



Air Quality Monitoring in Northern Ireland 2003



Department of the
Environment
www.doeni.gov.uk



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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 2003.

2. Which Pollutants are monitored in Northern Ireland?

The following pollutants were monitored in Northern Ireland during 2003:

- ▶ Carbon Monoxide (CO)
- ▶ Oxides of Nitrogen (NO_x) and Nitrogen Dioxide (NO₂)
- ▶ Sulphur Dioxide (SO₂)
- ▶ Particles (as PM₁₀)
- ▶ Particles (as Black Smoke)
- ▶ Ozone
- ▶ Benzene
- ▶ 1,3-Butadiene
- ▶ Polycyclic Aromatic Hydrocarbons (PAH)

Metals were not monitored in Northern Ireland during 2003. 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 constitute a problem.

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

<i>Averaging period</i>	<i>EC Limit Value or AQS Objective</i>	<i>No. of Permitted exceedences</i>	<i>To be achieved by (AQS Objectives)</i>	<i>To be achieved by (EC Directive Limit Values)</i>
Carbon Monoxide (CO)				
Max. Daily 8-hour Mean	10 mgm ⁻³	-	-	1 Jan 2005
Running 8-hour mean	10 mgm ⁻³	-	31 Dec 2003	-
Nitrogen Dioxide (NO₂) 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 NO _x	-	31 Dec 2000	19 July 2001
Sulphur Dioxide (SO₂)				
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 (PM₁₀), 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 (O₃)				
Max. daily 8-hour mean. Compliance assessment based on average no. of days 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, 25 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:

- ▶ 9 authorities have identified areas where Objectives may not be met
- ▶ 6 of these (Antrim, Ballymena, Belfast, Carrickfergus, Newtownabbey and Strabane) have declared Air Quality Management Areas.
- ▶ A further two councils, Ards and Derry, have indicated their intention to declare.
- ▶ Armagh has submitted further information and indicated that it will not be declaring an AQMA.
- ▶ One District Council (Newry and Mourne) has still to complete the first round.
- ▶ Most of the existing and proposed AQMAs declared in Northern Ireland are for PM₁₀, although two are for NO₂ and one is for SO₂.

5. Where are the Monitoring Sites?

Fifteen new automatic monitoring sites were commissioned in 2002, and a further seven were added in 2003. These sites were set up under the Environment and Heritage Service Local Air Quality Grant Scheme, which provided approximately £2.5M over 2001 –2004 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 the automatic monitoring sites, located at Holywood, North Down. This site began monitoring in 2003. The locations of all Northern Ireland's automatic monitoring sites are shown in Figure 3 overleaf, together with the range of pollutants monitored.

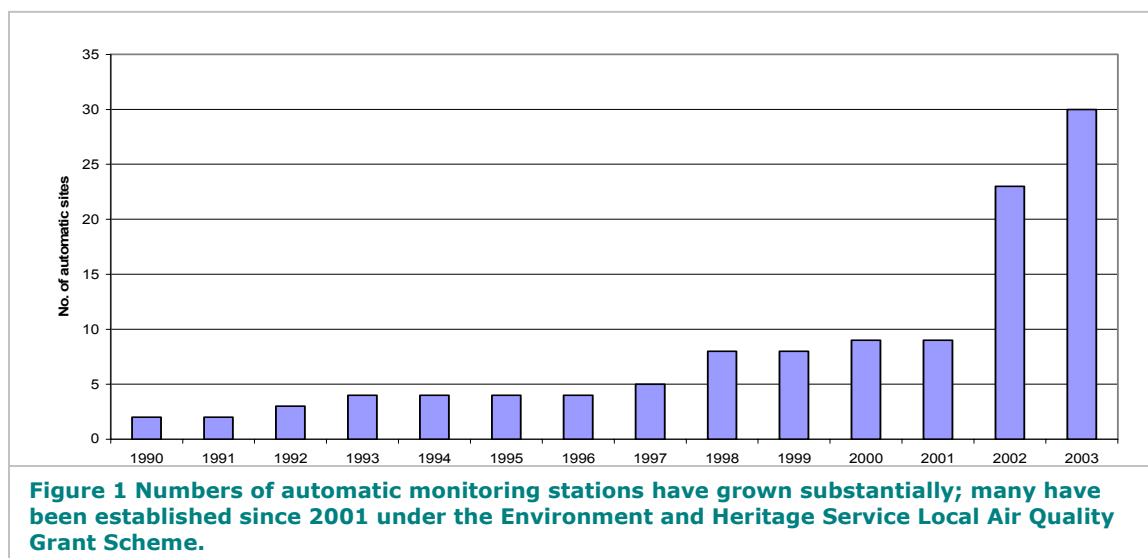


Figure 2- Automatic air monitoring station at Holywood, North Down

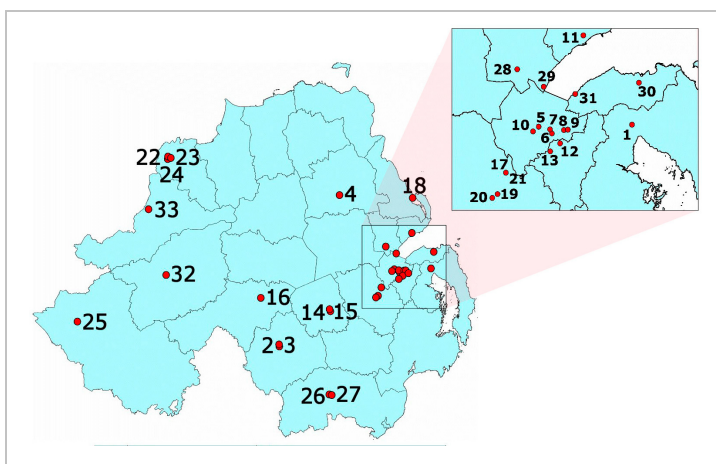


Figure 3. Automatic Monitoring Sites in Northern Ireland; details of sites and pollutants measured at each location are shown in the accompanying table.

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

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

- ▶ **NO₂** - using diffusion tubes at 260 sites.
- ▶ **SO₂** - using the 8-port sampler at 37 sites.
- ▶ **Particulate matter** as "black smoke", using the same network of 8-port samplers as for SO₂; the two pollutants are monitored simultaneously.

6. Monitoring Results For 2003 and Long-Term Trends

Northern Ireland was required to achieve three Air Quality Objectives by 31st December 2003; these were for carbon monoxide, benzene, and 1,3 butadiene. Data from monitoring sites in the region confirmed that these Objectives have been met by the required date.

On the basis of results from 2003 and previous years, it is expected that Northern Ireland will also meet air quality objectives for sulphur dioxide and metallic elements such as lead. However, monitoring results indicate that some parts of Northern Ireland may have difficulty in meeting the air quality objectives for nitrogen dioxide, particulate matter as PM₁₀, ozone, and PAH.

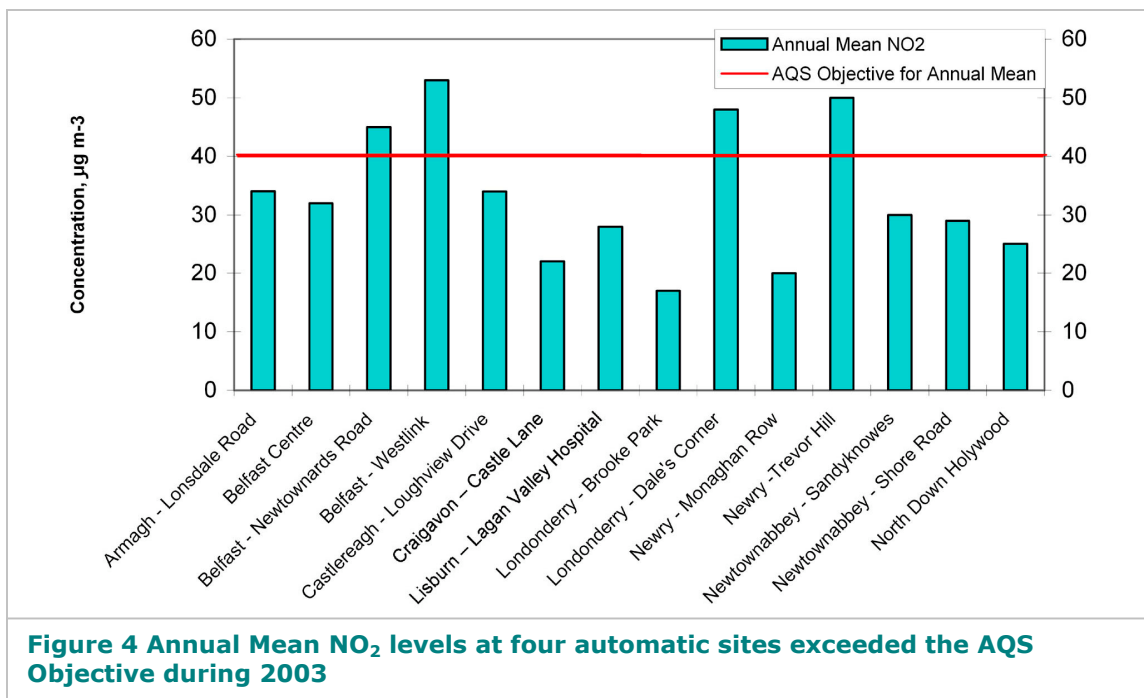
Weather conditions during parts of 2003, although not exceptional, were a contributing factor to some periods of poor air quality. Conditions included a hot, sunny summer, as well as long-range transport of pollutants from mainland Europe; these including ozone and its precursors- pollutants which react in the presence of sunlight to produce it. This long-range transport gave rise to higher UK levels - compared to recent years- of several pollutants including oxides of nitrogen, PM₁₀ and ozone. This was reflected in the slightly higher results obtained for some Northern Ireland sites in 2003, although it is important to note that these were not outside the expected range of year-on-year variation.

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 have achieved the Air Quality Strategy (AQS) objective for this pollutant by the required date of 31st December 2003.

Nitrogen dioxide was monitored using automatic techniques at 14 sites, 4 of which started operation during 2003. Results from some sites revealed potential exceedences of AQS objectives. One site, Belfast Westlink (beside a major urban road), exceeded the AQS objective of $200 \mu\text{g m}^{-3}$ for the hourly mean more than the permitted 18 times. Four roadside automatic sites exceeded the AQS objective for the annual mean ($40 \mu\text{g m}^{-3}$) - see Figure 4. These were Belfast Westlink, Belfast Newtownards Road, Londonderry Dale's Corner, and Newry Trevor Hill. Dale's Corner began operation very late in 2003 and data capture was limited; however, 2004 data from this site confirm that it may have difficulty in meeting the annual mean objective for NO_2 .



Nitrogen dioxide was also monitored using passive diffusion tube samplers at 260 sites. The Air Quality Strategy objective for the annual mean was exceeded at 18 roadside sites, all of these beside busy roads in urban centres and smaller towns. This indicates that locations of this nature may have difficulty in meeting this AQS Objective.

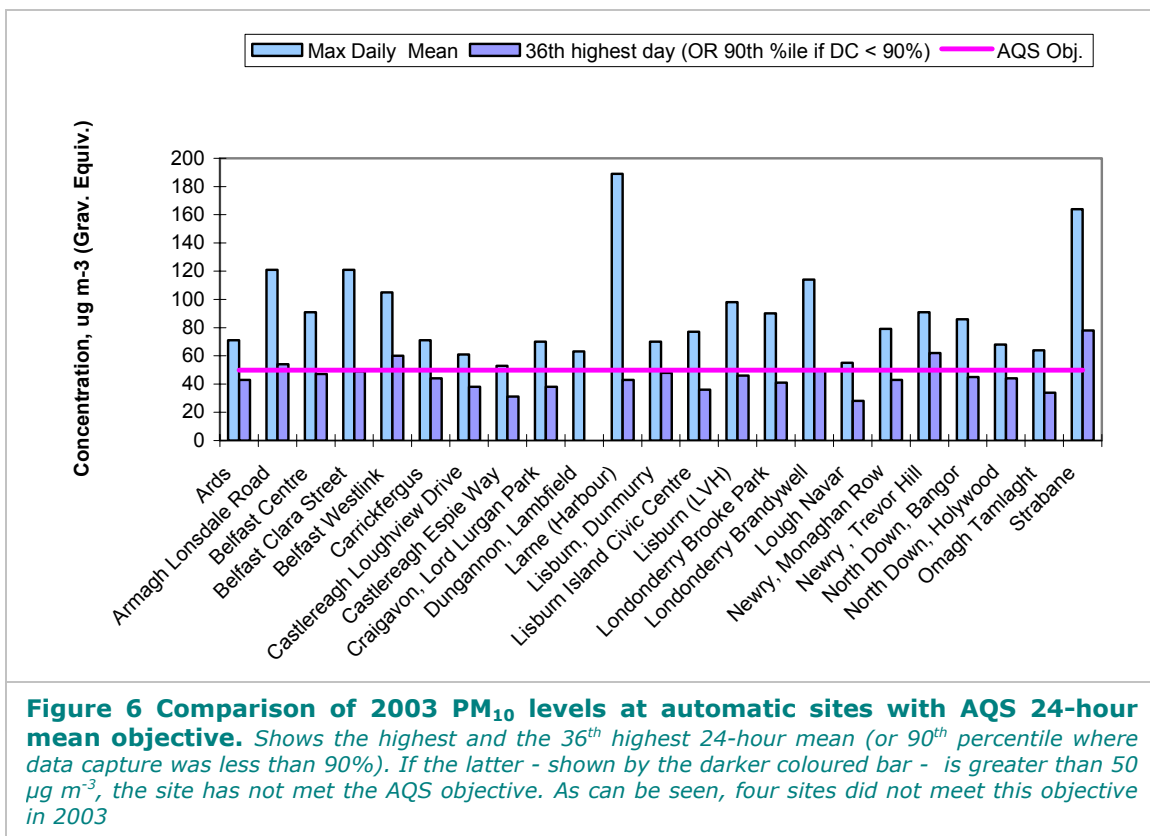
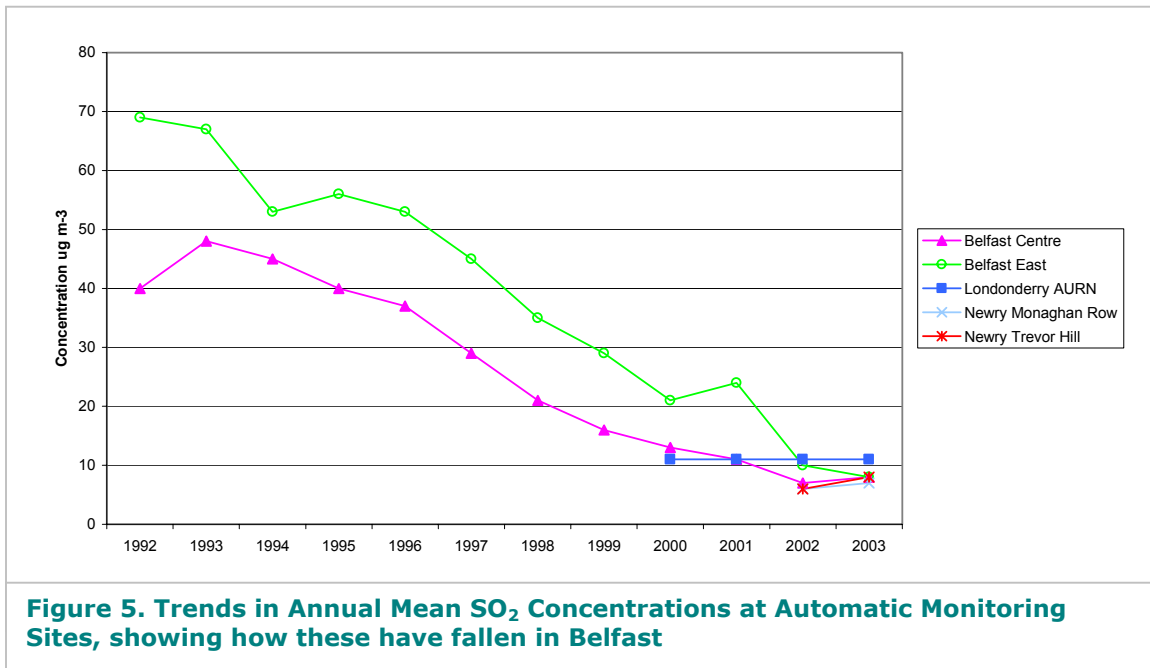
Sulphur Dioxide was monitored using automatic techniques at 17 sites, of which 3 were new in 2003. All met the 1st Daughter Directive limit values and AQS objectives. No sites recorded any exceedences of the 1-hour or 24-hour mean objectives for SO_2 . Belfast East, a long-running site that has until recently recorded relatively high SO_2 concentrations, now appears to meet the objectives.

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 2003.

Particulate matter - PM_{10} Five new automatic sites monitoring particulate matter as PM_{10} were commissioned in 2003, taking the total to 23. Four sites exceeded the AQS objective of $50 \mu\text{g m}^{-3}$ (gravimetric equivalent) for the 24-hour mean, on more than the permitted 35 occasions - see Figure 6 overleaf. These were Armagh Lonsdale Road, Belfast Westlink, Newry Trevor Hill, and Strabane Springfield Park. One of these, (Strabane), also exceeded the AQS objective of $40 \mu\text{g m}^{-3}$ for the annual mean PM_{10} , as gravimetric equivalent. This site is on a housing estate where domestic solid fuel use is prevalent.

Particulate Matter: Black Smoke

Suspended particulate matter was also measured using the older 'black smoke' method at 35 urban sites. Levels were highest in residential areas where domestic solid fuel use is widespread, but none of these sites exceeded limit values.



Ozone was monitored at three sites using automatic techniques (Belfast, Londonderry and the rural Lough Navar). Ozone (O_3) is a secondary pollutant which is formed by reactions involving other pollutant gases, in the presence of sunlight, and over several hours. Weather conditions in 2003 caused several episodes of ozone pollution from April to September. For the second consecutive year, Londonderry exceeded the target value of the AQS objective on more than the permitted ten days. Annual mean concentrations of ozone at Northern Ireland's three monitoring sites are showing no statistically significant trends, either upwards or downwards.

Benzene and 1,3-Butadiene are monitored at Belfast Centre and Belfast Roadside. Both sites achieved the AQS Objective for benzene and 1,3-butadiene by the due date of 31st December 2003. The 2003 annual mean benzene concentrations were also well within the EC 2nd Daughter Directive limit value.

Polycyclic aromatic hydrocarbons (PAH) are monitored at two sites: Lisburn (Dunmurry) and Belfast (Clara Street). Belfast Clara Street showed a big reduction in annual mean benzo(a)pyrene concentration in 2003, and now 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, continuing monitoring has identified some areas across the province that will require action.
- 2) Seven new automated monitoring sites were established in Northern Ireland during 2003. Measurements from these, together with the existing sites, show potential exceedences of Air Quality Strategy Objectives for –
 - ▶ **Nitrogen dioxide** in Belfast, Londonderry and Newry.
 - ▶ **Particulate matter** in Armagh, Belfast, Newry and Strabane.
 - ▶ **Ozone** in Londonderry.
- 3) The corresponding Objectives for carbon monoxide, benzene, and 1,3-butadiene were met by the due date of 31st December 2003.
- 4) There has been a significant improvement in sulphur dioxide levels in Belfast.
- 5) First Round Review and Assessments have been completed by 25 of the 26 District Councils in Northern Ireland. Nine of these have identified areas where AQS Objectives may not be met. Six councils have declared Air Quality Management Areas, with a further two proposed.

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 2003", report number AEAT/ENV/R/1868, February 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

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