Air Pollution in Scotland 2007

A report to the Scotttish Government

AEA

The Scottish Government

1. Introduction

This Newsletter is the first in a series of annual reports on air quality in Scotland. Produced by AEA Energy & Environment on behalf of the Scottish Government, it is intended to provide a summary of air quality monitoring carried out on behalf of Government and Local Authorities in Scotland during 2006/7.

Section 2 of this report reviews the continuing developments in air quality legislation and policy affecting Scotland. Section 3 summarises the main national air quality monitoring programmes, together with locations of monitoring sites. In Section 4, we review long-term trends in air quality, followed by spatial patterns of pollution in Section 5. Finally, for readers wanting to find out more, additional web-based and published sources of information on Scotland's air quality issues are summarised in Section 6. A more detailed Annual Report on the Scottish Air Quality Database Project will also be available on the Air Quality in Scotland website in April 2008.

At present, the Scottish Air Quality Database consists of about 50 monitoring stations in total, with a further 7 monitoring stations in 5 Local Authorities due to be incorporated soon; this will increase in future years. All data incorporated into the Scottish database undergo full QA/QC checks which are equivalent to those used in the UK Automatic Urban and Rural Monitoring Network.

As this body of high-quality air data accumulates, it will provide a valuable resource for assessment of air quality trends and spatial distribution within the project as well as a convenient data source for the general public, health professionals, academics and other interested parties.

The UK Air Quality Strategy reports that current average levels of man-made particulate pollution in the UK are estimated to reduce life expectancy by up to eight months. Continued efforts to reduce air pollution are therefore important, together with monitoring to assess progress.

2. Legislation and policy

The management of air quality is based on a series of statutory measures and policy programmes originating from Europe, the UK and within Scotland. Together, these form the basis of a strong framework for managing air quality over the coming years.

2.1 The European Union Process

Much of the foundation for managing air quality in Scotland can be traced back to the objectives and provisions contained within the series of Air Quality Directives adopted by all Member States of the European Union.

One of the most recent developments in European policy will affect the way that we manage fine particulate matter in the air, known as PM. Currently, PM is most commonly monitored as PM_{10} (fine particles with an aerodynamic diameter less than or equal to a nominal 10 micrometer). However, evidence from a number of epidemiological studies and directly from the World Health Organisation (WHO) suggests that major health impacts of PM are associated with the fraction below 2.5 microns in size (known as $PM_{2.5}$). Based on this and other evidence, a new Air Quality Directive is currently being formulated at the European level, and this is set - for the first time - to incorporate objectives for $PM_{2.5}$.

In addition, scientific evidence now suggests that PM should be considered as a 'non-threshold' pollutant, i.e. there is no 'safe' limit below which effects on health will not occur. Therefore the new Air Quality Directive is proposing that an 'exposure reduction' approach should be adopted for managing PM, whereby a year-on-year percentage reduction of observed levels is required. Revisions to the provisions and objectives for other pollutants

are also being considered. It is expected that the new Directive will be agreed by all Member States and finalised during 2008.

The UK National Network for monitoring PM – the Automatic Urban and Rural Monitoring Network (AURN) – is currently being re-configured to incorporate monitoring of $PM_{2.5}$ at a number of monitoring sites in compliance with the new Directive. This monitoring will need to be in place by the end of 2008 and is likely to include $PM_{2.5}$ monitoring at five urban and one rural location in Scotland.

2.2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, first published in 1997, establishes a strong framework for tackling air pollution. It was based on strong scientific evidence and a science-based understanding of the effects of air pollutants on health and the environment. The Strategy sets objectives for a series of pollutants to be met within all UK countries. The scientific basis, the objectives set and provisions contained within the Strategy are closely associated with the corresponding standards set within European Air Quality Directives, as described above. However, provisions and corresponding objectives for some pollutants differ from those in the Air Quality Directives; these differences relate to scientific evidence and expert opinion that is specific to the UK.

A major revision of the Strategy was published in July 2007. The revision provides a detailed update of the effectiveness of current provisions and objectives, as well as proposing a series of new regulatory measures and objectives to be adopted. The key outcomes from the Strategy revision are that all current objectives for pollutants will be maintained. Additional objectives for $PM_{2.5}$ to protect human health, and for ozone to protect ecosystems, have been adopted. Both of these new objectives are in line with corresponding standards that are either already adopted within existing Air Quality Directives, or are proposed under the new Directive (Table 1). In addition, a series of policy measures have been considered for adoption following detailed cost-benefit analysis. The full revised Air Quality Strategy and associated technical annexes can be seen at: http://www.scotland.gov.uk/Topics/Environment/Pollution/16215/6116

The objectives which are to be considered by local authorities for review and assessment purposes are contained in the Air Quality (Scotland) Regulations 2000 and the Air Quality (Scotland) Amendment Regulations 2003. The Air Quality Standards (Scotland) Regulations 2007, which came into operation on March 29th, consolidate the requirements of the various EU Directives. Other relevant legislation includes: The Road Traffic (Vehicle Emissions) (Fixed Penalty) (Scotland) Regulations 2003, which enable local authorities to check vehicles at roadside to ensure that emissions limits are not exceeded; the Public Service Vehicles (Traffic Regulation Conditions) Amendment (Scotland) Regulations 2008, which allow local authorities to request the Scottish Traffic Commissioner to attach Traffic Regulation Conditions to public service vehicle operating licenses to control emissions from buses; and The Sulphur Content of Liquid Fuels (Scotland) Regulations 2000 which limit the permissible sulphur content of liquid fuel oils such as those used for domestic heating, and thus helps to reduce emissions of sulphur dioxide.

2.3 Local Air Quality Management

Local Air Quality Management (LAQM) provides the framework within which air quality is managed by Local Authorities in Scotland. LAQM requires Local Authorities to review and assess a range of air pollutants against the objectives set out within the Air Quality Strategy, using a range of monitoring, modelling, observations and corresponding analyses. For locations where objectives are not expected to be met by the relevant target date, Local Authorities are required to declare an Air Quality Management Area (AQMA), and develop an Action Plan to address the problem.

Nine of Scotland's 32 Local Authorities have declared Air Quality Management Areas at the time of preparing this report. Of these nine:

- One has declared an AQMA for PM_{10} alone

- Four have declared AQMAs for NO_2 and PM_{10} together
- Three have declared an AQMA for NO_2 only
- One for SO_2

Table 2 shows the locations of these AQMAs, and what pollutants they deal with. Six Local Authorities- Aberdeen, East Dunbartonshire, Falkirk, North Lanarkshire, Edinburgh (for one of its AQMAs) and Glasgow (for one of its AQMAs) have submitted Air Quality Action Plans to the Scottish Government. The remaining three have still to complete their plans.

Table 1: New objectives to be adopted within the Air Quality Strategy for England, Scotland, Wales and Northern Ireland from 2007.

Pollutant	Applies	Objective	Measure	Date to be achieved	European obligation	Date to be achieved
Particles ($PM_{2.5}$)	Scotland	12 μg m $^{-3}$	Annual Mean	2020	Limit value 25 μg m^{-3}	2015
Exposure Reduction	UK urban areas	Target of 15% reduction in concentrations at urban background		Between 2010 and 2020	Target of 20% reduction in levels at urban background locations	Between 2010 and 2020
Ozone: vegetation and ecosystems	UK	Target value of 18,000 μg m^{-3} based on AOT40[1] to be calculated from hourly values from May to July	Average over 5 years	1 January 2010	Target value of 18,000 μg m^{-3} based on AOT40[1]	1 January 2010

[1] *AOT40 is a measure of accumulated ozone dose exceeding a 40ppb – 80*μg m $^{-3}$ *threshold; it provides a useful measure of the exposure of crops and ecosystems to this pollutant.*

Table 2: Air Quality Managements Areas Declared by Local Authorities in Scotland

Council	Pollutant	Source	Date Declared	No. of AQMAs
Aberdeen	NO_2 & PM_{10}	Roads	July 2006	1
Edinburgh	NO_2	Roads	December 2000, December 2006	2
Glasgow City	NO_2	Roads	January 2002, July 2007	3
Dundee City	NO_2	Roads	July 2006	1
East Dunbartonshire	NO_2 & PM_{10}	Roads	December 2005	1
Falkirk	SO_2	Industry	November 2005	1
North Lanarkshire	PM_{10}	Roads	December 2005	3
Perth	NO_2 & PM_{10}	Roads	May 2006	1
Renfrewshire	NO_2	Roads	September 2005	1

2.4 Choosing Our Future: Scotland's Sustainable Development Strategy

In Choosing our Future: Scotland's Sustainable Development Strategy, published in December 2005, a commitment was made by the Scottish Government to develop a broad set of indicators that capture the different dimensions of sustainable development reflecting Scotland's social, environmental and economic goals. Indicators are categorised and air quality is considered under the heading "Wellbeing" due to its potential impacts on human health. The number of AQMAs in Scotland year-on-year has been adopted as the air quality indicator.

3. Networks and data

A wide range of air quality monitoring activities is carried out in Scotland. Some monitoring sites are run as part of UK-wide monitoring networks; others are operated by Local Authorities in order to meet local objectives. The following Air Quality Strategy pollutants were monitored in Scotland during 2007:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NO_x) and Nitrogen Dioxide (NO_2)
- Sulphur Dioxide (SO_2)
- Particles (as PM_{10} and $PM_{2.5}$)
- Ozone
- Benzene
- 1,3-Butadiene
- Polycyclic Aromatic Hydrocarbons (PAH)
- Lead

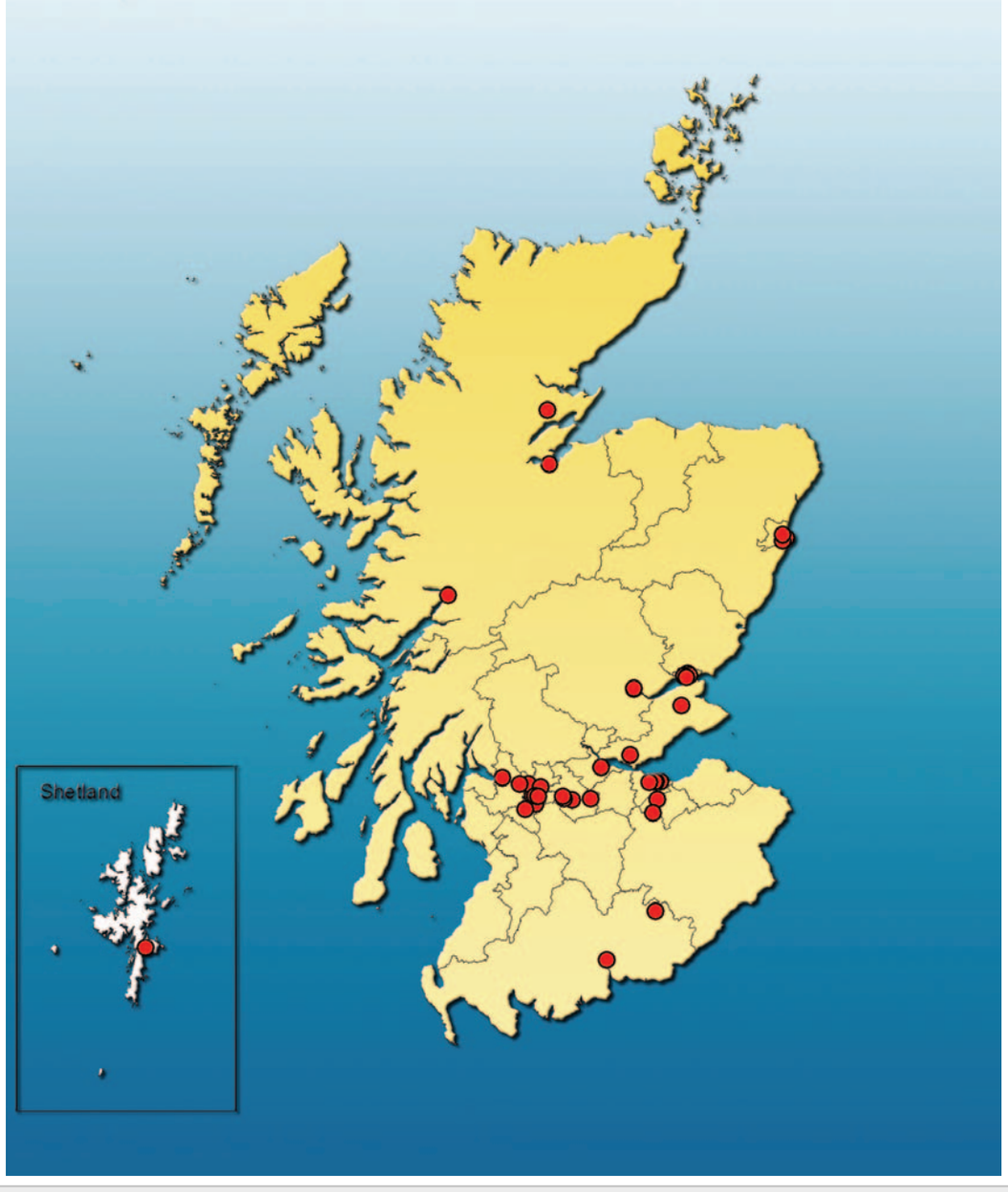

Figure 1 Automatic monitoring stations in Scotland

During 2007, monitoring was carried out in Scotland for all of the above pollutants. The locations of the automatic monitoring sites are shown in Figure 1; they provide high-resolution hourly information on a wide range of pollutants. In the case of sites comprising the automatic monitors in national network, this is communicated rapidly to the public, together with warnings when levels approach or exceed the 'high' pollution band. Two example automatic monitoring sites are shown in Figure 2, one urban Local Authority site at Battlefield Road in Glasgow and a National Network rural site at Auchencorth Moss, south of Edinburgh.

Scotland's automatic sites are supplemented by a large number of non-automatic monitoring sites, which use less expensive techniques to provide additional information on air quality. The majority of these utilise diffusion tubes: low cost single-use samplers that absorb the pollutant directly from the air and need no power supply. These measure average concentrations over a specified sampling period (typically one month) instead of instantaneous concentrations, but still provide invaluable data for screening purposes, 'hot-spot' identification, local impact assessment and mapping overall levels of pollution across the country as a whole.

Air quality data for Scotland are archived in a database that is available at www.scottishairquality.co.uk. The measurement data in the database for 2007, site numbers and areas covered are summarised in Table 3 below.

Table 3. Summary of Air Quality monitoring data available in the Scottish Air Quality Database www.scottishairquality.co.uk

Pollutant	Major sources	Sites with Data in the AQ Database	Areas covered
Nitrogen Dioxide (NO_2)	Road transport and industry	43 (Auto)	Mostly urban
Ozone (O_3)	Sunlight and heat, acting on road transport and industrial emissions	10 (Auto)	Urban & rural
Particles (PM_{10}, $_{2.5}$)	Road transport, industry, construction, soil and natural sources	28 (Auto PM10) 1 (Auto PM2.5)	Mostly urban
Sulphur dioxide (SO_2)	Industry and fuel combustion	8 (Auto)	Mostly urban
Carbon Monoxide	Road transport	11 (Auto)	Urban
PAH	Industry, transport, solvent use and some natural sources	3 (Non-auto)	Urban & rural
Acid Deposition	Fuel burning, agricultural and other emissions	9 (Non-auto)	Rural
Benzene	Vehicles and industry	2 (Auto)	Urban and Rural
1,3 butadiene	Mostly industrial	2 (Auto)	Urban and rural

In addition, monitoring is also undertaken within national networks in Scotland of a range of important pollutants for which no specific UK Objective has been set. These include Heavy Metals (urban and Rural), Ammonia, Black Smoke and Acid Deposition.

3.1 Automatic Monitoring - key results for 2007

Please note that Automatic data for 2007 are not yet fully ratified; there may therefore be changes to the final data, which could affect the summary given in this section.

This section summarises some of the results of Scotland's air quality monitoring in 2007, including compliance with Air Quality Strategy Objectives. Further information is provided on the Scottish Air Quality website at www.scottishairquality.co.uk.

Figure 2 Urban and rural: Glasgow Battlefield Road (right) and Auchencorth Moss (left) automatic air quality monitoring stations

Carbon monoxide is monitored using automatic techniques at 11 sites. All achieved the Air Quality Strategy (AQS) Objective for this pollutant.

Nitrogen dioxide data from 43 sites utilising automatic monitoring are available for 2007. Three sites (Aberdeen Market Street, Edinburgh St. John's Road and Glasgow Kerbside) exceeded the AQS Objective of 200μg m^{-3} for the hourly mean more than the permitted 18 times. However, nine roadside automatic sites exceeded the AQS Objective for the annual mean (40μg m^{-3}). These were Aberdeen Market Street, Aberdeen Union Street, Dundee Lochee Road, Dundee Seagate, Dundee Whitehall street, Fife Cupar, Glasgow City Chambers, Glasgow Kerbside, and Perth Atholl Street, all of which are close to busy roads.

Sulphur dioxide data from eight sites utilising automatic monitoring are available for 2007. All sites in Scotland continue to meet the requirements of the Air Quality Strategy for 15-minute, 1-hour and 24-hour mean SO_2.

Particulate matter – PM_{10} data from 28 sites utilising automatic monitoring are available for 2007. In this section, we have used a conversion factor of 1.3 to convert measurements made with TEOM analysers into gravimetric equivalent results. Please note that a number of studies have demonstrated that this 1.3 TEOM correction factor may be over-precautionary, especially in Scotland where the proportion of volatile particulate matter is likely to be smaller than in more southern parts of the UK. However, use of the 1.3 correction factor presented here is consistent with the results which are currently reported annually by the Scottish Government to the European Commission. The 1.3 correction factor is likely to be phased out in future years as (a) More gravimetric

monitoring becomes available across Scotland, and (b) More sophisticated correction techniques using regional volatile particulate measurements are published.

Most monitoring stations met the AQS Objective of 40µg m^{-3} (gravimetric equivalent) for the annual mean PM_{10}, although an exceedence was observed at Aberdeen Market Street. Aberdeen Market Street and Glasgow Kerbside exceeded the AQS Objective of 50μg m^{-3} (gravimetric equivalent) for the 24-hour mean on more than the permitted 35 occasions. Based on 2007 data, the 18μg m^{-3} annual mean objective for 2010 could be exceeded at even more of Scotland's monitoring sites.

Ozone data from 10 sites utilising automatic monitoring are available for 2007. Ozone (O_3) is a secondary pollutant formed by reactions involving other pollutant gases, in the presence of sunlight, and over several hours; it may persist for several days and be transported over long distances. This means that Local Authorities have little control over ozone levels in their area. In 2007, the target value for the 8hr running mean Objective was exceeded on more than the permitted ten days at Eskdalemuir and Strath Vaich.

Benzene and 1,3-Butadiene are monitored at Glasgow Kerbside. The site continues to easily meet AQS objectives for these pollutants. Background concentrations of these pollutants are also monitored at Auchencorth Moss.

Summary: Results from Scotland's network of automatic air quality monitoring stations show that the Air Quality Strategy Objectives for carbon monoxide, benzene and 1,3-Butadienehave been met by the due dates. In 2007, however, there remain a number of sites close to busy roads in urban areas that did not meet AQS Objectives for nitrogen dioxide and/or particulate matter as PM_{10}; there are, additionally, some rural sites that did not meet the EU target value for ozone. Because of this situation, nine Scottish Local Authorities have already declared Air Quality Management Areas, with more in the process of being declared throughout the country.

3.2 Non-Automatic Monitoring in 2007

Sampler-based pollution monitoring can provide a powerful and cost-effective way of determining overall pollution levels over large areas. Scotland's automatic monitoring sites are therefore supplemented by more than 800 Local Authority-operated sites using non-automatic sampling methods. The most widely used of these techniques is passive sampling, using diffusion tubes.

The main programmes of sampler-based monitoring in Scotland are as follows:

1) Diffusion tubes

These measure periodic (typically monthly) concentrations of nitrogen dioxide (NO_2). Diffusion tubes are easy to use and relatively inexpensive, so they can be deployed in large numbers over a wide area, giving good spatial coverage. They may also be used to complement detailed measurements made at automatic monitoring sites, or in circumstances where hourly measurements from automatic analysers are not required.

Although there is no longer a national monitoring network based on NO_2 diffusion tubes, these samplers are still widely used by local authorities for the purpose of Local Air Quality Management (LAQM). Or example, NO_2 is monitored at several hundred locations in Scotland in this way. Moreover, Scottish Government continues to provide a central web-based NO_2 diffusion tube data collation facility, together with QA/QC support for NO_2 diffusion tube monitoring.

The majority of Scotland's diffusion tube sites monitor NO_2. As well as this pollutant, however, diffusion tubes are also used in the region to provide indicative monitoring of ozone, sulphur dioxide and a range of hydrocarbons including benzene.

2) Non-automatic Hydrocarbon Monitoring

Pumped tube samplers for benzene (C_6H_6) and 1,3-butadiene are operated as part of the UK hydrocarbon network (run by National Physical Laboratory) in Edinburgh and Grangemouth. Running annual mean concentrations for benzene and 1,3-butadiene in 2007 were significantly below the relevant UK Air Quality Strategy Objectives.

Figure 3.1 Busses in Princes Street Edinburgh. Traffic remains the dominant air pollution source in Scottish cities

Figure 3.2 Grangemouth Refinery after a storm. Industry remains an important source of air pollution in some parts of Scotland

4. Air quality trends

Overall, recent years have seen a marked improvement in Scotland's air quality. In particular, levels of pollutants associated with motor vehicle and industrial emissions have declined significantly over the past decade.

Here we examine how overall pollution levels in Scotland have changed over the last 20 years. To an extent, these analyses are affected by changes in monitoring site numbers. Since these were relatively low for background monitoring sites up until 2000, and for roadside/kerbside sites up until 2002, trends in the earlier years should be regarded with caution. Recent research has indicated that - for reasonably robust annual mean trends analysis - at least four monitoring sites with good annual data capture should be available.

For the purpose of this analysis, we will concentrate on those pollutants for which we have identified that Air Quality Strategy Objectives are currently not being met in Scotland, namely nitrogen dioxide, particulate matter as PM_{10} and ozone. We will examine the trends in annual mean statistics which reflect the effects on health of long-term exposure to elevated levels of pollution.

4.1 Nitrogen Dioxide (and Oxides of Nitrogen)

Within Scotland (and elsewhere across the UK) the largest number of AQMAs are currently declared based on exceedences of the annual mean NO_2 objective of 40 $\mu g/m^3$. This is also reflected in the number of monitoring stations recording an exceedence of this objective (see earlier in Section 3 of this report). It is therefore important to understand how trends in this pollutant are varying with time, and whether concentrations are improving or deteriorating.

Trends in NO_2 cannot be considered without also taking into account the variations in total NO_x concentrations, since a large proportion of NO_2 is formed from the oxidation of NO to NO_2 subsequent to its emission from the motor vehicle tailpipe or chimney stack.

Figure 4 below presents the annual mean variation in measured NO_x concentrations at roadside/kerbside and urban background monitoring stations since reliable measurements began in Scotland in 1987. Despite the limitations in the number of monitoring stations in the early years, it is clear that there has been a smooth and clear long-term improvement in NO_x concentrations, due to the reductions in emissions from combustion sources which UK and EC policies have delivered.

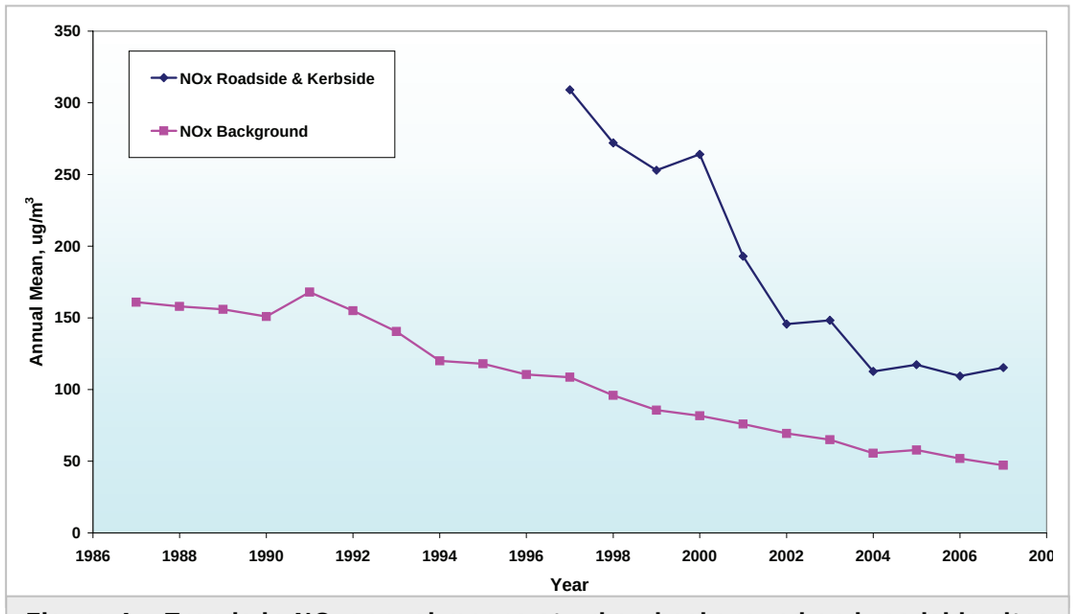

Figure 4 – Trends in NO_x annual means at urban background and roadside sites in Scotland: 1987 - 2007.

Figure 5 below shows the corresponding trends for NO_2, which also indicate a long-term decline in concentrations of this pollutant. In this case, the progression is clearly less smooth, due primarily to the dependence of NO_2 concentrations on atmospheric ozone chemistry and hence the predominant weather conditions from year-to-year. There is also evidence of a levelling-off in the reduction in concentrations at roadside locations, which UK experts (AQEG 2007) believe may be due to an increase in the proportion of NO_2 emitted directly to the atmosphere. This is due to:

a) The increased market penetration of diesel cars and the retrofitting of pollution control devices, such as catalytically regenerative traps to buses.

b) Increasing background O_3.

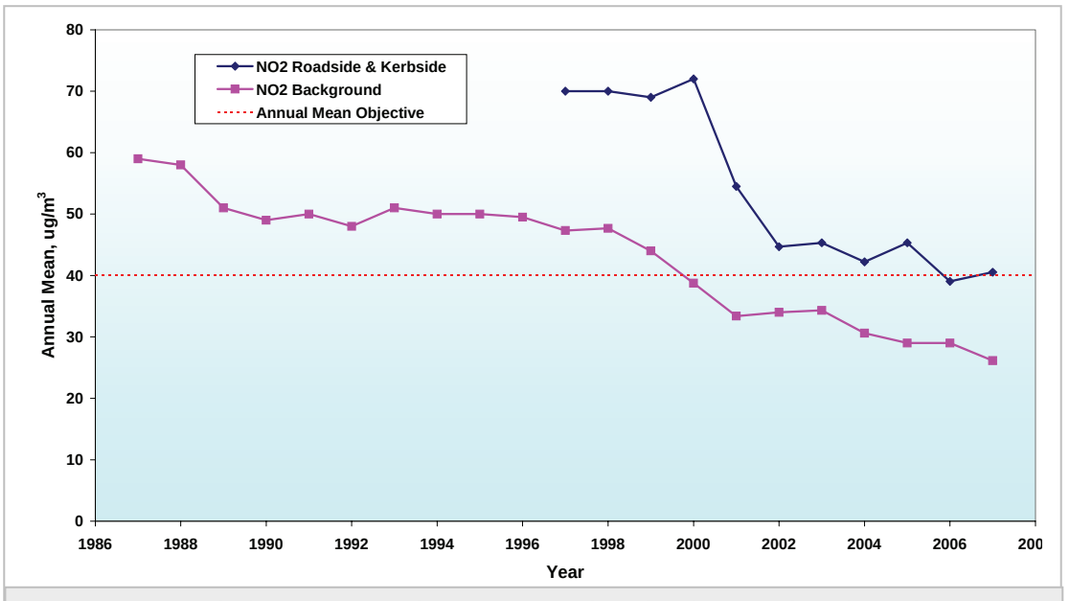

Figure 5: Trends in NO_2 annual means at urban background and roadside sites in Scotland: 1987 - 2007.

Figure 6 below illustrates the increase in background ozone, which is small but detectable at rural and remote locations in Scotland, but dramatic and clear at urban background sites.

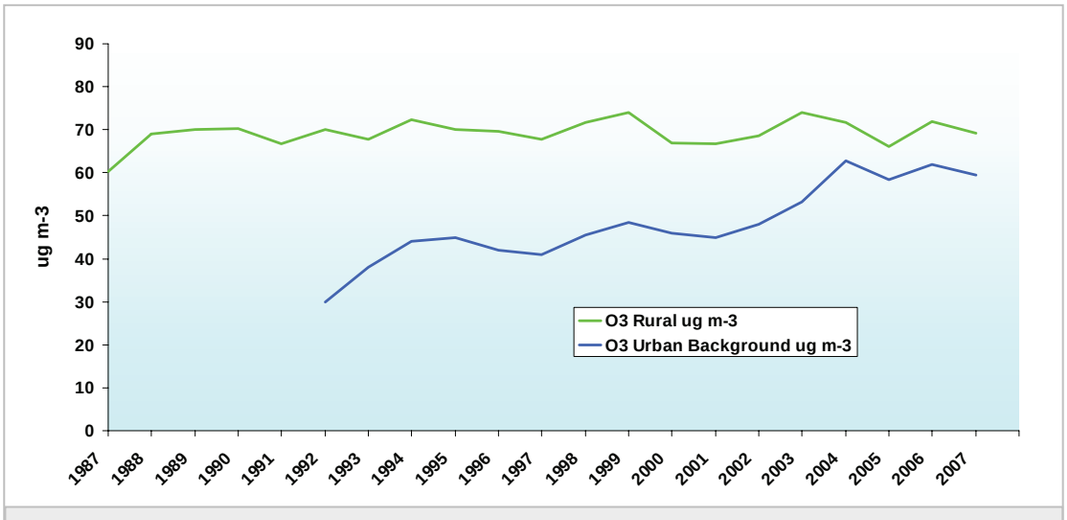

Figure 6: Trends in Ozone at Rural and Urban Background Sites in Scotland: 1987 - 2007.

Finally, we examine the trends in PM_{10} particulate matter across Scotland in Figure 7 below. These are of great interest since:

a) Scotland has adopted a more stringent annual mean PM_{10} objective than the rest of the UK for 2010, at 18 $\mu g/m^3$.

b) Scientists do not believe that there is actually a safe level of this pollutant in terms of human health effects.

This figure demonstrates that there has been a general reduction in urban background PM_{10} concentrations since 1992, but that - for the last few years - concentrations have stabilised right on the 18 $\mu g/m^3$ annual mean objective level. For roadside sites, the trend is less clear, mainly due to a large increase in the number of monitoring sites available from 2005 onwards.

This indicator appears to show a decreasing trend from 1997 to 2004, and then a step change up to a slightly higher (but level) concentration from 2005 onwards: however, this should be interpreted with caution as it is probably due to the fact that many new roadside PM_{10} sites were set up in 2005, at locations where particulate concentration were likely to be high.

Please note that many new monitoring sites have been coming on-line in Scotland in recent years. If these are at highly polluted locations, than this can have a noticeable effect when they are included in the trends analysis (average across all sites). This is what happened with PM_{10} measurements for roadside and kerbside sites in 2005. As a general comment, statistical studies have shown that the trends indicator is robust (4 µg/m3 range) if at least 4 sites are used, and extremely robust (1.4 µg/m3 range) if at least seven sites are used. For Scotland, this means that the trends should be robust from 2001 onwards, although the PM_{10} increase in 2005 is clearly on the 4 µg/m3 borderline.

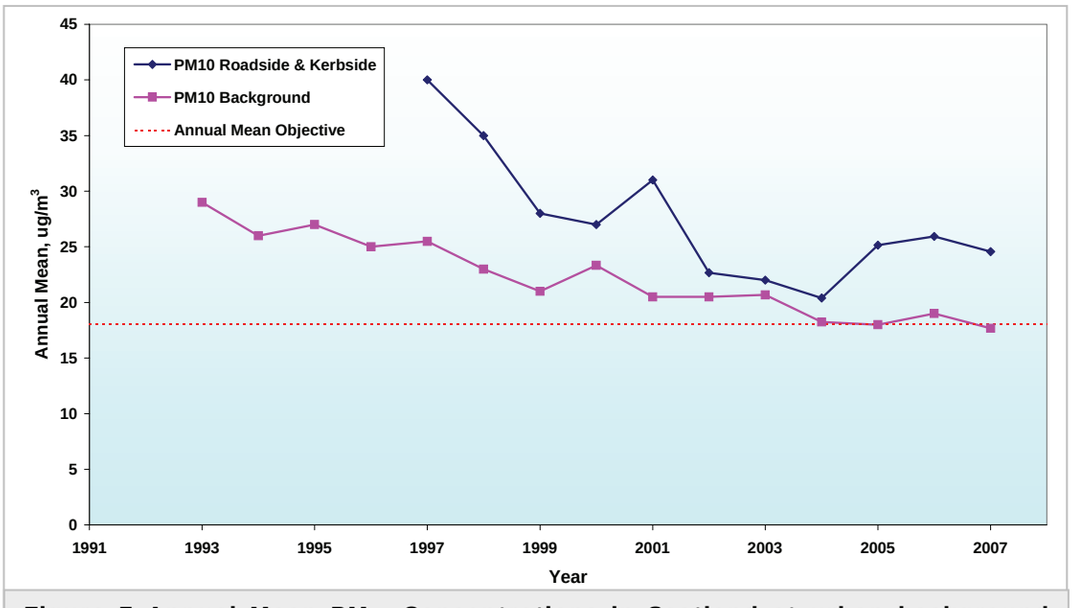

Figure 7 Annual Mean PM_{10} Concentrations in Scotland at urban background and roadside/kerbside locations from 1992 to 2007.

5. Maps of air quality

Data from the air quality monitoring sites in Scotland have been combined with pollutant emissions data from the UK's National Atmospheric Emissions Inventory (NAEI) to produce detailed maps - at 1km resolution - of average or peak background pollutant concentrations across the country. These maps (Figures 8.1, 8.2, 8.3 and 8.4) illustrate that ambient air quality in Scotland is generally good.

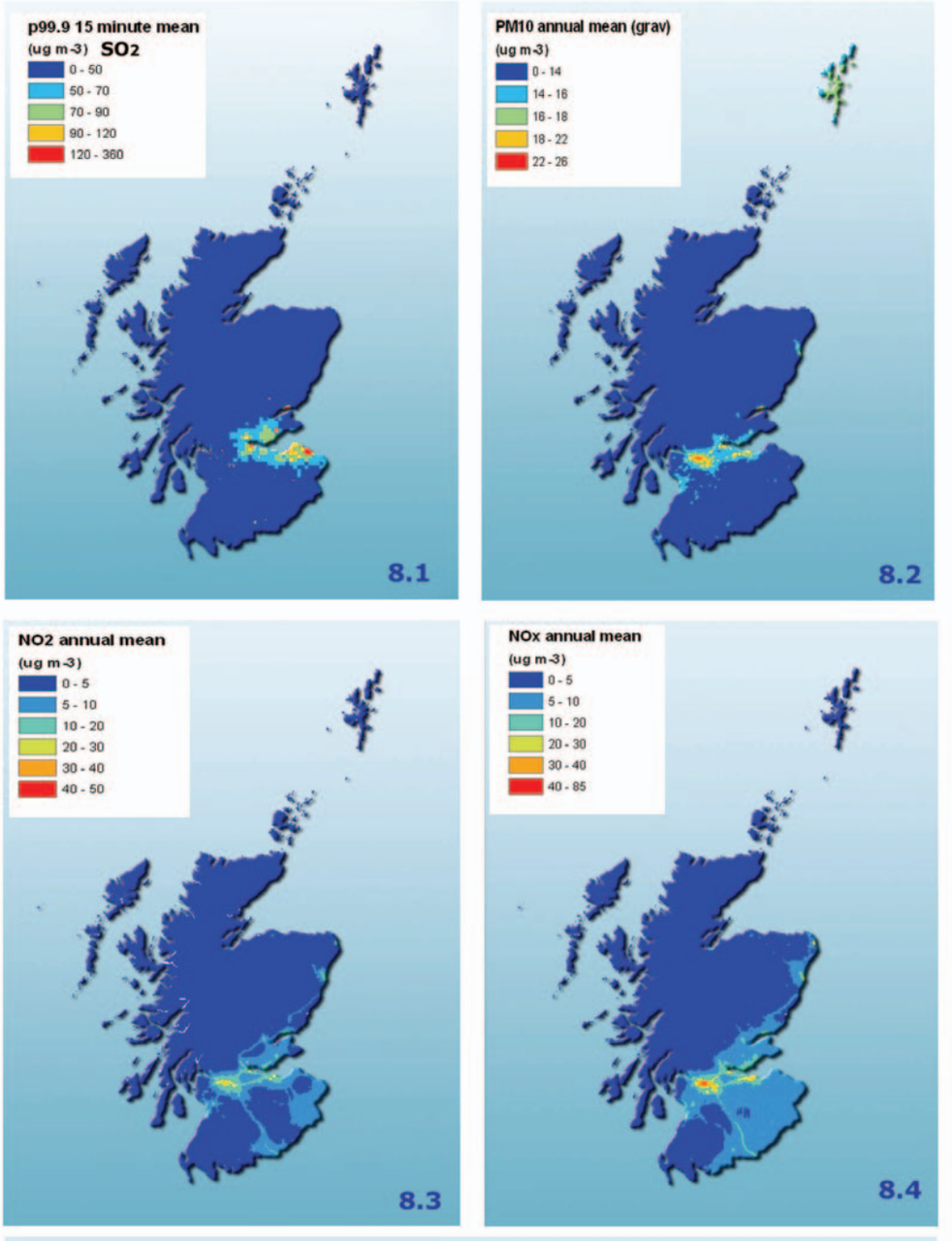

Figure 8 Maps of air quality in Scotland for four key pollutants:
8.1 Estimated 99.9th percentile on 15-minute mean SO2 µgm-3
8.2 Estimated annual mean PM10 µgm-3
8.3 Estimated annual mean NO2 µgm-3
8.4 Estimated annual mean NOx µgm-3

Figure 8.1 shows peak (99.9th percentile) 15-minute average concentrations of sulphur dioxide (SO_2). The main sources of this pollutant are industrial and domestic fuel burning (particularly coal and oil). While peak concentrations are very low over most of Scotland, the map shows clusters of elevated peak SO_2 concentrations around Grangemouth, Longannet, Cockenzie and Dunbar along the Firth of Forth.

There are also isolated "hot spots" of higher concentration throughout the rest of the region. These may indicate small pockets of high domestic coal or oil use in rural small towns and villages. However, it is also likely that this is, to some extent, a feature of the emissions inventory used in the model, as monitoring data at corresponding locations indicate that measured concentrations of SO_2 in Scotland are lower than these estimates suggest.

The gravimetric PM_{10} map (Figure 8.2) is an interesting one for Scotland, showing a swathe of highest concentrations across the central region, and also in the remote Shetland Islands. This pattern results from a combination of emissions from motor vehicles (central region) with enhanced sea salt (chloride) concentrations around the coastal regions and islands. Some of the hotspots seen on the SO_2 map and associated with domestic heating and industrial processes can also be picked out here, but not so dramatically as for SO_2.

As for the other pollutants represented in these maps, estimated background NO_2 concentrations modelled for Scotland in 2006 (Figure 8.3) are generally low. The highest concentrations - which approach 40 $\mu g/m^3$ annual mean - are mainly limited to Glasgow and Edinburgh, although the other main urban centres and transport routes across Scotland can be clearly picked out from the map. It should be noted that higher nitrogen dioxide concentrations are likely to be recorded at near roadside locations, but these cannot be modelled across the whole of Scotland and are not presented here.

The map of nitrogen oxide concentrations (Figure 8.4) shows a very similar pattern to that for NO_2. This is not surprising, since emissions of NO_x and NO_2 have a common fuel combustion source, and much of the NO_2 is formed from the oxidation of the NO emissions. As expected, the NO_x map picks out the major urban centres and transport routes even more clearly than does the map for NO_2.

6. More information

1) The Air Quality Scotland Website

The website, 'Air Quality Scotland' at www.scottishairquality.co.uk - has been created to provide a 'one stop shop' resource for information covering all aspects of air pollution in Scotland.

This site is part of a family of air quality websites covering the UK, Wales, Scotland and Northern Ireland.

The site is funded by the Scottish Government. It was designed from the outset to be:

- Accurate and reliable
- Comprehensive
- User-friendly
- Easily navigable
- Interactive
- Able to meet the needs of the general public as well as technical, local government and regulatory user communities.

The website provides comprehensive information on:

- Latest up-to-date air quality levels across Scotland
- Reports and analysis of trends and historical data
- Information on both national air quality policy and the work of Scotland's Local Authorities
- Descriptions of what causes air pollution, how it is measured, and relevant health, amenity and ecosystem impacts

The home page provides a simple summary of latest up-to-date concentrations using an 'Air Pollution Index', and a map showing where Scotland's automatic monitoring stations are located. By clicking on the map, users can view details of each monitoring site, a photograph of its location, and a list of the pollutants monitored.

2) Current and forecast air quality (national and local)

In addition to the Air Quality Scotland website, this information is rapidly available from:

- Teletext page 156
- The Air Pollution Information Service on freephone 0800 556677
- The UK Air Quality Archive on www.airquality.co.uk

3) General information on Air Quality

- The Scottish Government's Air Quality Management Internet Pages at http://www.scotland.gov.uk/Topics/Environment/Pollution/16215/4561
- The UK Air Quality Information Archive on www.airquality.co.uk
- The National Atmospheric Emissions Inventory on www.naei.org.uk
- The Defra air quality information web resource on www.defra.gov.uk/environment/airquality/index.htm
- The Air Quality Scotland website at: www.scottishairquality.co.uk
- The Air Pollution Information System website at www.apis.ac.uk

4) Local Air Quality Issues

For further information on air quality issues in your area, please contact the Environmental Health Department at your Local Authority office. Further information on Local Air Quality Management, including AQMAs and progress reports, may also be found at:

http://www.scotland.gov.uk/Topics/Environment/Pollution/16215/4561

http://www.scottishairquality.co.uk/laqm.php

and the Local Authority support site at: http://www.laqmsupport.org.uk.

Please note that the Scottish air quality website also has a section dedicated to Local Air Quality Management at http://www.scottishairquality.co.uk/laqm.php

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The Scottish Government
Environment

AEA Energy & Environment
From the AEA group

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