AEAT/Env/R/ 1018

Air Quality Review and Assessment - Stage 2

A report produced for Omagh District Council

February 2002

AEAT/Env/R/ 1018

Air Quality Review and Assessment - Stage 2

February 2002

Title	Air Quality Review and Assessment - Stage 2
Customer	Omagh District Council
Customer reference	-
Confidentiality, copyright and reproduction	
File reference	
Report number	AEAT/R/ENV/ 1018
Report status	Issue 1
ISBN number	

National Environmental Technology Centre
Culham
Abingdon
Oxfordshire
OX14 3ED
Telephone 01235 46 3128
Facsimile 01235 46 3011

AEA Technology is the trading name of AEA Technology plc
AEA Technology is certificated to BS EN ISO9001:(1994)

	Name	**Signature**	**Date**
Author	Melanie Hobson		
Reviewed by	Beth Conlan		
Approved by	Beth Conlan		

Executive Summary

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality which culminated in the Environment Act, 1995. The National Air Quality Strategy provides a framework for air quality control through air quality management and air quality standards. New national air quality standards have been proposed by the Expert Panel on Air Quality Standards (EPAQS) for the UK. These and other air quality standards and their objectives have been enacted through the Air Quality Regulations. The Environment Act 1995 requires Local Authorities in England, Wales and Scotland to undertake an air quality review. For Northern Ireland authorities this process is voluntary. In areas where air quality objectives are not anticipated to be met by the specified date, Local Authorities are required to establish Air Quality Management Areas to improve air quality.

The first step in this process is to undertake a review of current and potential future air quality. A minimum of two air quality reviews are recommended in order to assess compliance with air quality objectives, one to assess air quality at the outset of the Air Quality Strategy and a second to be carried out towards the end of the policy timescale (2005). The number of reviews necessary depends on the likelihood of achieving the objectives.

This report is equivalent to a stage two air quality review as outlined in the Government's published guidance. The air quality review investigates current and potential future air quality through an examination of the location and size of principal emission sources, emissions modelling exercises and by reference to monitored air quality data.

The conclusions of the report are as follows:

Contents

Appendices

Acronyms and definitions

AQS	Air Quality Strategy
AADTF	annual average daily traffic flow
APEG	Airborne Particles Expert Group
AQMA	Air Quality Management Area
AUN	Automatic Urban Network
CHP	Combined Heat and Power plant
CNS	central nervous system
CO	Carbon monoxide
CRI	Chemical Release Inventory (now the Pollution Inventory)
DEFRA	Department of the Environment, Food and Rural Affairs.
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EPA	Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards
HA	Highways Agency
HFO	heavy fuel oil
HGV	heavy goods vehicle
IPPC	Integrated Pollution Prevention and Control
M	mega ($1x10^6$)
MoD	Ministry of Defence
NAEI	National Atmospheric Emission Inventory
NETCEN	National Environmental Technology Centre
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ODC	Omagh District Council
PG	Process Guidance (notes)
PI	pollution inventory
ppb	parts per billion
ppm	parts per million
PSG	Pollutant Specific Guidance (see Reference section)
SO_2	Sulphur dioxide
SoS	Secretary of State
SSAQR	Second Stage Air Quality Review
TEOM	tapered element oscillating microbalance
VOC	volatile organic compound

1 Introduction

This chapter introduces the important elements of the government's air quality strategy. Chapters 2 onwards present the results of the air quality review and assessment.

1.1 THE NEED FOR A NATIONAL AIR QUALITY STRATEGY

During the early 1990s, the Department of Environment, Transport and the Regions' (DETR) investigated the need for a new framework for air quality control. This was fuelled by episodes of poor air quality in many of the UK's major urban areas and increasing concerns expressed by both the public and the scientific community. The need to reconcile rising demands in living standards with the maintenance of environmental quality has already been recognised in Agenda 21 and is now taken further with the development of the Air Quality Strategy (AQS)[1].

On the whole, air quality in the UK today is much improved compared to that of fifty years ago when the occurrence of high SO_2 and smoke concentrations as 'smog' in towns and cities resulted in acute health effects on the resident population. However, there is now some evidence of an association between ambient air quality and chronic health effects and discomfort for sensitive individuals. For example, health effects have been linked to particulate emissions from sources such as road transportation. A new approach to the control of air quality was sought to tackle these issues and to provide a further basis for the achievement of wider objectives in relation to sustainable development in the UK.

Part IV of the Environment Act 1995, the main elements of which are shown in Table 1.1, requires the formulation of a national strategy and provides for the further development of local air quality assessment and management. This Act and the subsequent AQS are the culmination of work surrounding a number of consultation documents issued by the Government, the most important of which was 'Air Quality: Meeting the Challenge' in 1995. The Strategy was also developed within the context of information provided by an ongoing programme of research conducted by Government Panels and Review Groups. A draft Strategy was produced in August 1996 and the first National Air Quality Strategy was adopted in April 1997 (DoE, 1997). In December 1997, Air Quality Regulations set out the process of air quality review and assessment.

The Government published its proposals for review of the National Air Quality Strategy in early 1999 (DETR, 1999). These proposals included revised objectives for many of the regulated pollutants. A key factor in the proposals to revise the objectives was the agreement in June 1998 at the European Union Environment Council of a Common Position on Air Quality Daughter Directives (AQDD).

Following consultation on the Review of the National Air Quality Strategy, the Government prepared the Air Quality Strategy for England, Scotland, Wales and Northern Ireland for consultation in August 1999. It was published in January 2000 (DETR, 2000).

Table 1.1 Major elements of the Environment Act 1995

Part IV Air Quality	Commentary
Section 80	Obliges the Secretary of State (SoS) to publish a National Air Quality Strategy as soon as possible.
Section 81	Obliges the Environment Agency to take account of the strategy.
Section 82	Requires local authorities, any unitary or district, to review air quality and to assess whether the air quality standards and objectives are being achieved. Areas where standards fall short must be identified.
Section 83	Requires a local authority, for any area where air quality standards are not being met, to issue an order designating it an air quality management area (AQMA).
Section 84	Imposes duties on a local authority with respect to AQMAs. The local authority must carry out further assessments and draw up an action plan specifying the measures to be carried out and the timescale to bring air quality in the area back within limits.
Section 85	Gives reserve powers to cause assessments to be made in any area and to give instructions to a local authority to take specified actions. Authorities have a duty to comply with these instructions.
Section 86	Provides for the role of County Councils to make recommendations to a district on the carrying out of an air quality assessment and the preparation of an action plan.
Section 87	Provides the SoS with wide ranging powers to make regulations concerning air quality. These include standards and objectives, the conferring of powers and duties, the prohibition and restriction of certain activities or vehicles, the obtaining of information, the levying of fines and penalties, the hearing of appeals and other criteria. The regulations must be approved by affirmative resolution of both Houses of Parliament.
Section 88	Provides powers to make guidance which local authorities must have regard to.

1.2 OVERVIEW OF THE PRINCIPLES AND MAIN ELEMENTS OF THE NATIONAL AIR QUALITY STRATEGY

The main elements of the AQS can be summarised as follows:

- The use of a health effects based approach using national air quality standards and objectives.
- The use of policies by which the objectives can be achieved and which include the input of important actors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with a target dates of 2003, 2004 and 2005 for the achievement of objectives and a commitment to review the Strategy every three years.

It is intended that the AQS will provide a framework for the improvement of air quality that is both clear and workable. In order to achieve this, the Strategy is based on several principles which include:

- the provision of a statement of the Government's general aims regarding air quality;
- clear and measurable targets;
- a balance between local and national action and
- a transparent and flexible framework.

Co-operation and participation by different economic and governmental sectors is also encouraged within the context of existing and potential future international policy commitments.

1.2.1 National Air Quality Standards

At the centre of the AQS is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. Most of the proposed standards have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). These standards and associated specific objectives to be achieved between 2003 and 2008 are shown in Table 1.2. The table shows the standards in ppb and $\mu g\ m^{-3}$ with the number of exceedences that are permitted (where applicable) and the equivalent percentile.

Specific objectives relate either to achieving the full standard or, where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as November 5th. For example, if an objective is to be complied with at the 99.9th percentile, then 99.9% of measurements at each location must be at or below the level specified.

Table 1.2 Air Quality Objectives in the Air Quality Regulations (2000) for the purpose of Local Air Quality Management

Pollutant	Concentration limits		**Averaging period**	**Objective** [number of permitted exceedences a year and equivalent percentile]	
	($\mu g\ m^{-3}$)	(ppb)		($\mu g\ m^{-3}$)	date for objective
Benzene	16.25	5	**running annual** mean	**16.25**	by 31.12.2003
1,3-butadiene	2.25	1	**running annual** mean	**2.25**	by 31.12.2003
CO	11,600	10,000	**running 8-hour** mean	**11,600**	by 31.12.2003
Pb	0.5	-	**annual** mean	**0.5**	by 31.12.**2004**
	0.25	-	**annual** mean	**0.25**	by 31.12.**2008**
NO_2 (see note)	200	105	**1 hour** mean	**200** [maximum of 18 exceedences a year or equivalent to the 99.8th percentile]	by 31.12.2005
	40	21	**annual** mean	**40**	by 31.12.2005
PM_{10} (**gravimetric**) (see note)	50	–	**24-hour** mean	**50** [maximum of 35 exceedences a year or ~ equivalent to the 90th percentile]	by 31.12.2004
	40	–	**annual** mean	**40**	by 31.12.2004
SO_2	266	100	**15 minute** mean	**266** [maximum of 35 exceedences a year or equivalent to the 99.9th percentile]	by 31.12.2005
	350	132	**1 hour** mean	**350** [maximum of 24 exceedences a year or equivalent to the 99.7th percentile]	by 31.12.2004
	125	47	**24 hour** mean	**125** [maximum of 3 exceedences a year or equivalent to the 99th percentile]	by 31.12.2004

Notes

1. Conversions of ppb and ppm to ($\mu g\ m^{-3}$) correct at 20°C and 1013 mb.
2. The objectives for nitrogen dioxide are provisional.
3. PM_{10} measured using the European gravimetric transfer standard or equivalent. The Government and the devolved administrations see this new 24-hour mean objective for particles as a staging post rather than a final outcome. Work has been set in hand to assess the prospects of strengthening the new objective.

This Stage 2 review and assessment compares the air quality in the Omagh District Council area with those standards in the Air Quality Regulations (2000). On September 17th 2001 new guidelines were issued, however these are yet to come official.

Policies in place to allow these objectives to be achieved

The policy framework to allow these objectives to be achieved is one that that takes a local air quality management approach. This is superimposed upon existing national and international regulations in order to effectively tackle local air quality issues as well as issues relating to wider spatial scales. National and EC policies which already exist provide a good basis for progress towards the air quality objectives set for 2003 to 2008. For example, the Environmental Protection Act 1990 allows for the monitoring and control of emissions from industrial processes and various EC Directives have ensured that road transport emission and fuel standards are in place. These policies are being developed to include more stringent controls. Recent developments in the UK include the announcement by the Environment Agency in January 2000 on controls on emissions of SO_2 from coal and oil fired power stations. This system of controls means that by the end of 2005 coal and oil fired power stations will meet the air quality standards set out in the AQS.

Local air quality management provides a strategic role for local authorities in response to particular air quality problems experienced at a local level. This builds upon current air quality control responsibilities and places an emphasis on bringing together issues relating to transport, waste, energy and planning in an integrated way. This integrated approach involves a number of different aspects. It includes the development of an appropriate local framework that allows air quality issues to be considered alongside other issues relating to polluting activity. It should also enable co-operation with and participation by the general public in addition to other transport, industrial and governmental authorities.

An important part of the Strategy is the requirement for local authorities to carry out air quality reviews and assessments of their area against which current and future compliance with air quality standards can be measured. Over the longer term, these will also enable the effects of policies to be studied and therefore help in the development of future policy. The Government has prepared guidance to help local authorities to use the most appropriate tools and methods for conducting a review and assessment of air quality in their District. This is part of a package of guidance being prepared to assist with the practicalities of implementing the AQS. Other guidance covers air quality and land use planning, air quality and traffic management and the development of local air quality action plans and strategies.

1.2.2 Timescales to achieve the objectives

In most local authorities in the UK, objectives will be met for most of the pollutants within the timescale of the objectives shown in Table 1.2. The Government has recognised the problems associated with achieving the standard for ozone and this will not therefore be a statutory requirement. Ozone is a secondary pollutant and transboundary in nature and it is recognised that local authorities themselves can exert little influence on concentrations when they are the result of regional primary emission patterns.

1.3 AIR QUALITY REVIEWS

A range of Technical Guidance has been issued to enable air quality to be monitored, modelled, reviewed and assessed in an appropriate and consistent fashion. This includes the Technical Guidance LAQM.TG4(00) May 2000, on 'Review and Assessment: Pollutant Specific Guidance[2]. This review and assessment has considered the procedures set out in the Guidance.

The primary objective of undertaking a review of air quality is to identify any areas that are unlikely to meet national air quality objectives and ensure that air quality is considered in local authority decision making processes. The complexity and detail required in a review depends on the risk of failing to achieve air quality objectives and it has been proposed therefore that reviews should be carried out in three stages. All three stages of review and assessment may be necessary and every authority is expected to undertake at least a first stage review and assessment of air quality in their authority area. The Stages are briefly described below.

Stage 1 A Stage 1 review is expected to have considered all sources of pollutants which could have a significant impact in the authority's locality, either due to the emission of significant quantities of the pollutant(s) of concern, or for which there is potential for exposure of the general public to poor air quality. The review should include details of any significant existing or planned transportation, industrial or other sources in and around the District. If no sources are identified, or the size of the emissions are small, the local authority can conclude that the risk of failing to meet set air quality objectives is negligible and it is it therefore not necessary to conduct a second stage review. Alternatively, if the local authority can identify a significant source for one or more pollutants, it is necessary to proceed to a second stage air quality review.

Stage 2 The second stage air quality review provides a further screening of pollutant concentrations in local authority areas. This involves estimating, through the use of monitored or modelled data, the highest likely concentrations of air pollutants within its area and the localities where this may occur in order to assess whether there is a significant risk of an air quality objective not being met. If, as a result of estimations of ground level concentrations at roadside, industrial and background sites, a local authority judges that there is no significant risk of not achieving an air quality objective, it can be confident that an Air Quality Management Area (AQMA) will not be required. However, if there is doubt that an air quality objective will be achieved a third stage review should be conducted.

Stage 3 A third stage review is an accurate and detailed review and assessment of current and future air quality in a particular district. The approaches requires more sophisticated modelling and monitoring techniques than those applied at Stage 2. This enables a local authority to predict the likelihood of meeting the objective and so determine the location of any necessary Air Quality Management Areas (AQMAs). For each pollutant of concern, it may be necessary to construct a detailed emissions inventory and model the extent, location and frequency of potential air quality exceedences. Once an AQMA has been identified, there is further set of requirements to be considered. Firstly, a further assessment of air quality in the AQMA is required within 12 months which will enable the degree to which air quality objectives will not be met and the sources of pollution that contribute to this to be determined. A local authority must also prepare a written action plan for achievement of the air quality objective. Both air quality reviews and action plans are to be made publicly available.

Local authorities in England, Wales and Scotland are expected to have completed review and assessment of air quality by June 2000. A further review will also need to be completed for the purposes of the Act before the target date of 2003. However, in Northern Ireland undertaking review and assessments of air quality is voluntary.

1.3.1 Which locations should the review and assessment concentrate on?

For the purpose of review and assessment, the authority should focus their work on locations where members of the public are likely to be exposed over the averaging period of the objective. Therefore for objectives with short averaging periods (the 15-minute and 1-hour objective for sulphur dioxide and the 1-hour objective for nitrogen dioxide) the review and assessment should focus on any non-occupational, near ground level outdoor location where members of the public might reasonably be expected to be present over the relevant averaging time. For NO_2, examples might include a pavement of a busy shopping street, a path running close to a busy road, playing fields close to a busy road. For SO_2, examples would be locations downwind of a point source.

For objectives with longer averaging periods (benzene, 1,3-butadiene, carbon monoxide, lead, PM_{10}, the 24-hour objective for sulphur dioxide and the annual mean for nitrogen dioxide) the review and assessment should focus on the following near ground level outdoor locations:

- background locations
- roadside locations (sites close to the façade of a building) where there is housing
- other areas where members of the public might reasonably be expected to be regularly exposed to outdoor air for a substantial part of the day (for example near housing, schools or hospitals)

It is unnecessary to consider exceedences of the objectives at any location where public exposure over the relevant averaging period would be unrealistic.

Key Points

- The Environment Act 1995 has required the development of a National Air Quality Strategy for the control of air quality.
- A central element in the Strategy is the use of air quality standards and associated objectives based on human health effects that have been included in the Air Quality Regulations.
- The Strategy uses a local air quality management approach in addition to existing national and international legislation. It promotes an integrated approach to air quality control by the various actors and agencies involved.
- Air quality objectives, with the exception of ozone, are to be achieved by specified dates up to the end of 2005 (2008 for one lead objective).
- A number of air quality reviews are required in order to assess compliance with air quality objectives. The number of reviews necessary depends on the likelihood of achieving the objectives.

2 Introduction to the air quality review

Part IV of the Environment Act, 1995, establishes a national framework for air quality management, and requires all local authorities in Wales, and Scotland and London borough, district and unitary councils in England to conduct local air quality reviews. Where the reviews indicate that objectives set out in the Air Quality Regulations, 2000[3], will not be met by the prescribed dates, the relevant authority is required to designate an Air Quality Management Area. Further work is then required to investigate ways to ensure compliance of the area by the prescribed dates.

2.1 PURPOSE OF THE STUDY

NETCEN was commissioned by Omagh District Council (ODC) to complete a Second Stage Air Quality Review (SSAQR) within their area. The review:

- Investigates present and potential future air quality in the ODC area
- Recommends actions, if necessary, to control the subsequent air quality within the ODC area

2.2 APPROACH TAKEN

The approach taken in this study was to:
1. Identify the principal sources of pollutant emissions affecting air quality in the ODC area.
2. Model expected present and potential future levels of pollutant concentrations in the ODC area and identify the areas of the district which are likely to experience the highest concentrations of pollutants.
3. Indicate whether present and predicted future air quality in the district is likely to comply with the requirements of the Air Quality Strategy.
4. Identify areas for further investigation.

In preparing this report the latest version of the Pollutant Specific Guidance has been used LAQM TG4(00).

2.3 STRUCTURE OF THIS REPORT

Chapter 1 considers details of the Air Quality Strategy (AQS).

This chapter, Chapter 2, considers proposed developments in ODC which might affect air quality by 2005, the extent of local air quality measurements made by ODC, traffic speed and flow data available, Part A and B processes in the ODC region and sources outside the region which might affect air quality. Chapters 3 to 5 consider the pollutants specified in the AQS and give an overview including the AQS objectives, the national perspective and the input required for this review. Data from national concentration maps, monitoring studies, road traffic, and local and distant point sources are then considered. Each chapter closes with an indication of

whether the relevant AQS objective is expected to be met, or whether further work is required. Chapter 6 summarises all the findings and recommendations of the work.

2.4 INFORMATION PROVIDED BY ODC TO SUPPORT THIS ASSESSMENT

NETCEN requested a range of information from ODC that was needed to complete this SSAQR. This information included details about:

- Local air quality monitoring data
- Proposed developments
- Part A and B processes under the Environmental Protection Act (EPA)
- Traffic flow and speed data
- Transport strategy
- Large combustion sources
- Quarries

2.5 OMAGH AND ITS ENVIRONS

This section has been summarised from the Stage one review and assessment. Omagh District Council (ODC) is located within County Tyrone and has an area of approximately 1,128km^2 (440 square miles) making it the second largest local government district in terms of area in Northern Ireland. ODC is located approximately 70 miles from Belfast City Council.

ODC occupies a central position in the west of the province with much of the district being characterised as marginal upland with its northern boundaries rising to over 400 metres above sea level in the Sperrin mountain range. The district is largely centred on Omagh. The district has a population of approximately 47,000 people of which about 50% live in Omagh town. The economy within the district is heavily reliant on the service sector. The district does not have a large manufacturing base.

2.5.1 Local air quality monitoring data

2.5.1.1 Extent of data available

The following local air quality monitoring data for NBC is available:

- nitrogen dioxide diffusion tube data for four sites

Where appropriate, data from these surveys have been used. Appendix 1 gives more information about the local air quality monitoring.

~~1.1.1.2~~2.5.1.2Quality Assurance/Quality control of data

The diffusion tubes were analysed by Harwell Scientifics, who participate in the laboratory intercomparison exercises for the National NO_2 Diffusion Tube Network. The results presented in this report have been corrected for bias.

~~1.1.4~~2.5.2Traffic data

Appendix 2 summarises the traffic information used in the assessment. Developments that are currently planned in the district include the Omagh by-pass scheme which should be completed by 2005. According to the Environmental Statement produced, it is expected to increase traffic along Crevenagh Road, Killyclogher Road and on the surrounding road network. However, it will lead to an improvement in air quality at certain locations where traffic flows will be displaced from existing roads onto the link road, effectively by-passing the residential area of Dublin Road

~~1.1.6~~2.5.3Part A and B process and >5 MW (thermal) combustion plants

Combustion processes can contribute a range of pollutants to ambient air. ODC provided a list of three combustion processes that needed further assessment in a Stage 2. These were:

- Tyrone and Fermanagh hospital
- Nestles
- Omagh Meats
- Haddens Quarry, Carrickmore - Coating plant.

3 Review and assessment of nitrogen dioxide

3.1 INTRODUCTION

Nitrogen oxides are formed during high temperature combustion processes from the oxidation of nitrogen in the air or fuel. The principal source of nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x, is road traffic, which is responsible for approximately half the emissions in Europe. NO and NO_2 concentrations are therefore greatest in urban areas where traffic is heaviest. Other important sources are power stations, heating plant and industrial processes.

Nitrogen oxides are released into the atmosphere mainly in the form of NO, which is then readily oxidised to NO_2 by reaction with ozone. Elevated levels of NO_x occur in urban environments under stable meteorological conditions, when the air mass is unable to disperse.

Nitrogen dioxide has a variety of environmental and health impacts. It is a respiratory irritant, may exacerbate asthma and possibly increase susceptibility to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. In addition, nitrogen oxides have a lifetime of approximately 1 day with respect to conversion to nitric acid. This nitric acid is in turn removed from the atmosphere by direct deposition to the ground, or transfer to aqueous droplets (e.g. cloud or rainwater), thereby contributing to acid deposition.

3.1.1 Standards and objectives for nitrogen dioxide

The national air quality objectives for NO_2 are:

- An annual average concentration of 40 μg m^{-3} (21 ppb); to be achieved 31st December 2005
- 200 μg m^{-3} (105 ppb) as an hourly average with a maximum of 18 exceedences in a year to be achieved 31st December 2005

Modelling studies suggest that in general achieving the annual mean of 40 μg m^{-3} is more demanding than achieving the hourly objective. If the annual mean is achieved, the modelling suggests the hourly objectives will also be achieved.

3.1.2 The National Perspective

All combustion processes produce some NO_x, but only NO_2 is associated with adverse effects on human health. The main sources of NO_x in the United Kingdom are road transport, which, in 1997 accounted for about half of the emissions, power generation (20%), and domestic sources (4%). In urban areas, the proportion of local emissions due to road transport sources is larger.

The results of the analysis set out in the National Air Quality Strategy suggest that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures will be required to

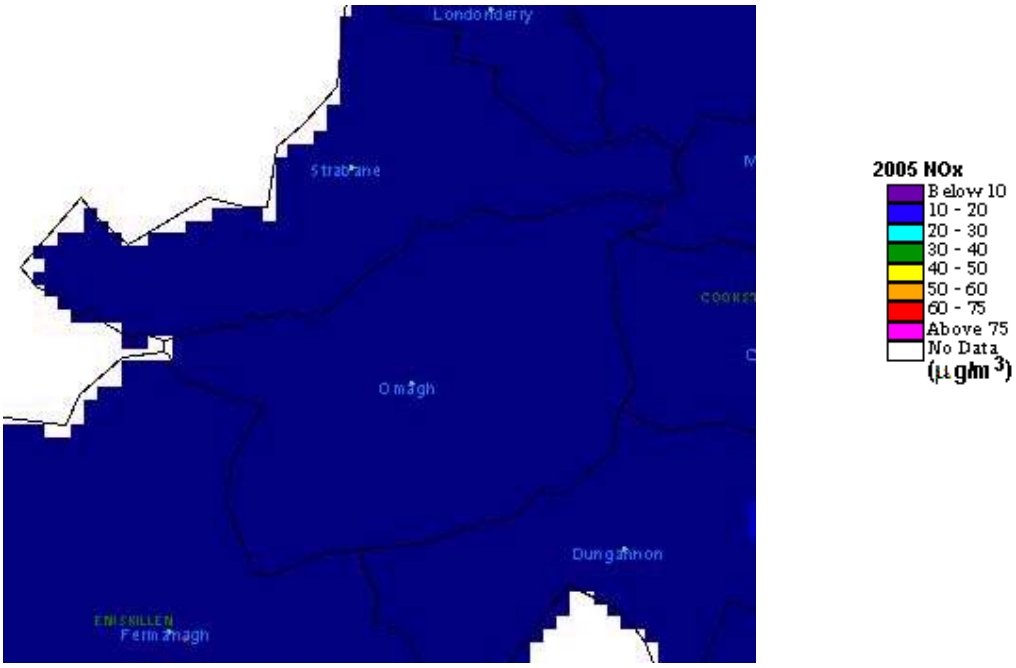
ensure that air quality objectives are achieved everywhere by the end of 2005. Local authorities with major roads, or highly congested roads, which have the potential to result in elevated levels of NO_2 in relevant locations, are expected to identify a need to progress to the second or third stage review and assessment for this pollutant.

~~1.2~~3.2 BACKGROUND CONCENTRATIONS OF NITROGEN DIOXIDE

Background concentrations were obtained for the Omagh area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html.

Figures 3.2 shows estimates of NO_x background concentrations for 2005.

Figure 3.2 Background NO_x concentrations 2005



A maximum background NOx estimate of 10.1 µg/m^3 has been estimated for 2005 in the ODC region.

~~1.33.3~~MONITORING OF NITROGEN DIOXIDE

3.3.1 Diffusion tube data

Monthly average concentrations of NO_2 have been measured with diffusion tubes at four sites in Omagh district council since 1993. The data for 1999 (the latest available) are summarised in Table 3.3.1 below. The monitoring period is representative of a full year and therefore the period average concentrations can be compared with the annual mean objective. Analysis of the tubes was carried out by Harwell Scientifics which was found to have a positive bias of 4.2% in 1999 relative to an automatic analyser (Bush 2000).

Table 3.3.1 Annual average concentrations measured at four locations in the Omagh area in 2001.

Site Name	Site Type	Average NO_2 μgm^{-3} uncorrected for bias	Average NO_2 μgm^{-3} corrected for bias	Prediction in 2005 μgm^{-3}
Dublin Rd	K	51.6	49.4	42
Dergmoney Place	I	17.2	16.5	14
Ardmore Dr, Tamlaght Rd	B	11.5	11	9
Gortmore Gdns, Derry Rd	B	21.0	20.1	17

K=kerbside 1-5m from a busy road
I = Between 20 - 30m from a busy road
B = background in a residential area more than 50 metres from a busy road.

In 2005, it is predicted that the diffusion tubes exposed on Dublin Road will exceeded the annual mean AQS for nitrogen dioxide of 40 $\mu g/m^3$.

3.4 IMPACT OF ROAD TRAFFIC ON CONCENTRATIONS OF OXIDES OF NITROGEN

The Stage one Review and Assessment for Omagh District Council identified ten roads as needing further study in a Stage two assessment. The concentrations at these kerbside locations were estimated using the Design Manual for Roads and Bridges (DMRB) using the traffic flow data provided by ODC. The effect of junctions has been taken into account in DMRB where traffic data have been provided. Traffic flow details are given in Appendix 2. The model has been used to predict nitrogen dioxide concentrations for 2005. A background NOx concentration of 10.1 $\mu g\ m^{-3}$ has been used. This is a conservative estimate.

Concentrations have been assessed at traffic speeds (20 kph at road junctions in the urban areas and 32 kph on free flowing roads in urban areas) which may be lower than those considered representative. The speed of 20 kph is representative of traffic congestion in the city centre. Therefore this will give a conservative estimate. The distance from the receptor to the centre of the road and from the receptor to the kerb of the road are required by DMRB. These distances were estimated from maps provided by ODC. A figure of 11% was provided by ODC for the % of HDV on all of the roads.

Table 3.4 lists the annual average and 99.8th percentile of maximum hourly average kerbside concentrations (equivalent to 18 exceedences per year) of nitrogen dioxide predicted for 2005 in the ODC area. Following advice given in LAQM TG4(00), the 99.8th percentile of hourly averages has been estimated as 3.5 times the annual mean for roadside locations. For 2005, annual average concentrations of nitrogen dioxide are predicted to be over 40 μg m^{-3} at four road junctions. The hourly objective was exceeded at the Great Northern Junction. At all other locations the hourly objective was predicted to be met.

Table 3.4 Nitrogen dioxide concentrations at roadside locations in ODC without the by-pass.

Description of Link	Distance to nearest receptor from kerbside (m)	NO_2 Annual mean (μg m^{-3}) 2005	NO_2 99.8th percentile of hourly averages (μg m^{-3}) 2005
Dublin Rd, Omagh	7.5	39.3	137.4
Great Northern Junc. Omagh	5	**58.5**	**204.6**
Campsie Rd, Omagh	2.5	31.7	110.9
Hoggs Head Junc. Omagh	2.5	31.0	108.5
County Hall Junc. Omagh	12.5	**43.1**	150.7
ODC offices Junc.	2.5	**41.7**	145.8
Swinging Bars Rdbt, Omagh	12.5	**45.8**	160.4
Hospital Rd, Omagh	10	35.7	124.8
Tamlagnt Rdbt, Omagh	21.25	35.2	123.3

At road junctions, the distance from the kerb to the nearest receptor has been given as the closest receptor to any of the road links.

In accordance with the above results, the diffusion tubes exposed at 41 Dublin Road (shown as the Great Northern Junction in Table 3.4 above) have consistently exceeded the annual mean objective since monitoring began in 1993 (see Table 3.3.1). However, using the factors in the PSG to predict diffusion tube concentrations in 2005, a figure of 42 μg/m^3 is obtained, compared to DMRB predicting 58.5 μg/m^3. Therefore DMRB is likely to be over predicting and therefore it is recommended that more accurate % HDV data is obtained and that DMRB is run again.

By 2005, the Omagh by-pass should have been completed. This will affect the traffic flows on roads in Omagh town. In particular traffic will be much reduced on Dublin Road. Predicted traffic flows after the by-pass has been built were available for some of the road links. Table 3.4a shows the estimated concentrations predicted by DMRB after the by-pass is built.

Table 3.4a Nitrogen dioxide concentrations at roadside locations in ODC with the by-pass

Description of Link	Distance to nearest receptor from kerbside (m)	NO_2 Annual mean (µg m^{-3}) 2005	NO_2 99.8th percentile of hourly averages (µg m^{-3}) 2005
Dublin Rd, Omagh	7.5	19.1	66.9
Great Northern Junc. Omagh	5	**49.8**	174.4
Campsie Rd, Omagh	2.5	26.2	91.7
Swinging Bars Rdbt, Omagh	12.5	**54.5**	190.8
Hospital Rd, Omagh	10	35.7	125

The above results show a predicted decrease of nitrogen dioxide concentrations along Dublin Road and Campsie Road when the by-pass is built. Traffic flows along Hospital Road are predicted to stay the same hence the same nitrogen dioxide concentrations are predicted on this road prior to and after the by-pass being built. At the two road junctions (Great Northern Junction & Swinging Bars roundabout) an exceedence is still predicted after the by-pass it built.
Data was unavailable for the other road junction in Omagh.

3.5 CONCLUSIONS FOR NITROGEN DIOXIDE CONCENTRATIONS IN THE NBC AREA

With and without the by-pass, emissions arising from road transport at four road junctions in the ODC area may cause an exceedence of the AQS. It is recommended that more accurate % HDV data is obtained for the following roads of concern and that the DMRB model is run again:

Great Northern Junction
County Hall Junction
ODC Offices Junction
Swinging Bars Roundabout

4 Review and assessment of PM_{10}

4.1 INTRODUCTION

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. Particles are often classed as either primary (those emitted directly into the atmosphere) or secondary (those formed or modified in the atmosphere from condensation and growth). PM_{10} particles (the fraction of particulates in air of very small size, <10 μm aerodynamic diameter) can potentially pose significant health risks as they are small enough to penetrate deep into the lungs. Larger particles are not readily inhaled.

A major source of fine primary particles is combustion processes, in particular diesel combustion, where transport of hot exhaust vapour into a cooler tailpipe or stack can lead to spontaneous nucleation of "carbon" particles before emission. Secondary particles are typically formed when low volatility products are generated in the atmosphere, for example the oxidation of sulphur dioxide to sulphuric acid. The atmospheric lifetime of particulate matter is strongly related to particle size, but may be as long as 10 days for particles of about 1 μm in diameter.

Concern about the potential health impacts of PM_{10} has increased very rapidly over recent years. Increasingly, attention has been turning towards monitoring the smaller particle fraction, $PM_{2.5}$, which is capable of penetrating deepest into the lungs, or to even smaller size fractions or total particle numbers.

4.1.1 Standards and objectives for particulate matter

The Air Quality Strategy objectives to be achieved by 31st December 2004 are:

- An annual average concentration of 40 μg m^{-3} (gravimetric);
- A maximum 24-hourly mean concentration of 50 μg m^{-3} (gravimetric) not to be exceeded more than 35 times a year.

4.1.2 The National Perspective

National UK emissions of primary PM_{10} have been estimated as totalling 184,000 tonnes in 1997. Of this total, around 25% was derived from road transport sources. It should be noted that, in general, the emissions estimates for PM_{10} are less accurate than those for the other pollutants with prescribed objectives, especially for sources other than road transport.

The Government established the Airborne Particles Expert Group (APEG) to advise on sources of PM_{10} in the UK and current and future ambient concentrations. Their conclusions were published in January 1999 (APEG, 1999)[5]. APEG concluded that a significant proportion of the current annual average PM_{10} is due to the secondary formation of particulate sulphates and nitrates, resulting from the oxidation of sulphur and nitrogen oxides. These are regional scale pollutants and the annual concentrations do not vary greatly over a scale of tens of kilometres. There are also natural or semi-natural sources such as wind-blown dust and sea salt particles. The impact of local urban sources is superimposed on this regional background. Such local sources are generally responsible for winter

episodes of hourly mean concentrations of PM_{10} above 100 μg m^{-3} associated with poor dispersion. However, it is clear that many of the sources of PM_{10} are outside the control of individual local authorities and the estimation of future concentrations of PM_{10} are in part dependent on predictions of the secondary particle component.

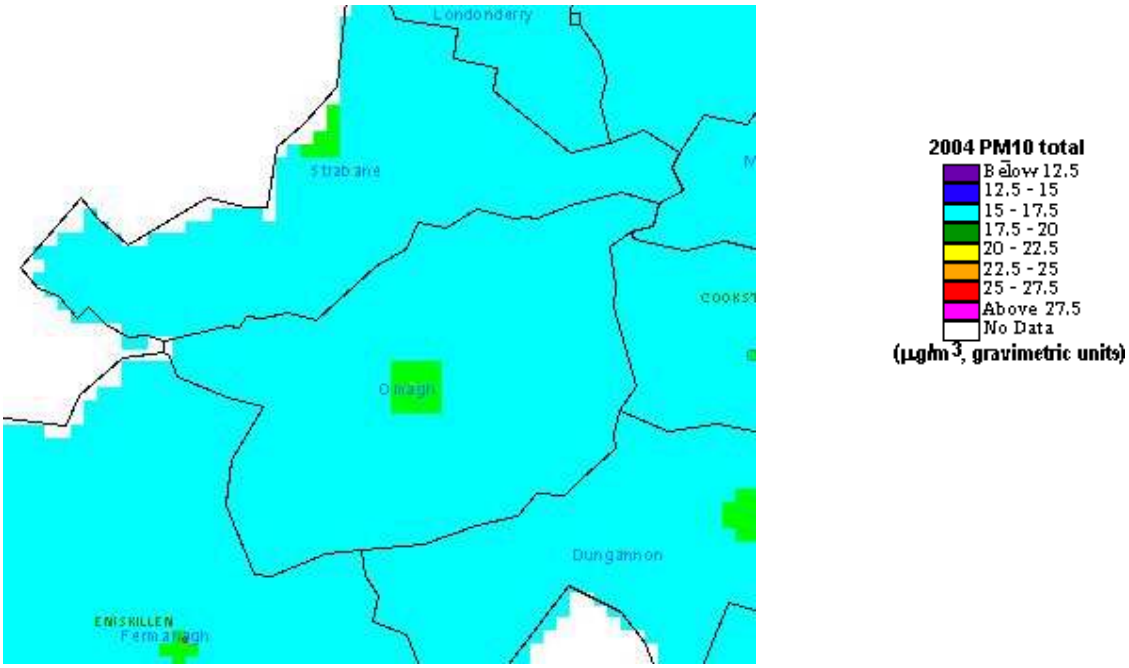
~~1.2~~4.2 MONITORING OF PM_{10}

There has been no monitoring of PM_{10} concentrations in the ODC area.

~~1.3~~4.3 BACKGROUND CONCENTRATIONS OF PM_{10}

Estimates of background concentrations of PM_{10} were obtained for the ODC area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html. Figure 4.3 shows that the estimated annual average background concentration for 2004 in the ODC area was 19.2 μg/m^3 or lower.

Figure 4.3 Background total PM_{10} concentrations 2004 ($\mu g\ m^{-3}$)



4.4 IMPACT OF ROAD TRAFFIC ON PM_{10}

As recommended in TG4 (00) DMRB has been used to predict PM_{10} concentrations for 2004 from road traffic but the background concentrations given within the model have been ignored. The estimated maximum background concentration for 2004 of 19.2 μg m^{-3} for the ODC area has then been added to provide total predicted PM_{10} concentrations. Estimated traffic flows for 2005 (as expected traffic flows in 2004 were not available) as supplied by ODC were used in these calculations.

Guidance TG4(00) states that the 24-hour objective is highly unlikely to be exceeded if the annual mean concentration is below 28 μg m^{-3}, gravimetric.

Table 4.4a and 4.4b show the 2004 predictions that may be compared against the objectives. For 2004, the method predicts annual average concentrations of PM_{10} less than 28 μg m^{-3} at all of the locations modelled.

Table 4.4a Predicted PM_{10} concentrations at roadside locations in the ODC region without the by-pass.

Description of Link	PM_{10} Annual mean (μg m^{-3}) 2004
Dublin Rd, Omagh	22.0
Great Northern Junc. Omagh	25.0
Campsie Rd, Omagh	21.2
Hoggs Head Junc. Omagh	21.1
County Hall Junc. Omagh	22.2
ODC offices Junc.	22.6
Swinging Bars Rdbt, Omagh	22.5
Hospital Rd, Omagh	21.5
Tamlagnt Rdbt, Omagh	21.5

Table 4.4b Predicted PM_{10} concentrations at roadside locations in the ODC region with the by-pass.

Description of Link	PM_{10} Annual mean (μg m^{-3}) 2004
Dublin Rd, Omagh	20.0
Great Northern Junc. Omagh	23.5
Campsie Rd, Omagh	20.6
Swinging Bars Rdbt, Omagh	23.6
Hospital Rd, Omagh	21.5

4.5 CONCLUSIONS FOR PM_{10} CONCENTRATIONS IN THE ODC AREA

Emissions from traffic are not predicted to lead to an exceedence of the PM_{10} objectives in 2004.

5 Review and assessment of sulphur dioxide

5.1 INTRODUCTION

Sulphur dioxide is a corrosive acid gas which combines with water vapour in the atmosphere to produce acid rain. Both wet and dry deposition have been implicated in the damage and destruction of vegetation and in the degradation of soils, building materials and watercourses. SO_2 in ambient air is also associated with asthma and chronic bronchitis.

The principal source of this gas is power stations burning fossil fuels which contain sulphur. Episodes of high concentrations of SO_2 now only tend to occur in cities in which coal is still widely used for domestic heating, in industry and in power stations. As some power stations are now located away from urban areas, SO_2 emissions may affect air quality in both rural and urban areas. Since the decline in domestic coal burning in cities and in power stations overall, SO_2 emissions have diminished steadily and, in most European countries, they are no longer considered to pose a significant threat to health.

5.1.1 Standards and objectives for sulphur dioxide

Two new objectives have been introduced for SO_2 in the AQS based on the limit values in the Air Quality Daughter Directive, and the three objectives are:

- 266 μg m^{-3} as a 15 minute mean (maximum of 35 exceedences a year or equivalent to the 99.9th percentile) to be achieved by the 31st December 2005
- 350 μg m^{-3} as a 1 hour mean (maximum of 24 exceedences a year or equivalent to the 99.7th percentile) to be achieved by the 31st December 2004
- 125 μg m^{-3} as a 24 hour mean (maximum of 3 exceedences a year or equivalent to the 99th percentile) to be achieved by the 31st December 2004

The 15 minute mean objective is the most stringent; the other two objectives will not be exceeded if this objective is not exceeded.

5.1.2 The National Perspective

Sulphur dioxide is emitted in the combustion of coal and oil. Emissions today are dominated by fossil-fuelled power stations which in 1997 accounted for 62% of the national total emission. Emissions from road transport are a very small fraction of the national total: 2%.

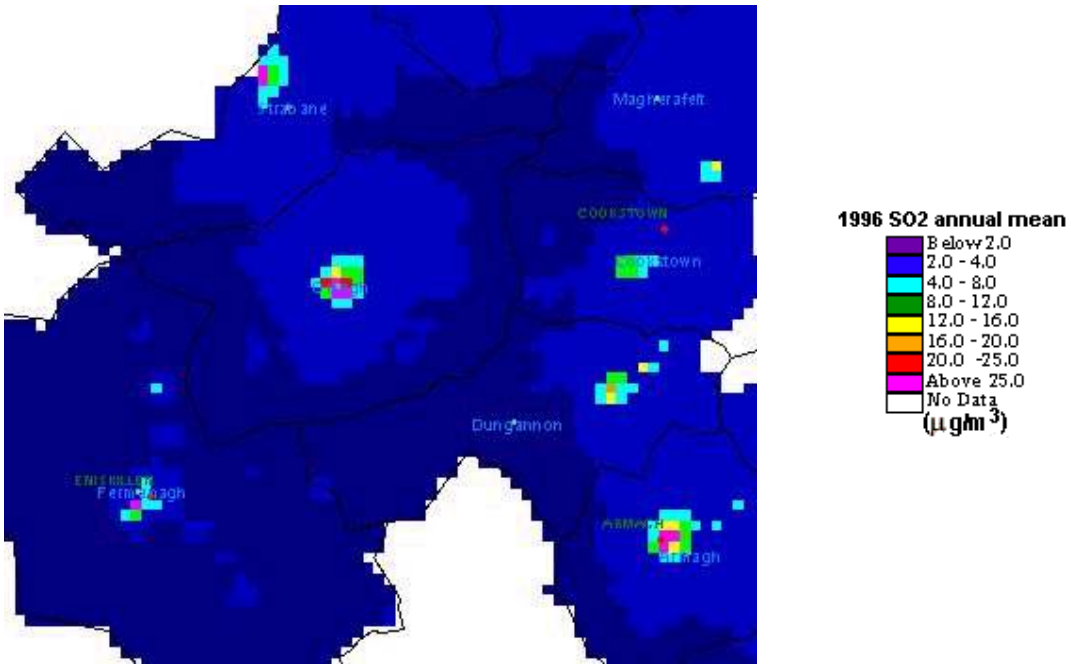
Exceedences of the 15-minute air quality standard currently occur near industrial processes for which the stack heights were designed to meet previous air quality standards and downwind of large combustion plant such as power stations. Exceedences are also possible in areas where significant quantities of coal are used for space heating. These large combustion plant are currently regulated under BATNEEC and the EPA 1990, and will come under the provisions of the IPPC. The government considers that bearing in mind the envisaged change in fuel use, it does not expect exceedences of the 15-minute objective by 2005 from these sources. Sulphur dioxide concentrations

are elevated at the kerbside but not sufficiently to exceed the air quality standard in the absence of other sources.

5.2 BACKGROUND CONCENTRATIONS OF SULPHUR DIOXIDE

Estimates of background concentrations were obtained for the ODC area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html. Figure 5.2 shows the most recent estimates available, for 1996. The maximum estimated background annual average concentration for 1996 in the ODC area 66.5 μg/m^3. The average background concentration was 2.6 μg/m^3. Guidance TG4(00) assumes that the annual mean at the end of 2004 and 2005 will be half the 1996 annual mean. However, for Northern Ireland an annual mean of 0.75 times the 1996 mean has been used due to the high levels of domestic coal burning in the region. Thus the maximum estimated annual mean background concentration in the ODC area in 2004 will be 50 μg m^{-3} and the average will be 1.9 μg m^{-3}.

Figure 5.2 Background SO_2 concentrations 1996



~~1.25.3~~MONITORING OF SULPHUR DIOXIDE

There has been no monitoring of SO_2 in the region.

5.4 IMPACT OF COMBUSTION PROCESSES IN ODC ON SO_2 CONCENTRATIONS

There are three combustion processes that were identified in the stage one review and assessment that needed further assessment. They are the following:

- Tyrone and Fermanagh hospital
- Nestles
- Omagh meats

In addition a Part C process, Hadden's Quarry, Carrickmore which operates a coating plant was identified as needing further assessment.

5.4.1 Tyrone & Fermanagh hospital

Tyrone & Fermanagh hospital operate a boiler ??

5.5 CONCLUSIONS FOR SULPHUR DIOXIDE CONCENTRATIONS IN THE ODC AREA

There were no predicted exceedences of the Strategy objectives in the ODC region and it is concluded that the National Strategy targets for sulphur dioxide will be achieved by the due dates in 2004 and 2005. There is no need to proceed to a Stage 3 Review and Assessment for this pollutant.

6 Conclusions and recommendations for each pollutant

6.1 NITROGEN DIOXIDE

Accurate HDV and speed data was not available for roads in ODC when this assessment was carried out. Due to DMRB predicting higher results than that recorded by diffusion tubes in the borough, it is suggested that more accurate HDV and speed data is obtained and that DMRB is run again. If DMRB still predicts exceedences on any of the roads then a stage 3 review and assessment will be needed.

6.2 PARTICULATE MATTER (PM_{10})

Emissions from traffic are not predicted to lead to an exceedence of the PM_{10} objectives in 2004.

6.3 SULPHUR DIOXIDE

It is concluded that the Strategy objectives for sulphur dioxide are likely to be achieved by 2004. There is no need to progress to a more detailed Stage 3 review and assessment for this pollutant.

7 References

1. DETR (2000) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department of the Environment, Transport and the Regions. Cm 4548, SE 2000/3, NIA 7.

2. Review and Assessment : Pollutant Specific Guidance LAQM TG4(00) ISBN 1 85112 387 3DETR May 2000

3. The Air Quality (England) Regulations 2000 DETR April 2000

4. EA (1998b) Guidance for estimating the air quality impact of stationary sources. Guidance Note 24.

5. APEG (1997) Source apportionment of airborne particulate matter in the United Kingdom. Report of the Airborne Particles Expert Group.

6. Abbott, J. and Vincent, K. (1999) Dispersion modelling of SO_2 concentrations in the United Kingdom for comparison with the National Air Quality Strategy. A report produced for the Department of the Environment, Transport and the Regions. AEAT-5120 Issue 1. AEA Technology Environment, Culham, Abingdon, Oxon., OX14 3ED.

7. Bush (2000). Summary results from the UK NO_2 network field inter comparison exercise 1999. A report produced for the Department of the Environment, Transport and the Regions, the Welsh office, the Scottish office and the Department of the Environment for Northern Ireland. AEA Technology Plc.

8. Stedman, JR, Bush, TJ, Murrells, TP and King K (2001). Baseline PM10 and NOx projections for PM10 objective analysis. AEA Technology, National Environmental Technology Centre. Report AEAT/ENV/R/0728

9. Clareke, RH. A model for short and medium range dispersion of radionuclides released to the atmosphere. A first report of a working group on atmospheric dispersion. NRPB – R91. National Radiological Protection Board, Harwell, Didcot. September 1979.

Appendices

CONTENTS

Appendix 1
Diffusion tube monitoring data

CONTENTS

Appendix 2
Detailed traffic flow data