored were likely to exceed any applicable air quality limit values and objectives.

3. What Air Quality Objectives and Limit Values Apply in Northern Ireland?

Two sets of air quality objectives and limits apply to air quality in Northern Ireland:

(i) EC Directives

The European Community has agreed a series of Air Quality Directives covering key pollutants. These Directives establish Limit Values for specified pollutants; these requirements have been incorporated into Northern Ireland's own legislation.

(ii) The UK Air Quality Strategy

The Air Quality Strategy (AQS) sets out a comprehensive strategic framework for air quality policies, and establishes Air Quality Objectives for key air pollutants.

In most cases, the Air Quality Strategy (AQS) Objectives are identical to the EC Directive Limit Values, the only differences being the more stringent dates by which the former must be achieved. Table 1 overleaf shows the AQS Objectives and EC Limit Values applicable to Northern Ireland.

4. What Are District Councils Doing About Air Quality?

Under the Environment (NI) Order 2002, District Councils in Northern Ireland must carry out a regular Review and Assessment of their local air quality. Where it is likely that an AQS Objective will not be met in an area where the public will be exposed, the Council is required to:

- Declare an Air Quality Management Area (AQMA), and
- Develop an Action Plan to address the problem.

Table 1: Air Quality Strategy Objectives &EC Directive Limit Values applicable in Northern Ireland

Averaging period	*EC Limit Value or AQS Objective*	*No. of Permitted exceedences*	*To be achieved by (AQS Objectives)*	*To be achieved by (EC Directive Limit Values)*
Carbon Monoxide (CO)				
Max. Daily 8-hourMean	10 mgm^{-3}	-	-	1 Jan 2005
Running 8-hour mean	10 mgm^{-3}	-	31 Dec 2003	-
Nitrogen Dioxide (NO_2) and total oxides of nitrogen (NO_x)				
1 hour	200 μg m^{-3}	18 per year	31 Dec 2005	1 Jan 2010
Annual Mean	40 μg m^{-3}	-	31 Dec 2005	1 Jan 2010
Annual Mean, for protection of vegetation (rural areas)	30 μg m^{-3} Total NOx	-	31 Dec 2000	19 July 2001
Sulphur Dioxide (SO_2)				
15 minute	266 μg m^{-3}	35 per year	31 Dec 2005	-
1 hour	350 μg m^{-3}	24 per year	31 Dec 2004	1 Jan 2005
24 hour	125 μg m^{-3}	3 per year	31 Dec 2004	1 Jan 2005
Annual mean and winter (1st October – 31st March), for protection of vegetation (rural)	20 μg m^{-3}	-	31 Dec 2000	19 July 2001
Particulate Matter (PM_{10}), as measured using a gravimetric method				
24 hour	50 μg m^{-3}	35 per year	31 Dec 2004	1 Jan 2005
24 hour [a]	50 μg m^{-3}	7 per year	31 Dec 2010	1 Jan 2010
Annual Mean	40 μg m^{-3}	-	31 Dec 2004	1 Jan 2005
Annual Mean [a]	20 μg m^{-3}	-	31 Dec 2010	1 Jan 2010
Ozone (O_3)				
Max. daily 8-hour mean. Compliance assessment based on average no. of day's exceedence over 3 consecutive years.	120 μg m^{-3}	25 days per calendar year	-	Averaged over 3 years, beginning 2010.
AOT40[b], calculated from 1h values May- July. *For protection of vegetation.*	18,000 μg m^{-3} h	-	-	Averaged over 5 years, beginning 2010
Max. daily running 8-hour mean [a]	100 μg m^{-3}	10 days per year	31 Dec 2005	-
Benzene				
Running annual mean	16.25 μg m^{-3}	-	31 Dec 2003	-
Calendar Year Mean	3.25 μg m^{-3}	-	31 Dec 2010	-
Calendar Year Mean	5 μg m^{-3}	-	-	1 Jan 2010
1,3-Butadiene				
Running annual mean	2.25 μg m^{-3}	-	31 Dec 2003	-
PAH				
PAHs *(B(a)P as an indicator)*		-		
Calendar year mean	0.25 ng m^{-3}		31 Dec 2010	
Lead				
Calendar Year Mean (1)	0.5 μg m^{-3}	-	31 Dec 2004	1 Jan 2005.
Calendar Year Mean (2)	0.25 μg m^{-3}	-	31 Dec 2008	-

a Not prescribed in regulations for the purposes of local air quality management
b AOT 40 is the sum of the differences between hourly concentrations greater than 80 µg m^{-3} (=40ppb) and 80 µg m^{-3}, over a given period using only the 1-hour averages measured between 0800 and 2000.

At the time of writing, all of Northern Ireland's 26 District Councils have completed the first round of review and assessments. The current status of these Authorities may be summarised as follows:

- 11 Authorities have identified areas where Objectives may not be met
- 9 of these (Antrim, Ards, Ballymena, Ballymoney, Belfast, Carrickfergus, Derry, Newtownabbey and Strabane) have declared Air Quality Management Areas.
- A further two councils, Limavady and Newry & Mourne, are considering declaration of AQMA's .
- Most of the existing and proposed AQMAs declared in Northern Ireland are for PM_{10}, although two are for NO_2 and one is for SO_2.

5. Where are the Monitoring Sites?

Six new automatic monitoring sites were commissioned in 2004, taking the total to 36. These sites were set up under the Environment and Heritage Service Local Air Quality Grant Scheme, which provided approximately £3.0M over 2001 –2005 to support District Councils in their review and assessment of air quality.

Figure 1 shows how the number of automatic air monitoring stations in Northern Ireland has grown over the last 14 years, whilst Figure 2 shows one of these automatic monitoring sites, located at Ballymena (North Road). This site began monitoring in 2004. The locations of all Northern Ireland's automatic monitoring sites are shown in Figure 3 overleaf, together with the range of pollutants monitored.

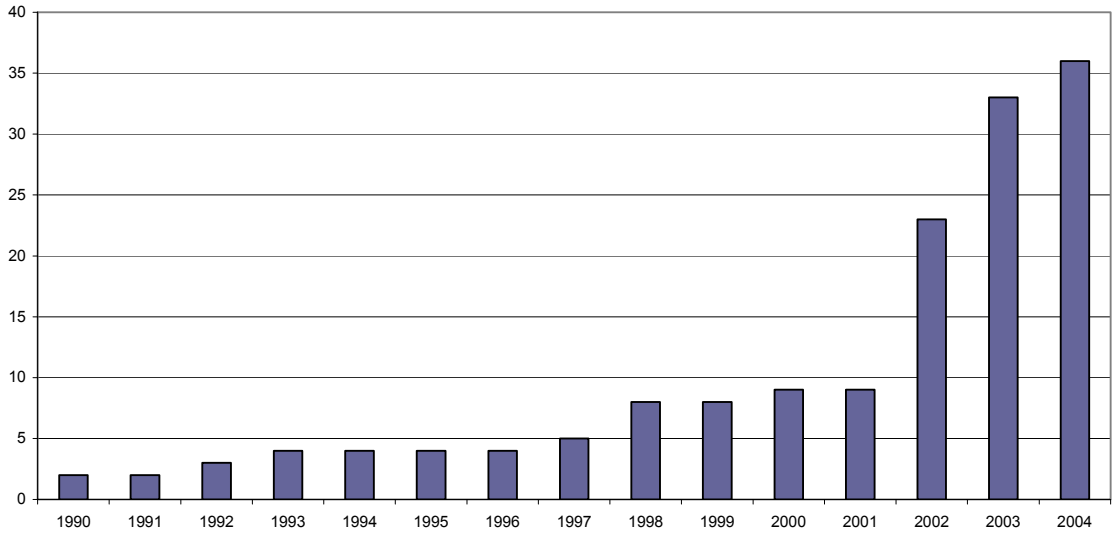

Figure 1 Numbers of automatic monitoring stations have grown substantially; many have been established since 2001 under the Environment and Heritage Service Local Air Quality Grant Scheme.

Figure 2- Automatic air monitoring station at Ballymena North Road.

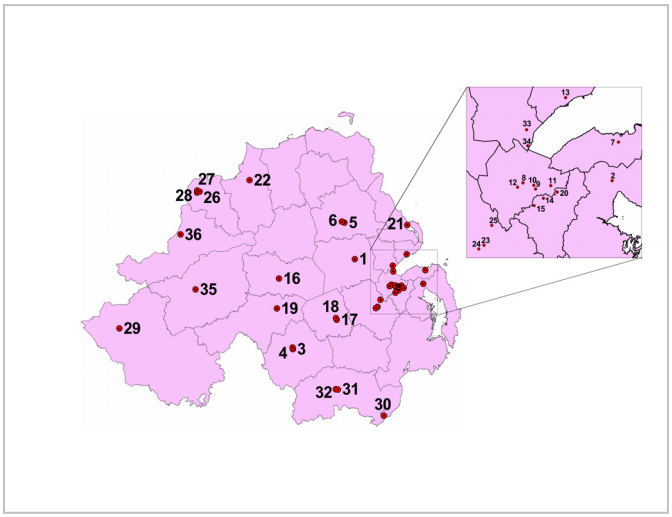

Figure 3. Automatic Monitoring Sites in Northern Ireland; details of sites and pollutants measured at each location are shown in the accompanying table.

No.	Site Name	Pollutants
1	Antrim, Greystone Est.	SO2
2	Ards	SO2, PM10
3	Armagh, Dobbin St.	SO2
4	Armagh, Lonsdale Rd.	NO2, PM10
5	Ballymena Ballykeel	SO2
6	Ballymena North Road	NO2
7	Bangor	SO2, PM10
8	Belfast Centre	CO, NO2, SO2, PM10, benzene, 1,3 butadiene
9	Belfast Clara St	PM10, PAH
10	Belfast East	SO2
11	Belfast Upper Newtownards Rd.	NO2, Benzene, 1,3-butadiene
12	Belfast Westlink	NO2, PM10
13	Carrickfergus, Rosebrook Ave	SO2, PM10
14	Castlereagh, Espie Way	SO2, PM10
15	Castlereagh, Loughview Drive	NO2, PM10
16	Cookstown	SO2, PM10
17	Craigavon, Castle Lane	NO2
18	Craigavon, Lord Lurgan Park	SO2, PM10
19	Dungannon	SO2, PM10
20	Holywood	NO2, PM10
21	Larne	SO2, PM10
22	Limavady Coolessan	PM10
23	Lisburn (Island Civic Centre)	SO2, PM10
24	Lisburn (Lagan Valley Hospital)	NO2, PM10
25	Lisburn, Dunmurry	PM10, PAH
26	Londonderry Brandywell	SO2, PM10
27	Londonderry, Brooke Park	CO, NO2, SO2, PM10
28	Londonderry, Dale's Corner	NO2
29	Lough Navar	PM10, 03
30	Newry Kilkeel	PM10
31	Newry Monaghan Row	NO2, SO2, PM10
32	Newry Trevor Hill	NO2, SO2, PM10
33	Newtownabbey, Sandyknowes	NO2
34	Newtownabbey, Shore Road	NO2
35	Omagh, Tamlaght	PM10
36	Strabane	SO2, PM10

As well as automatic monitoring, indicative monitoring is widely undertaken in Northern Ireland using low-cost non-automatic techniques, primarily:

- **NO_2** - using diffusion tubes at 276 sites.
- **SO_2** - using the 8-port sampler at 33 sites.
- **Particulate matter** as "black smoke", using the same network of 33 8-port samplers as for SO_2; the two pollutants are monitored simultaneously.

6. Monitoring Results For 2004 and Long-Term Trends

Northern Ireland was required to achieve three Air Quality Objectives by 31st December 2004; these were for lead, 1-hour and 24-hour mean sulphur dioxide, and PM_{10}. As explained in Section 2, results from earlier years have already established that Northern Ireland has met the air quality objective for lead.

Monitoring results from 2004 showed that all automatic monitoring sites in Northern Ireland met the Air Quality Objectives for 1-hour and 24-hour mean sulphur dioxide, by the due date, and have also achieved the objective for the 15-minute mean, for which the due date is 2005. However, four of Northern Ireland's automatic monitoring sites (Ballymoney, Belfast, Newry and Strabane) did not meet the air quality objectives for PM_{10} by the required date. In addition, some parts of Northern Ireland may have difficulty in meeting the air quality objectives for nitrogen dioxide, ozone, and PAH in future years.

Air quality in Northern Ireland is generally improving, as decreasing emissions have led to reductions in ambient concentrations of these pollutants. Please see the National Atmospheric Emissions Inventory (NAEI), on the World Wide Web at www.naei.org.uk for more information on this downward trend in emissions.

It is usually considered that at least five years' data are required for the meaningful assessment of trends in pollutant concentrations at any location. Most of Northern Ireland's automatic monitoring sites have not been running this long. However, some sites have been operating for a sufficient time to assess trends in air quality.

Carbon monoxide was monitored using automatic techniques at two sites (Belfast and Londonderry). Both achieved the Air Quality Strategy (AQS) Objective for this pollutant by the required date of 31st December 2003, and continue to meet the objective.

Nitrogen dioxide was monitored using automatic techniques at 15 sites. Results from some sites revealed potential exceedences of AQS Objectives. One site, Belfast Westlink (beside a major urban road), exceeded the AQS Objective of 200 μg m^{-3} for the hourly mean more than the permitted 18 times. Three roadside automatic sites exceeded the AQS Objective for the annual mean (40 μg m^{-3}) - see Figure 4. These were Belfast Westlink, Belfast Newtownards Road, and Londonderry Dale's Corner. These sites may have difficulty in meeting the annual mean objective for NO_2 by the end of 2005 as required.

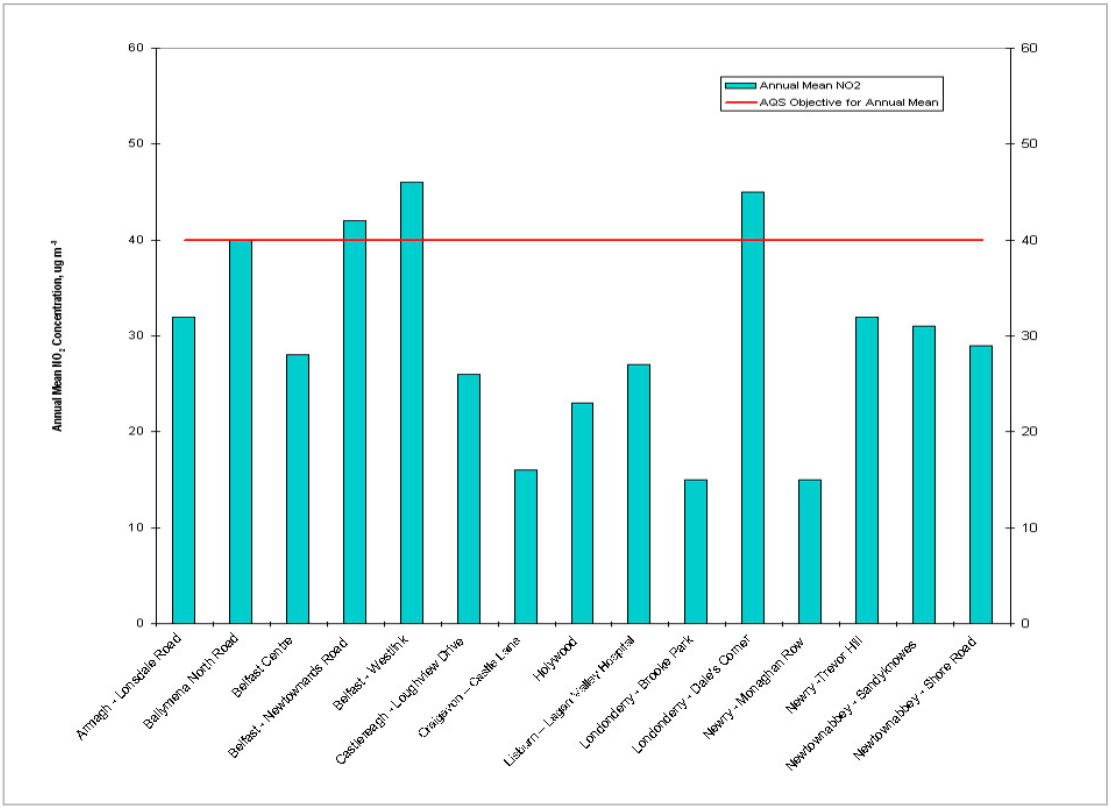

Figure 4 Annual Mean NO_2 levels at three automatic sites that exceeded the AQS Objective during 2004

Sulphur Dioxide Sulphur Dioxide was monitored at 19 automatic sites in 2004. All sites in Northern Ireland met the requirements of the Air Quality Strategy for 1-hour and 24-hour mean SO_2 by the due date of 31st December 2004 (and also the 15-minute mean objective for which the due date is 31st Dec 2005). In particular, Belfast East, a long-running site that has until recently recorded relatively high SO_2 concentrations, met the objectives on time.

Three automatic sites have been in operation long enough to assess trends (Figure 5 overleaf). Regression analysis identified a significant downward trend in annual mean SO_2 concentrations at Belfast Centre and Belfast East, though not at Londonderry. Belfast East, in particular, showed a marked decrease in annual mean SO_2 concentration between 2001 and 2004.

Particulate matter – PM_{10} Particulate matter as PM_{10} was monitored at 27 automatic sites in 2004. Four of these exceeded the AQS Objective of 50 μg m^{-3} (gravimetric equivalent) for the 24-hour mean, on more than the permitted 35 occasions – see Figure 6 overleaf. These were Ballymoney, Belfast Westlink, Newry Trevor Hill, and Strabane Springhill Park. One of these, (Strabane), also exceeded the AQS Objective of 40 μg m^{-3} for the annual mean PM_{10}, as gravimetric equivalent. This site is on a housing estate where domestic solid fuel use is prevalent. The due date for both the above AQS Objectives was 31st Dec 2004. (It should be noted however that the first calendar year in which the corresponding EC Stage 1 Limit Values must be achieved is 2005).

The EC Stage 2 Limit Values for PM_{10} were exceeded at many sites in 2004: 12 sites had more than seven 24-hour means greater than 50 μg m^{-3}, while 16 sites had annual mean PM_{10} concentrations above 20 μg m^{-3}. However, all sites have until 2010 to meet these limits.

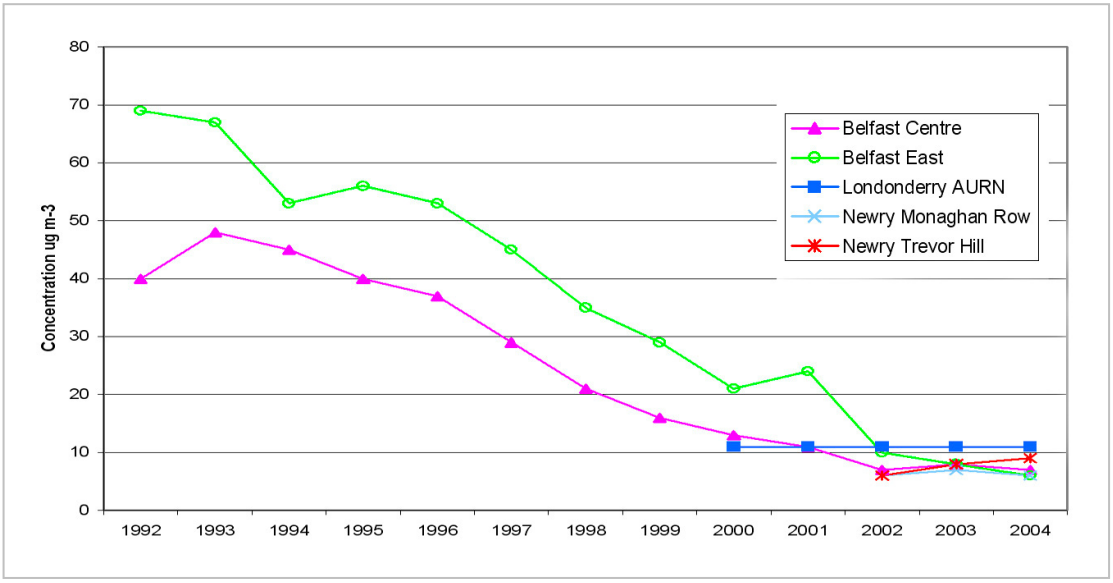

Figure 5. Trends in Annual Mean SO_2 Concentrations at Automatic Monitoring Sites, showing how these have fallen in Belfast

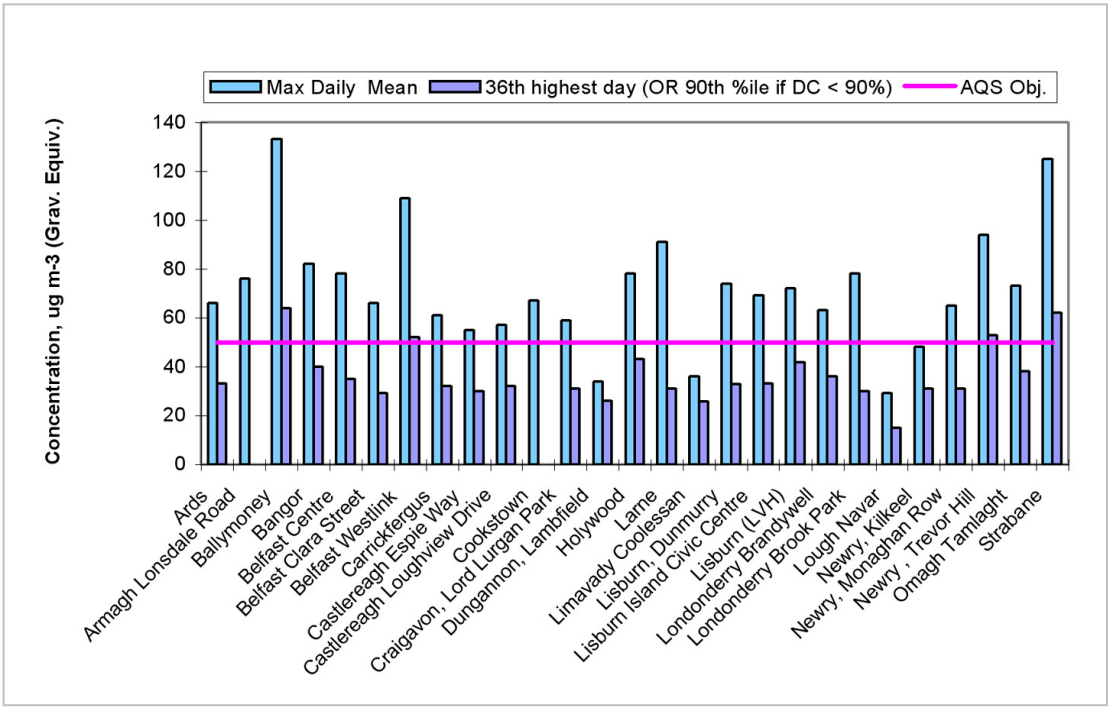

Figure 6. Comparison of 2004 PM_{10} levels at automatic sites with AQS 24-hour mean objective. *Shows the highest and the 36th highest 24-hour mean (or 90th percentile where data capture was less than 90%). If the latter - shown by the darker coloured bar - is greater than 50 µg m^{-3}, the site has not met the AQS Objective. As can be seen, four sites did not meet this objective by the end of 2004*

Ozone (O3) is a secondary pollutant that is formed by reactions involving other pollutant gases, in the presence of sunlight, and over several hours. Once formed, it may persist for several days and be transported over long distances. This means that District Councils have little control over ozone levels in their area. No sites exceeded the target value of the AQS Objective on more than the permitted ten days in 2004. There is some year-to-year variation in ozone concentration, but no significant trends. Ozone exceedences (such as that recorded in 2003) therefore remain a possibility.

Benzene and 1,3-Butadiene are monitored at Belfast Centre and Belfast Upper Newtownards Road. Both sites achieved the AQS Objective for benzene and 1,3-butadiene by the due date of 31st December 2003, and continue to meet the requirements of the Objective.

Polycyclic aromatic hydrocarbons (PAH) are monitored at two sites: Lisburn (Dunmurry) and Belfast (Clara Street). Belfast Clara Street meets the AQS Objective. However, levels of this pollutant at Lisburn remained high compared with other urban sites, and significantly above the AQS Objective (to be achieved by 2010). The major source of PAH in the vicinity of the site is thought to be the widespread use of domestic solid fuels.

7. Conclusions

1) Air quality is continuing to improve generally in Northern Ireland; however, monitoring has identified some areas across the province that will require action.

2) Six new automated monitoring sites were established in Northern Ireland during 2004. Measurements from these, together with the existing sites, show that the Air Quality Strategy Objectives for the following pollutants have been met by the due dates –

- **Carbon Monoxide**
- **Benzene**
- **1,3-Butadiene**
- **Sulphur Dioxide (1-hour and 24-hour Objectives)**

3) The AQS Objective for 24-hour mean **Particulate matter as PM_{10}** were **not** met by the due date (31st December 2004) at sites in Ballymoney, Belfast, Newry and Strabane. Strabane also failed to meet the AQS Objective for annual mean PM_{10}, due by the same date.

4) It is predicted that some locations near busy roads will not meet the AQS Objectives for **Nitrogen Dioxide** by the end of 2005 as required. Exceedences of the Objectives for **Ozone** remain possible.

5) First Round Review and Assessments have been completed by all 26 District Councils in Northern Ireland. 11 of these have identified areas where AQS Objectives may not be met, and 9 councils have declared Air Quality Management Areas, with a further two under consideration.

Further Information

The information in this pamphlet is summarised from a larger report produced by **Netcen** for the Department of the Environment in Northern Ireland (DoE), in partnership with the Chief Environmental Health Officers' Group: "Air Quality Monitoring in Northern Ireland 2004", report number AEAT/ENV/R/2068, December 2005. This report is available via the Environment and Heritage Service web site at www.ehsni.gov.uk and the Defra Air Quality Archive on the World Wide Web, at www.airquality.co.uk. **For further information on local air quality please contact the Environmental Health Department at your local District Council Office or Environment and Heritage Service.**

Further information on Air Quality in Northern Ireland can also be obtained from the following sources:

Current and forecast air quality information
Ceefax pages 417 and Teletext page 156
Air Pollution Information Service, 0800 556677

Reported Data
The Air Quality Archive, www.airquality.co.uk

Environment and Heritage Service
Air and Environmental Quality Unit, Commonwealth House, 35 Castle Street BELFAST BT1 1GU
Telephone: 028 90546425
Web site: www.ehsni.gov.uk

Contact details for Netcen:
Alison Loader, Netcen, Harwell Business Centre, Didcot OX11 0QJ
Telephone 0870 190 6518
Facsimile 0870 190 6377

ISBN 1-905127-28-6

Produced on behalf of the Environment and Heritage Service by Netcen, an operating Division of AEA Technology. Netcen is certificated to ISO 9001 and ISO 14001

netcen
netcen is an operating division of AEA Technology plc

AEA TECHNOLOGY
ENVIRONMENT