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Executive Summary

The Environment Act 1995 Part IV establishes a statutory framework for local air quality management in the UK and places a duty upon all local authorities in Wales and Scotland, and on London boroughs, district and unitary councils in England, to undertake a local air quality review and assessment. During 1996 and 1997, a number of local authorities and local authority groups undertook a number of air quality review and assessment tasks in the so-called *First Phase*.

These authorities have compiled detailed reports of their work but to ensure that the main results are available to as wide an audience as possible, the Governments have commissioned the National Environmental Technology Centre (NETCEN) to prepare a précis of the detailed reports. In addition, the editors have used their own experience of air quality science to draw out the main scientific and important practical points conclusions from the First Phase work so that this report complements the formal technical guidance the Department has published for local authorities.

The First Phase work has encompassed the full spectrum of review and assessment:

- *Stage 1 and 2 assessments consisting of gathering available data and simple screening;*
- *Compilation of emissions inventories;*
- *Establishment of automatic monitoring sites;*
- *Local air quality surveys using passive samplers for nitrogen dioxide and benzene;*
- *Detailed dispersion modelling.*

The First Phase Groups have also undertaken research and development work to improve understanding of air pollution in the UK and to aid the development of the review and assessment process.

Key findings included:

- *Establishment of automatic monitoring sites is a complex process involving many organisations, especially for kerbside/roadside locations. First Phase Authorities showed how the exercise can be successfully carried out.*
- *Most authorities will not need a comprehensive emissions inventory. Where they do, emissions inventory compilation requires new skills but First Phase experience shows how local data can be collected which results in a significant improvement over what is available from the national inventory.*
- *There are several examples of successful dispersion modelling for sulphur dioxide. Results for PM_{10} were less reliable and results for VOCs very poor.*
- *Nitrogen dioxide diffusion tubes can be used for wide-scale spatial surveys but results must be interpreted with caution. The comparison between diffusion tubes and automatic monitors appears to vary between sites and analytical laboratories.*
- *Benzene diffusion tubes have also been used successfully but the caveats for nitrogen dioxide apply even more strongly for benzene. These samplers have a vital role, however, especially given the difficulty of modelling emissions from major sources of hydrocarbons (VOCs).*
- *Partisol measurements of PM_{10} are typically 0 to 30% larger than TEOM measurements and this has a very large effect on the number of exceedances of the PM_{10} objective of 50 μgm^{-3} as a 24 hour running mean.*
- *Although there are significant contributions to concentrations of PM_{10} at most sites from secondary particles and unidentified "background" sources, local sources such as major roads and industrial processes do contribute to the risk of exceedances of the air quality objective for 2005 in some areas. Specific industrial processes have been identified by First Phase measurements, including quarries, steel*

works and metal product fabrication sites.

- *Some industrial processes could lead to current exceedance of the air quality objective for lead for 2005. The areas affected are likely to be small in the immediate vicinity of the plant.*

- *Air quality management tools such as Indic Airviro and ADMS-Urban can be used successfully by local authorities but users must be aware of the pitfalls. Both models require a large body of input data that is time-consuming to collate. ADMS-Urban, the more recently-developed model of the two, can only handle a limited number of sources and run times are long. Both models showed poor agreement with measured concentrations on an hour-by-hour basis, although reasonable agreement is possible for longer term statistics.*

- *The guidance for First and Second Stage review and assessment was at a very early stage of drafting when the First Phase work was being carried out. Advice from the First Phase Authorities has aided the revision and completion of this guidance.*

Many authorities identified potential air quality problems that are leading to predicted exceedances of air quality objectives for 2005. Fewer authorities tackled the more complex task of assessing whether the objectives are likely to be met by 2005. This is likely to be the most difficult aspect of the formal implementation of the Act.

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1 Introduction

The Environment Act 1995 Part IV establishes a statutory framework for local air quality management in the UK and places a duty upon all local authorities in Wales and Scotland, and on London boroughs, district and unitary councils in England, to undertake a local air quality review and assessment. This review is to determine whether air quality objectives, as set out in the Air Quality Regulations 1997 and summarised in Table 1.1, are likely to be achieved by the end of 2005. Where, in the local authority's judgement, an objective will not be achieved by the end of 2005, an air quality management area must be designated.

TABLE 1.1 AIR QUALITY OBJECTIVES

Substance	*Air Quality Objective levels*
Benzene	A running annual mean of 5 ppb or less
Butadiene	A running annual mean of 1 ppb or less
Carbon Monoxide	A running 8 hour mean of 10 ppm or less
Lead	An annual mean of 0.5 μg m^{-3} or less
Nitrogen Dioxide	An hourly mean of 150 ppb or less
Nitrogen Dioxide	An annual mean of 21 ppb or less
PM_{10}	A 99th percentile of daily maximum running 24 hour means of 50 μg m^{-3} or less
Sulphur Dioxide	A 99.9th percentile of 15 minute means of 100 ppb or less

The Government has recently carried out a comprehensive review of the strategy. A draft of a revised strategy was published for consultation in August 1999 and the revised strategy itself is expected to be published in January 2000.

To facilitate the introduction of air quality review and assessment, the Department of Environment, Transport and the Regions (DETR) made funding available for a first phase of local authorities to begin implementation of the new system in 1996/7. The aims of the first phase were to assist in:

- *checking that the initial drafts of the guidance were suitable for local authorities with varying degrees of experience;*
- *testing its applicability to areas of differing need, differing complexity and with different sources of pollution;*
- *developing best practice guidance for local authorities on air quality assessment;*
- *developing further guidance for local authorities on air quality review and assessment.*

Fifteen groups of local authorities (over 90 authorities in total) were selected and are listed below, together with specific tasks agreed with DETR (Figure 1.1). In addition, whilst the Environment Act 1995 does not apply in Northern Ireland, Belfast City Council were invited to join the First Phase as a shadow authority.

The First Phase Authorities collected a wealth of information on local air quality and on the practicalities of local air quality review and assessment. This report presents a summary of

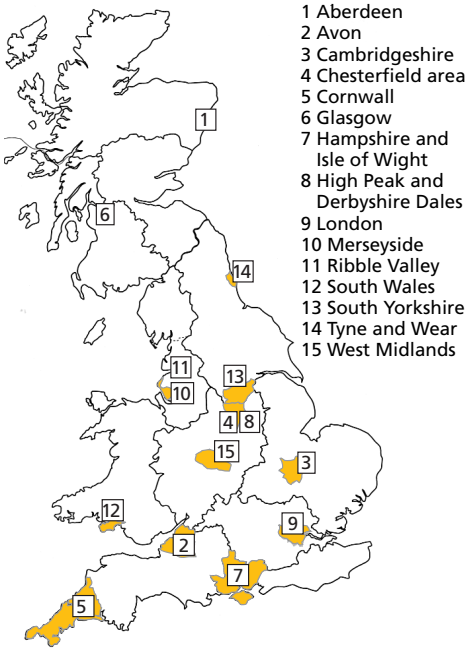

Figure 1.1 A map showing the locations of the first phase areas

their findings. A brief summary of each authority's work has already been published in *Clean Air* (1998), but here we discuss the results collectively, ordered by subject area rather than by authority. Copies of the individual reports will be available for inspection in the local authorities themselves or in the library of the Department of the Environment, Transport and the Regions at Ashdown House.

1.1 AUTHORITIES SELECTED FOR FIRST PHASE FUNDING

Aberdeen

Aberdeen is a medium sized city and its experience in review and assessment will be useful to other such authorities. It also provided an opportunity to test the applicability of procedures for urban areas in Scotland. Aberdeen agreed to:

- *Establish a fixed monitoring site, continuously monitoring CO, NO_2 and PM_{10} at a kerbside location in a congested, or a congested canyon, street in the centre of Aberdeen.*
- *Model and assess these pollutant levels at the kerbside location using a range of models and screening methods and compare modelled values with continuous monitoring concentrations.*
- *Construct an emission inventory for oxides of nitrogen and PM_{10} covering 10 km^2 of the city centre of Aberdeen.*

Avon

Four unitary authorities, Bristol, Bath & North East Somerset, North Somerset and South Gloucestershire, formed a first phase group. This group includes a major urban authority with considerable experience of air quality review and assessment and rural areas for whom review and assessment was relatively new. It also includes the industrial complex of Avonmouth. The group was given the following tasks:

- *Continuously monitor hydrocarbons, including benzene and 1,3 butadiene, in the Avonmouth area.*
- *Undertake a survey of benzene and 1,3 butadiene levels using non-continuous methods at a number of sites where it is anticipated that benzene levels may be high due to emissions from industrial processes.*
- *Identify and quantify significant sources of benzene, 1,3 butadiene and SO_2 in the Avonmouth area and model the impact of these sources on the levels of the three pollutants in the surrounding area*
- *Model and assess levels of oxides of nitrogen, NO_2, PM_{10} and CO at the kerbside of the automatic monitoring stations in Bristol and Bath, using a range of models and screening methods.*

Cambridgeshire

It was intended that the first phase groups should include medium sized urban areas. Cambridge is one such town. As specific tasks, Cambridge agreed to:

- *Model and assess levels of CO, oxides of nitrogen, NO_2, PM_{10} and benzene at the kerbside of Cambridge City Council's Regent Street automatic monitoring station;*
- *Assess levels of nitrogen dioxide, black smoke and particulate (PM_{10}) pollution using non-automatic methods at the existing automatic urban monitoring site and*
- *Develop a simple screening tool for first stage review and assessment of congested narrow canyon streets carrying traffic flows as low as 8000 vehicles per day.*

Chesterfield area

The participating local authorities in this group include Bolsover District Council, Chesterfield Borough Council and North East Derbyshire District Council. This is a largely rural area with major quarrying activities with the potential to generate elevated levels of PM_{10}. The following specific tasks were agreed:

- *Using 6 low volume gravimetric samplers fitted with CEN approved PM_{10} sampling heads, assess the levels of PM_{10} at 5 locations close to either industrial sites, including an open-cast coal mine and a solid fuel works, or the M1 motorway, along with 1 control location.*
- *Characterise the sources of collected particulates.*

Cornwall

A Cornwall Air Quality Forum was established to undertake the following tasks and included the six local authorities in Cornwall, the County Council and Cornwall College. As for the Derbyshire group, Cornwall is a largely rural area with major industrial processes with the potential to generate elevated levels of PM_{10}. The Cornwall Air Quality Forum agreed to:

- *Using a TEOM continuous monitor and three low volume gravimetric samplers, assess the levels of PM_{10} at a location near to a quarry and another minerals process and*
- *Characterise the sources of the collected particles.*

Glasgow

A major conurbation in Scotland with considerable experience of air quality matters. Specific tasks were:

- *Model and assess levels of CO, oxides and nitrogen, NO_2, PM_{10} and benzene at the kerbside of the Glasgow Hope Street kerbside automatic monitoring station using models and screening methods.*
- *Assess levels of nitrogen dioxide, sulphur dioxide, black smoke and particulate (PM_{10}) pollution using non-automatic methods at the Hope street monitoring site.*
- *Assess the value of using three different methods of constructing an emission inventory for CO, NO_x, benzene, 1,3 butadiene, PM_{10}, SO_2, lead and volatile organic compounds from Part A and Part B processes within Glasgow.*

Hampshire and Isle of Wight

This group included 14 local authorities. This is a rural county with urban development along the south coast and provides an example of the potential for rural district authorities to form groups along with neighbouring urban authorities. They agreed to undertake the following specific tasks:

- *Assess the value of using three different methods of constructing an emission inventory for volatile organic compounds from Part B processes within Hampshire.*
- *Assess levels of benzene and 1,3 butadiene around a Part A industrial process using measurements and models.*

High Peak & Derbyshire Dales

This group includes High Peak Borough Council and Derbyshire Dales Borough Council which contain more than 60 mineral processes, four of which are Part A processes involving lime and/or cement production. Specific tasks were:

- *Assess the levels of PM_{10} at 3 locations near to quarries and at a control location which is remote from active quarries using a TEOM and 4 continuous monitors which operate using the light scattering principle.*
- *Characterise the sources of the collected particulates.*

London

The particular characteristics of London meant that it should form part of the first phase. It provided an opportunity to investigate the use of air pollution review and assessment tools in Britain's largest conurbation. Specific tasks included:

- *Establish a fixed air pollution monitoring site in London measuring PM_{10}, black smoke, NO_x, NO_2 (using passive diffusion tubes), CO, SO_2, O_3, 25 hydrocarbons including benzene and 1,3 butadiene, benzene (using passive diffusion tubes), 1,3 butadiene (using a non-continuous technique), polyaromatic hydrocarbons and lead.*
- *Establish 3 meteorological sites in London to assist in the assessment of traffic models and regional scale modelling*
- *Model and assess levels of pollutants at the kerbside or the roadside at which the monitoring station described above is situated.*
- *Carry out a benchmark study to model levels of air pollutants over the London area using at least 2 commercially available regional scale models and compare these estimated levels with measurements from existing and non-automatic monitoring data.*

Merseyside

Five local authorities participated in this group: Liverpool, Sefton, Wirral, St Helens and Knowsley. Potential sources of air pollution in this group's area included both dispersed urban sources and many industrial point sources. Specific tasks were:

- *Establish and operate automatic continuous SO_2 and PM_{10} monitors at the existing AUN hydrocarbon site at Speke.*
- *Model the dispersion of the SO_2, PM_{10} and hydrocarbon emissions from all significant sources around the Mersey Estuary.*
- *Assess a methodology for compiling an inventory of VOC emissions from selected Part A and Part B processes in the region.*

Ribble Valley

This area is rural with relatively small communities. However, the town of Clitheroe has a neighbouring large industrial complex which is a significant source of air pollution. Specific tasks were:

- *Establish a fixed automatic monitoring station in the village of Chatburn*
- *Compare the levels of NO_2 and PM_{10} measured by the automatic station and by non-continuous monitors.*
- *Model the dispersion of the pollutants emitted by Castle Cement, Clitheroe and the adjacent mineral processes.*

South Wales

This group included Neath and Port Talbot County Borough Council and Swansea City Council. This

area of urban communities includes many road transport and industrial sources of air pollution.

- *Monitor levels of PM_{10}, sulphur dioxide, nitrogen dioxide, carbon monoxide in the vicinity of the British Steel site in Port Talbot.*
- *Establish a fixed site to monitor levels of hydrocarbons, notably benzene and 1,3 butadiene in the vicinity of BP Baglan Bay using an automatic gas chromatography system.*
- *Estimate levels of benzene in the Port Talbot/East Swansea area using models and compare predicted results with measured concentrations.*
- *Model the dispersion of the NO_x, SO_2 and PM_{10} emissions from all significant sources around Port Talbot.*

South Yorkshire

This group was to assess PM_{10} and sulphur dioxide arising from the domestic burning of coal in the Barnsley, Rotherham and Doncaster area. Specific tasks were:

- *Assess levels of PM_{10} and SO_2 from domestic coal burning using both automatic and non-automatic monitoring methods.*
- *Establish a fixed air quality monitoring site in Goldthorpe Junior school to monitor SO_2 and PM_{10} using automatic technology co-located with an existing non-automatic SO_2 and particulate monitoring station.*
- *Undertake a survey to determine the social reasons for coal usage and the current and future usage of domestic coal within the area both in terms of the quantity supplies and the patterns of usage.*
- *Model sources of SO_2 and PM_{10} from domestic sources up to 2005.*

Tyne and Wear

Six local authorities made up the Tyne and Wear Air Quality Management Group, Gateshead MBC, Newcastle upon Tyne CC, North Tyneside MBC, South Tyneside MBC and Sunderland CC. This is another major urban area with both dispersed and industrial point sources of air pollution. Specific tasks were:

- *Assess the value, using three different methods, of constructing an emission inventory for volatile organic compounds from Part A and Part B processes within the Tyne and Wear area.*
- *Undertake a survey of benzene levels, using passive diffusion tubes, around a number of industrial and commercial processes, including petrol stations.*
- *Using four low volume gravimetric samplers assess the levels of PM_{10} near to four industrial processes, including an open-cast coal mine, and at a control location. Characterize the sources of the collected particulates.*
- *Undertake a survey of lead levels around both a large waste oil burner and a small (<0.4MW) waste oil burner.*

West Midlands

A joint working group was established to carry out the following tasks which included members of Birmingham and Coventry City Councils; Dudley, Sandwell, Solihull, Walsall and Wolverhampton Metropolitan Borough Councils; and staff from the School of Geography, Birmingham University. This is one of Britain's largest conurbations and the authorities have considerable experience in air quality assessment. Specific tasks were:

- *Carry out a benchmark study to model levels of air pollutants over the West Midlands area using at least 2 commercially available regional scale models and compare these estimated levels with measurements from existing automatic and non-automatic monitoring data.*
- *Validate the West Midlands emission inventory for NOx and CO using a simple box modelling approach.*

Belfast

This authority was asked to investigate the air quality impact from prevalent domestic combustion of coal. Specific tasks were:

- *Carry out a comparison of PM_{10} samplers.*
- *Carry out a survey of use of fuels.*
- *Undertake emission factor measurement work for SO_2 and PM_{10} from a variety of fuels used for domestic heating.*
- *Carry out dispersion modelling studies of SO_2 and PM_{10} in Belfast under different fuel usage scenarios and validate the results.*

Establishment of Monitoring Sites

2

All the groups were tasked with carrying out air quality monitoring. Some groups established fixed continuous air quality monitoring stations while others used non-automatic or passive sampling. Their experiences showed that establishing automatic monitoring stations can be a difficult task, requiring input from the Environmental Health, Planning and Transport Departments as well as external agencies. It was also time-consuming and the length of time between gaining financial support and the full commissioning of the monitoring station was up to 8 months. Once a site had been selected, various obstacles had to be surmounted before air pollution monitoring could begin. Some of the problems faced and solutions identified are described below.

2.1 MONITORING STRATEGY

Each of the groups tasked with establishing fixed monitoring sites had a defined objective for monitoring. For example, Glasgow, Aberdeen and London were tasked with establishing roadside/kerbside monitoring sites at locations where emissions from vehicles were of concern. In Ribble Valley, a monitoring site was to be established in a village downwind of a large industrial source. In Merseyside, air pollutant concentrations were to be measured in an area with significant industrial sources around the Mersey Estuary. Without such clearly defined objectives, it would have been difficult to develop appropriate siting criteria.

External expertise in monitoring network design may prove useful in site selection. In Ribble Valley, for example, some of the initial sites chosen were rejected after consultation with the National Monitoring Helpline because:

- *the proposed site was overshadowed by trees,*
- *the proposed site was obstructed by adjacent buildings*
- *pollution sources which could interfere with the data collection were too close to the site.*

2.2 SITE ESTABLISHMENT

The necessary works in establishing a monitoring installation are significant. Once a fixed structure housing the monitoring equipment is in place, it would be expensive to put right mistakes made at the planning stage. The experiences of the first phase groups will be particularly useful in ensuring that important facets of site installation planning are dealt with prior to construction.

2.2.1 Planning Permission

Planning permission was necessary for most of the new monitoring sites and, when required, the process was time consuming. It was often found that the number of interested parties and the complexity of the negotiations were not envisaged at the inception of the project. In London, planning permission was granted by Westminster City Council but the University of Westminster had to be consulted as the cabin was to be located outside their building. In this case, permission also had to be gained from the Highways Agency and the Traffic Director for London for the installation works on Marylebone Road since it is a "Red Route". The local police had to be consulted regarding the times for cement pouring and cabin delivery. Planning permission was granted in all cases, albeit usually on a temporary basis. Specifications in the planning approval included, for example, application of an anti-flyposting finish to the exterior of the cabin and specification of the cabin colour to match surrounding street furniture.

2.2.2 Road and Traffic Requirements

Consideration of the safety of road users is a necessary part of planning the installation of a roadside or kerbside monitoring station. Consequently, liaison with the Highways Authority and/or Transport Department of the Council is necessary at an early stage for consideration of impairment of drivers' visibility, available pavement width for pedestrians and access to underground services via manholes on the pavement. The Local Authority Roads Section in

Aberdeen required the station to be sited 0.5 m from the kerbside and approximately 20 m from traffic lights with sufficient pavement width for pedestrians to pass. This latter requirement excluded areas of narrow pavements on Union Street from consideration.

2.2.3 Commercial interests of businesses in the locality

If trying to locate a site in city streets, difficulties may be encountered in identifying businesses willing to accept the station outside their frontage. In Aberdeen, for example, the Chamber of Commerce provided assistance and an information pack detailing the need for air quality monitoring. The involvement of elected members in this process was also found to be beneficial.

In more rural locations commercial interest can still play a part. In Ribble Valley, for example, where the monitoring location was on the edge of the village of Chatburn, one early site selected was deemed inappropriate as negotiations with the land owners for permission to site the station failed due to rent charges.

2.2.4 Safety of Public and Operators

At roadside/kerbside monitoring locations, the safety of both pedestrians and operators was found to be a limitation particularly in congested streets. For example, in London, the Highways Agency requested railings between the cabin and the roadside railings to prevent pedestrians walking between the cabin and the roadside. These had to match the existing railings.

In Merseyside, alterations had to be made to the site after commissioning following a Council inspection to assess risk to health and safety of operatives visiting the station to carry out routine checks and maintenance. These included the provision of a roof access ladder and anchoring points, a steel mesh flooring on top of the roof and a guard rail to prevent falls. This was necessary as site operators were to work on the roof to maintain the TEOM head. In London, however, a reinforced roof to support the weight of the site operators routinely working on it along with a protective railing around the roof, was specified in the cabin design.

2.2.5 Site Security

Vandalism is always of concern at any air quality monitoring location and, in cases where this was thought significant, fences were erected to provide additional protection e.g., at Ribble Valley where the site was on a playing field. In the London study, a steel door with two five level dead locks and anti-jemmy bars were specified in the cabin design. Additional security can be arranged at sites in urban centres which benefit from CCTV.

2.2.6 Utilities

Continuous air quality monitoring equipment requires electricity and telephone connection, and the location of supplies may have a significant bearing on the cost of installation. Technical Services Departments of local authorities can identify where the closest supply is. In the case of Glasgow, arrangements were made with Railtrack and Scottish Power to obtain a power source from the adjacent railway station.

Site locations in more rural areas may be some distance from nearest main services. A new metered power connection was installed at the Chatburn site (Ribble Valley) and the supply cable had to be laid to ground to comply with the land owner's conditions. The estimated cost of a land line communication network was considered too high for a temporary site. As an alternative, a mobile communication system was used following negotiations with the station supplier. It was said that a mobile system would effectively provide the service more cheaply even though the individual calls would be more expensive. However, in practice, significant signal and cost difficulties were encountered as:

- *the communications system was set to collect the measured pollutants automatically off peak,*
- *intermittent signal strength meant that data downloading was unsatisfactory, and*
- *unknown to the local authority the mobile telephone was set on call divert, which cost 25p every minute and approximately 10p for the outward call.*

The local authority contacted a local communications expert who indicated that the set up being used was not ideal. He was able to provide a solution that involved the manufacture of a new directional aerial and this improved communications immensely.

2.3 MONITORING EQUIPMENT SELECTION

Each local authority purchasing air quality monitoring equipment implemented a competitive tendering process. This was generally found to be a difficult and time consuming task by those staff unfamiliar with the tendering process and lacking a technical knowledge of equipment components and operational requirements. Assistance was gained from the experiences of neighbouring local authorities that had previously purchased air quality monitoring equipment. Capital costs plus maintenance costs were usually requested in the invitation to tender along with ancillary products such as gas regulators, an air conditioning unit and chart recorders. A list of equipment suppliers and gas suppliers was provided by the National Monitoring Helpline. The operation of the equipment was required to meet the quality control and quality assurance criteria applicable to stations affiliated to the national network. Comparison of the tenders received required careful scrutiny to ensure items complied with the specification issued. One authority, when negotiating with a number of equipment suppliers, found it useful to gain independent advice from the national helpline, wherever possible.

2.4 SITE INSTALLATION AND COMMISSIONING

Following site infrastructure planning and award of contract to the equipment supplier, commissioning of the site required co-ordination by the local authority. A range of organisations were required to carry out works, prior to site installation. This was to ensure power and communication supplies and preparation of a concrete base for the cabin. Hauliers for delivery of the cabin were required and, in Glasgow, a crane was used to lower the cabin onto the prepared concrete site base. Other civil engineering works required prior to site commissioning included kerb re-alignment and footway widening in Glasgow.

In London it was necessary to remove two trees planted in the proposed location the week before the site base was to be laid, despite prior site consultation with the necessary body. The civil engineering works in London were sub-contracted but before any work could take place permission had to be given by the statutory undertakers who were National Grid, Thames Water Utilities, British Gas Transco, British Telecommunications plc and Videotron Corporation Ltd. Plans for any services that these companies had in the area were requested by the Local Authority. These companies were also given an invitation to attend the site excavation. This process in London took two months.

In the period immediately following commissioning, problems were encountered at some locations which delayed the output of monitoring data. These included software and hardware failures, various communication breakdowns caused by modem links, and problems encountered when automatically polling data. At all monitoring sites all problems were corrected.

2.5 QUALITY ASSURANCE AND CONTROL

To achieve data of sufficient quality to enable comparison with the national air quality objectives certain quality assurance and control activities must be carried out on a regular basis. Data can be reviewed remotely in most cases and this is usually done on a daily basis to ensure that equipment is functioning satisfactorily and no pollution episodes are evident. When this is not carried out faults can go undetected for some time. For example, at one site a faulty electrical connection in the anemometer resulted in the loss of two months' data.

Equipment calibration is required once a fortnight and this was found to take about half a day to a day of officer's time. Equipment suppliers generally provided the necessary training to equipment operators. A number of other procedures were also routinely required at site visits. These included the changing of filters, the cleaning of the manifold inlet, automatic calibration systems checks and the review of data recorded on a chart recorder.

Independent site audits and data ratification were undertaken on a 6 monthly basis by some local authorities using an external QA/QC organisation. This was especially helpful when drift in the analysers occurred. For example, at Aberdeen over a 6 month period analyser sensitivity reduced during the monitoring period resulting in a progressive under-estimation of NOx and CO concentrations. This resulted in originally recorded

NOx concentrations being only 60% of the ratified measurements. When equipment is regularly serviced and calibrated, the appropriate scaling of raw data can be carried out, resulting in good data quality.

2.6 DATA HANDLING

It is important that loggers are interrogated at frequent intervals and that data are backed up regularly onto a central computer. Ideally, these should be further backed up onto a network, floppy disc or CD-ROM.

Data can be examined using the software supplied with the equipment and this was found to be useful to check data on a daily basis. This was typically done twice daily to ensure equipment was functioning satisfactorily and to check pollution levels. More detailed data manipulation was best performed using spreadsheets where scaling of the data and statistical analysis could be carried out. Limitations were found in some of the equipment software such as:

- *initially data was stored according to the month of measurement which makes scanning data over several months difficult without using commercial spreadsheet packages,*
- *1 hour, 8 hour and 24 hour data were available on graphs but not as data listings which limited comparison to the national air quality standards and objectives,*
- *there was no facility to scale data within the software,*
- *there was no facility to edit or flag erroneous data*

2.7 NON-AUTOMATIC MONITORING

The first phase groups generally had less difficulty establishing non-automatic monitoring sites. Even so, when models were used to assess the ideal location for monitoring, groups found that the availability of suitable land or accommodation on the ground limited the choice of sites and some compromise had to be reached between the ideal measurement location and practical considerations. Even with passive samplers, which are particularly straightforward to use, Aberdeen found that NO_2 diffusion tubes had to be mounted at second floor level rather than at the kerbside as accessible tubes were lost to vandals.

2.8 SUMMARY

The establishment of a fixed air quality monitoring site was, perhaps, more involved than most authorities anticipated at the outset of the project. The staff resource required by Aberdeen is summarised in Table 2.1. It is apparent from the experiences of all the authorities that it is vital to ensure co-ordination and co-operation of various council departments and other organisations. Assistance can be gained, either from experiences of other authorities or from the National Monitoring Helpline to help in the selection and establishment of sites, procurement of equipment, quality assurance of the monitoring strategy, quality control of the data and the management of the data when collected. Co-ordination of site preparation, equipment delivery and

TABLE 2.1 PROGRESSION OF SITE SELECTION AND EQUIPMENT SUPPLY AND NUMBER OF HOURS OF OFFICER TIME REQUIRED AS REPORTED BY ABERDEEN COUNCIL.

Item	*Time*	*Number of hours*
Confirmation of Funding	July 1996	–
Demonstrations from equipment suppliers/familiarity	Aug-Sept 1996	20
Site identification including liaison with		
Planning/Roads Depts, commercial premises, site visits	Aug-Dec 1996	45
Preparation of tender document	Oct 1996	20
Evaluation of tender document	Dec 1996	20
Confirmation of contract	Dec 1996	–
Clarification of equipment layout	Jan-Feb 1997	6
Equipment delivery, commissioning	Mar 1997	20
AEA Technology audit	10 Mar 1997	7
TOTAL		138

TABLE 2.2 STAFFING RESOURCES REQUIRED FOR ROUTINE OPERATION OF AN AIR QUALITY MONITORING STATION, ASSUMING STAFF HAVE ALREADY RECEIVED ADEQUATE TRAINING.

Item	*Staffing Resources*
Equipment calibration routine visits	1 day/fortnight (2 persons)
Daily data checking /data back up	30 minutes/day
Report writing/data evaluation	2 days/month
Additional resources – equipment service, repair maintenance visits, gas delivery, investigation of pollution episodes/abnormal readings	10 days/annum

commissioning needs to be undertaken by the local authority to ensure commencement of air quality monitoring by the required time. In addition, significant staff time and resources are required for regular maintenance of the equipment, as summarised in Table 2.2, to ensure data quality and to manage and analyse the data to produce the required statistics for comparison to the national air quality objectives.