

UNITED KINGDOM

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I. Policy and Legal Basis

Proposals for an integrated approach to pollution control were first put forward by the Royal Commission on Environmental Pollution in their fifth report (*Air Pollution Control: An Integrated Approach*; 1976). Subsequent consultation papers reviewing the control of air and other forms of mainly industrial pollution resulted in the Environmental Protection Act 1990 (EPA).

The Clean Air Act, which came into force in August 1993, consolidates the 1956 and 1968 Acts. It is enforced by local authorities and provides controls on emissions of smoke, grit and dust from domestic fires and other commercial and industrial processes not covered by the EPA. Regulations about motor fuels and the sulphur content of gas oil and oil fuels are also contained within this Act [Murley, 1995].

Air pollutants have been monitored on a national scale in the UK since 1961, when nationwide measurements of black smoke and sulphur dioxide began. This UK monitoring network (initially called the National Survey) has monitored the improvement of air quality since the Clean Air Act of 1956. Since that time, these pollutant emissions responsible for the smogs in major UK cities have decreased substantially. As a result, attention was directed during the 1980s toward other pollutants of international concern, particularly those which can be transported over long distances. Major changes to UK national monitoring systems were initiated in 1987. These involved an expansion to acid deposition monitoring and the establishment of new networks monitoring nitrogen oxides in cities and ozone in rural areas [Bower, 1995]. The 1990 Government White Paper 'This Common Inheritance' made a commitment to expand the scope and coverage of urban air quality measurements in the UK. It also signalled increased emphasis on the public availability of air quality information [Department of Environment, 1995].

II. Scope of Each Network

The UK air monitoring system bases on the *national* air quality monitoring networks.

The *Smoke/SO₂ Monitoring Network* have operated for over 30 years and have successfully monitored the massive decline in the concentration of these pollutants. Prior to 1981, the term 'National Survey' was used to describe this network. In 1981, the survey was reorganized, with a considerable reduction in the number of sites.

In January 1992 Phase I of the *Enhanced Urban Monitoring Network (I)* was started. The aim of this network is to monitor background urban air quality in the UK's most highly polluted areas, and to disseminate results rapidly to the public. An increasing number of local authority funded stations are also being affiliated into the monitoring programme.

The aim of the second phase of the *Enhanced Urban Monitoring Network (II)* is to measure hydrocarbon species in urban air on a continuous basis.

The *Statutory Network* (EC Directive and Urban Baseline Monitoring) includes a number of long running baseline monitoring stations which have been commissioned by the Department of Environment at various times since 1972, as well as stations established to determine compliance with the EC NO_2 and SO_2 Directives.

The overall objective of the *Rural Network* is to provide information on photochemical pollution (O_3) across the country. From 1995 an EC Directive will come into force, setting guidelines on how ozone episodes are reported, recommending measurement and siting methodologies, and establishing health and vegetation protection thresholds. Exceedance of these thresholds will require appropriate action from Member States.

In order to improve the spatial coverage of the measurements, and to monitor nitrogen dioxide over the period of the introduction of catalytic converters on cars, an enlarged long-term *NO_2 Passive Diffusion Tube Network* was instigated in 1993. Over much of the UK, wet deposition is the major pathway for the transfer of pollutant species to the earth's surface.

At present, precipitation composition is measured by the *Acid Deposition Network*.

The aim of the *Toxic Organic Micropollutants Network* is to monitor the concentration of toxic organic micropollutants in the atmosphere, and in the deposition, at selected sites around the country.

There also exists the *Multi-Element and Local Monitoring Networks* which provide long-term concentration measurements for 10 metallic elements or lead since 1974.

The aim of the *Rural SO_2 Monitoring Network* is to estimate dry deposited inputs of SO_2 to the ecosystem. The deposition is not measured directly but is calculated by a model from rural ambient SO_2 measurements [Bower et al., 1995; Bower, 1995; Willis, 1994].

Activities recently have been started to involve local authorities in the national air quality monitoring programmes [Department of Environment, 1995].

The following table gives an overview of the conditions of the *national* air monitoring networks in the United Kingdom.

Network	STATUTORY	E. URBAN I	E. URBAN II	RURAL	DIV ¹⁾
Scale	National	National	National	National	4 National
Total number of sites, points	11	14	7	17	1839
Pollutant/site nos	SO ₂ /5	SO ₂ /14	VOCs/7	SO ₂ /3	SO ₂ /300
	NO/8	NO/14		NO/3	Black smoke/300
	NO ₂ /8	NO ₂ /14		NO ₂ /3	NO ₂ /1200
	CO/6	CO/14		O ₃ /17	Dioxins/7
	O ₃ /1	O ₃ /14			PAH/7
		TSP(PM ₁₀)/14			PCB/7
					Acid rain/32
Measurement technique	Automatic	Automatic	Automatic	Automatic	Sampling
Type of sites					
Urban	8	14	7		Mainly
Residential/ industrial	3				
Rural				17	

¹⁾ DIV = SMOKE/SO₂; NO₂ DIFFUSION TUBE SURVEY; TOXIC ORGANIC MICROPOLLUTANTS; ACID DEPOSITION

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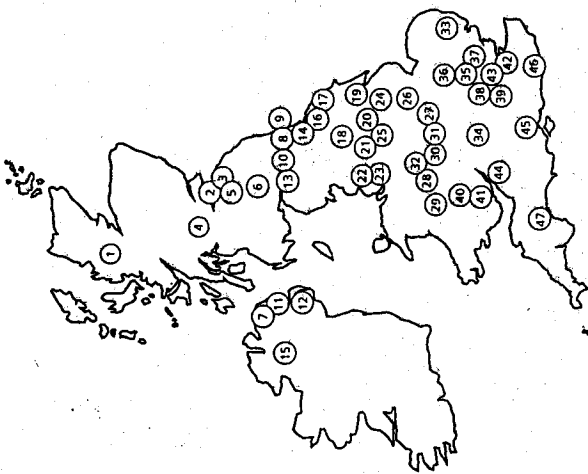
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Site No.	Site Name	Pollutants (see key)	Site No.	Site Name	Pollutants (see key)
1	Straith Vaich	★ ● ▲	26	Bottesford	★
2	Edinburgh Centre	★ ● ▲	27	Leicester Centre	★ ● ▲
3	Edinburgh Med S.	★ ● ▲	28	Walsall	●
4	Glasgow	●	29	Aston Hill	★
5	Bush	★	30	Birmingham East	★ ● ▲
6	Eskdalemuir	★	31	Birmingham Ward	★ ● ▲
7	Belfast Queens Uni	● ▲	32	Birmingham Centre	★ ● ▲
8	Newcastle Centre	● ▲	33	Sibton	★
9	Sunderland	● ▲	34	Harwell	★
10	Great Dun Fell	★ ● ▲	35	London UCL	●
11	Belfast Centre	★ ● ▲	36	London Bloomsbury	★ ● ▲
12	Belfast East	★ ● ▲	37	Bridge Place	★ ● ▲
13	Wharley Croft	★	38	Cromwell Road	● ▲
14	Billingham	★	39	West London	●
15	Lough Navar	★	40	Cardiff East	★ ● ▲
16	Middlesbrough	★	41	Cardiff Centre	★ ● ▲
17	High Muffles	★	42	London Bexley	★ ● ▲
18	Leeds Centre	★ ● ▲	43	London Eltham	★ ● ▲
19	Hull Centre	★ ● ▲	44	Bristol Centre	★ ● ▲
20	Barnsley	★ ● ▲	45	Southampton Centre	★ ● ▲
21	Manchester	★	46	Lullington Heath	★ ● ▲
22	Glazebury	●	47	Yarner Wood	★
23	Liverpool Centre	★ ● ▲			
24	Sheffield	●			
25	Ladybower	★ ● ▲			

Key ★ O₃ ● NO_x ▲ SO₂ ■ CO ● OPM₁₀ ● HC



Map 1: National Air Monitoring Networks in United Kingdom [Source: Willis, 1995]

I. National Air Monitoring Network in: UNITED KINGDOM

Name of Network: ENHANCED URBAN I (Automatic Measurement)

Site Information		Pollutants		Additional Information	
No.	Name	Monitoring Commenced	SO ₂ , NO ₂ , NO, CO, O ₃ , TSP, etc.	Other Network Programmes Concerned	Remarks (Monitoring Agency, e.g.)
		Type (rural, suburban, urban, etc.)			
1	BEXELEY	urban	May 1994	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
2	BIRMINGHAM E	urban	Dec 1993	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
3	BIRMINGHAM C	urban	Mar 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
4	BELFAST C	urban	Mar 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
5	BRISTOL	urban	Jan 1993	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
6	CARDIFF	urban	May 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
7	LONDON	urban	Jan 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
8	EDINBURGH	urban	Oct 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
9	HULL	urban	Jan 1994	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
10	LEEDS	urban	Jan 1993	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
11	LEICESTER	urban	Jan 1994	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
12	LIVERPOOL	urban	Apr 1993	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
13	NEWCASTLE	urban	Mar 1992	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾
14	SOUTHAMPTON	urban	Jan 1994	SO ₂ , NO, NO ₂ , CO, O ₃ , TSP/PM ₁₀	Eur. Directives DoE ¹⁾

¹⁾ DoE, Department of Environment, London

**I. National Air Monitoring Network in: UNITED KINGDOM
Name of Network: RURAL (Automatic Measurement)**

Site Information		Pollutants		Additional Information	
No.	Name	Monitoring Commenced	SO ₂ , NO ₂ , NO, CO, O ₃ , TSP, etc.	Other Network Programmes Concerned	Remarks (Monitoring Agency, e.g.)
	Type (rural, suburban, urban, etc.)				
1	ASTON HILL	rural	Jun 1986	O ₃	Eur. Directives DoE ¹⁾
2	BOTTES FORD	rural	Oct 1977	O ₃	Eur. Directives DoE ¹⁾
3	BUSH	rural	Apr 1986	O ₃	Eur. Directives DoE ¹⁾
4	ESKDALEMUIR	rural	Apr 1986	O ₃	Eur. Directives DoE ¹⁾
5	GREAT DUN FELL	rural	May 1986	O ₃	Eur. Directives DoE ¹⁾
6	GLAZEBURY	rural	Apr 1988	O ₃	Eur. Directives DoE ¹⁾
7	HARWELL	rural	Jun 1976	O ₃	Eur. Directives DoE ¹⁾
8	HIGH MUFFLES	rural	Jul 1987	O ₃	Eur. Directives DoE ¹⁾
9	LADYBOWER B23	rural	Jul 1988	O ₃ , SO ₂ , NO, NO ₂	Eur. Directives DoE ¹⁾
10	LULLINGTON HEATH	rural	Oct 1986	O ₃ , SO ₂ , NO, NO ₂	Eur. Directives DoE ¹⁾
11	LOUGH NAVAR	rural	Apr 1987	O ₃	Eur. Directives DoE ¹⁾
12	SIBTON	rural	Jul 1973	O ₃	Eur. Directives DoE ¹⁾
13	STRATH VAICH	rural	Mar 1987	O ₃ , SO ₂ , NO, NO ₂	Eur. Directives DoE ¹⁾
14	WHARLEY CROFT	rural	May 1985	O ₃	Eur. Directives DoE ¹⁾
15	YARNER WOOD	rural	Jun 1987	O ₃	Eur. Directives DoE ¹⁾
16	MACE HEAD	rural	Apr 1987	O ₃	Eur. Directives FORG ²⁾

17	NORTH NORFOLK	rural	Feb 1989	O ₃	Eur. Directives	DoE ¹⁾
¹⁾ DoE, Department of Environment, London ²⁾ PORG, United Kingdom Photochemical Oxidants Review Group						

DISCUSSION AND CONCLUSION

The main aim of this WHO Survey was to initiate a collection of information on national, regional and local air monitoring networks of the WHO European Region which has been expanded up to 50 Member States in the last few years. To realize this intention we had to elaborate appropriate instrumentation to compile all relevant information on policies and legislation on air pollution prevention and the scope of each network, with its details on sampling strategies, methods, devices, etc., in a most effective way. We therefore designed special questionnaires and started our investigation in a pilot phase with 13 selected countries. This overview presents the collection of all 70 air monitoring networks of the following 11 countries: Albania, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Hungary, Norway, Poland, Slovenia and the United Kingdom. The very satisfactory response to the Survey has shown that these questionnaires were valuable for this compilation especially at a time when the availability of information and data from Central and Eastern Europe has been dramatically extended.

The results of this WHO Survey show that air quality monitoring at national, regional and local scales is focussed on sulphur dioxide, nitrogen oxides and particle pollution uniformly in all investigated countries. Today these pollutants are still of concern for the assessment of environmental risks to health. However, there is a high diversity between countries regarding the monitoring of other pollutants. Also, despite of some differences concerning the applied measurement methods, technologies and devices in seven western as well as central-eastern countries, the operation is carried out by sampling and automatic measurements.

Sampling measurements are mostly manual methods, for which sampling and analysis are two separate steps. They are appropriate for use in air quality surveillance with a high spatial density. It has shown that sampling measurements are predominant in networks operating at the national and/or regional scale.

Automatic measurements involve automatic devices at a mostly fixed site to carry out both sampling and analysis. They are used for remote sensing of air pollution to establish a temporarily unbroken line of values. Automatic measurements are operating on all three scales (national, regional and local). They are sometimes supplemented by sampling measurements.

In four cases the networks operate with only one measurement technique at the various scales (3 sampling measurements; 1 automatic measurement).

In some cases the information available on the networks is not representative in all aspects. One important reason for this is that networks belong to different responsibilities, within one country or between the countries, for example, either to the Ministry of Environment or to the Ministry of Health. As a consequence, they operate their networks with varying philosophies and strategies. The main purpose is for many operating environmental authorities to measure the general spatial distribution of air pollutants over the country and their background concentrations with respect to sources, transport, and the aim to decrease emissions. For health authorities however air monitoring plays an important role in evaluating possible health effects. In this context air monitoring is essential for risk assessment in view of the exposure to air pollutants from specific sources. A network strategy of such kind is often hot spot oriented.

It also needs mentioning that quality control seems to be a problem in some countries. The World Health Organization recommends, as do other international organizations (such as the World Meteorological Organization for the Background Air Pollution Monitoring International Network and the United Nations Economic Commission for Europe for the long range transmission EMEP programme) establishing and extending quality assurance/quality control programmes. In such programmes all important pre-measurement phases of monitoring will cover the quality assurance activities, including the definition of data quality objectives, the evaluation of equipment, and the deployment and operator training. The quality control functions will cover directly measurement-related activities including network operation, calibration and data handling for example [UNEP/WHO, 1994a, 1994b].

Concerning the questionnaires designed and used it is well known of the authors and editors that, in addition to the reported information, sometimes there could be more data available on networks, such as:

- More detailed site information (address, geographical coordinates, and altitude of the sampling point);
- Measurement of meteorological parameters;
- Distance to relevant emission sources; and
- Details on data collection (transmutable or local registration).

The reason for designing these questionnaires in this way stemmed from the decision to focus the compilation on sampling and site characteristics (e.g. air pollutants, its measurement methods and devices, amounts and intervals of samplings, type of site) which are relevant aspects for air quality assurance/quality control measures.

It is of utmost importance that results of air monitoring networks can be compared on a worldwide scale, to investigate, for example, possible harmful effects on health. Depending on the large diversity of sampling and analytical methods employed in the different air monitoring networks, the installation of internationally accepted quality assurance/quality control measures has a high priority. As a consequence an internationally accepted framework with clearly defined standards for a coordinated and valid air quality monitoring should be established to avoid an undue influence from local sources and the problems regarding representative samplings. The network and sampling strategies of the UNEP/WHO Global Environmental Monitoring System on Urban Air Quality Programme could be one example in which quality assurance/quality control activities are successfully in use [UNEP/WHO, 1994a, 1994b].

At this time the Topic Centre for Air Quality of the European Environment Agency of the European Commission is also preparing an inventory on air pollution monitoring networks. It has been shown that the WHO Survey questionnaires are well suited for their activities when slightly modified. To avoid unnecessary duplication of work and in agreement with the contributing countries the World Health Organization and the European Commission stated in their collaboration that all information collected in these questionnaires will be available to both organizations. Information on air monitoring networks of some other countries of the WHO European Region, which not have been considered here, is to be published by the European Environment Agency in the near future.

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