AEAT/ENV/R/1009

Air Quality Review and Assessment - Stage 2

A report produced for Coleraine Borough Council

February 2002

AEAT/ENV/R/1009

Air Quality Review and Assessment - Stage 2

February 2002

Title	Air Quality Review and Assessment - Stage 2
Customer	Coleraine Borough Council
Customer reference	ED20615172
Confidentiality, copyright and reproduction	
File reference	J/EQ/Stage3_R&A/Ireland
Report number	AEAT/ENV/R/1009
Report status	Issue 1
ISBN number	

National Environmental Technology Centre
Culham
Abingdon
Oxfordshire
OX14 3ED
Telephone 01235 46 3554
Facsimile 01235 46 3005

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

	Name	Signature	Date
Author	Kate Haigh		
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 in Great Britain. 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 in England, Wales and Scotland (2000). The GB Environment Act 1995 requires Local Authorities to undertake an air quality review. 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.

In Northern Ireland there are at present no equivalent Air Quality Regulations. However, there is a duty to meet the Air Quality limit values set within the European Commission Air Quality Framework Directive on which the UK national air quality objectives are based. Consequently, Councils in Northern Ireland have proceeded with the review and assessment process of air quality on a non-statutory basis.

The first step in this process is to undertake a review of current and potential future air quality in a three staged approach. Coleraine Borough Council have completed a Stage 1 review and assessment which concluded that a Stage 2 review and assessment was required for the pollutants nitrogen dioxide, sulphur dioxide and particulate matter.

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:

The air quality objectives for the following pollutants are likely to be met and a third stage review is not required of emissions from vehicular and industrial sources:

- Nitrogen dioxide
- PM_{10}
- Sulphur dioxide

Contents

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
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 to the air quality review

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 in Great Britain. 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 in England, Wales and Scotland (2000). The GB Environment Act 1995 requires Local Authorities to undertake an air quality review. 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.

In Northern Ireland there are at present no equivalent Air Quality Regulations. However, there is a duty to meet the Air Quality limit values set within the European Commission Air Quality Framework Directive on which the UK national air quality objectives are based. Consequently, Councils in Northern Ireland have proceeded with the review and assessment process of air quality on a non-statutory basis.

1.1 PURPOSE OF THE STUDY

NETCEN was commissioned by Coleraine Borough Council to complete a Second Stage Air Quality Review (SSAQR) within their area for road vehicular and industrial sources of air pollution. The review:

- Investigates present and potential future air quality in the Coleraine Borough Council area
- Identifies any actions that are likely to be required by Coleraine Borough Council under Part IV of the GB Environment Act, 1995
- Recommends actions, if necessary, to control the subsequent air quality within the Coleraine Borough Council area

1.2 APPROACH TAKEN

The approach taken in this study was to:

1. Identify the principal sources of pollutant emissions affecting air quality in the Coleraine Borough Council area.
2. Model expected present and potential future levels of pollutant concentrations in the Coleraine Borough Council 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 Borough is likely to comply with the requirements of the UK Air Quality Strategy.
4. Identify areas for further investigation.

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

1.3 STRUCTURE OF THIS REPORT

This report is structured in the following way: Chapter 1 introduces the UK Air Quality Strategy (AQS) and the local data used in this review and assessment. Chapter 2 provides more details on the local air quality management process. 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.

1.4 INFORMATION PROVIDED BY COLERAINE BOROUGH COUNCIL TO SUPPORT THIS ASSESSMENT

The following information from Coleraine Borough Council that was used to complete this review and assessment:

- Local air quality monitoring data
- Proposed developments
- Part A and B processes under the Industrial Pollution Control (1997) Order NI
- Traffic flow and speed data
- Transport strategy
- Large combustion sources

1.4.1 Coleraine Borough and its environs

The Borough of Coleraine has a resident population of around 54,500 and covers an area of more than 120 square miles. Coleraine boasts an impressive history originating tin the first known human settlement on the island some 8,000 years ago and is now a vibrant and progressive university town housing a major campus of the University of Ulster. The current total number of households in the Coleraine Borough is 22,000. The Borough has experienced strong population growth – over twice the average Northern Ireland rate due to both natural increase and inward migration. The population is relatively urbanised – at the time of the 1991 census 85% of the households in the Borough were concentrated in the main towns of Coleraine, Portrush and Portstewart.

1.4.1.1 Industrial and Transport Development in Coleraine Borough Council

Some developments may have an important impact on air quality in the future and are therefore considered in the Stage 2 Review and Assessment.

1.4.2 Local air quality monitoring data

1.4.2.1 Extent of data available

Coleraine Borough Council has been monitoring nitrogen dioxide at four sites using passive diffusion tube samplers. Sulphur dioxide has been monitored using passive diffusion tube samplers at three sites. Appendix 1 gives more information about the local air quality monitoring.

1.4.2.2 Quality Assurance/Quality control of data

The diffusion tubes were analysed by the Ruddock and Sherratt laboratory, which participate in the laboratory intercomparison exercises for the UK National NO_2 Diffusion Tube Network. The results in this report have therefore been corrected for analyst bias as advised in the GB Government Pollutant Specific Guidance.

1.4.3 Traffic data

Appendix 2 summarises the traffic information used in the assessment.

1.4.3.1 Flow and speed

Coleraine Borough Council provided traffic flow measurements at a range of locations within Coleraine and in the surrounding area taken at varying times. Average traffic speeds and HGV percentages were also supplied.

1.4.3.2 Traffic Growth

The national air quality objectives are targets for 2004 or 2005. Traffic growth forecasts were used as supplied by Coleraine Borough Council.

1.4.3.3 Fraction of HGVs

The model requires estimates of the fraction of HGVs on the roads to predict the pollutant concentrations. These data was supplied by Coleraine Borough Council.

1.4.3.4 Assumed distance from the centre of the road to the kerbside

The model used to predict the roadside concentrations requires estimates of the distance of the receptor and the kerbside from the centre of the road. This information was available from the council either directly or supplied on 1:1250 scale maps on which the required measurements were already marked or could be measured.

1.4.4 Part A and B process and >5 MW (thermal) combustion plants

Part A and B processes can contribute a range of pollutants to ambient air. Lists of Part A and B processes and >5MW (thermal) combustion plants that needed further assessment in a Stage 2 were provided.

2 The updated Air Quality Strategy

The UK 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 2.1 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.

2.1 OVERVIEW OF THE PRINCIPLES AND MAIN ELEMENTS OF THE 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 NAQS 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 that 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.

2.1.1 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 2.2. 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 2.2 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
	266	100	**15 minute** mean	**266** [maximum of 35 exceedences a year or equivalent to the 99.9th percentile]	by 31.12.2005
SO_2	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.

2.1.2 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 that 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.

2.1.3 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 2.2. It is important to note that the objectives for NO_2 remain provisional. 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.

2.2 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 Note LAQM.TG4(98), and the latest version LAQM.TG4(00) May 2000, on 'Review and Assessment: Pollutant Specific Guidance'. This review and assessment has considered the procedures set out in the latest consultation draft.

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 in the following table, Table 2.3.

Table 2.3 Brief details of Stages in the Air Quality Review and Assessment process

Stage	Objective	Approach	Outcome
First Stage Review and Assessment	• Identify all significant pollutant sources within or outside of the authority's area.	• Compile and collate a list of potentially significant pollution sources using the assessment criteria described in the Pollutant Specific Guidance	
	• Identify those pollutants where there is a **risk** of exceeding the air quality objectives, and for which further investigation is needed.	• Identify sources requiring further investigation.	• Decision about whether a Stage 2 Review and Assessment is needed for one or more pollutants. If not, no further review and assessment is necessary.
Second Stage Review and Assessment	• Further screening of significant sources to determine whether there is a significant risk of the air quality objectives being exceeded.	• Use of screening models or monitoring methods to assess whether there is a risk of exceeding the air quality objectives.	
	• Identify those pollutants where there is a **risk** of exceeding the objectives, and for which further investigation is needed.	• The assessment need only consider those locations where the highest likely concentrations are expected, and where public exposure is relevant.	• Decision about whether a Stage 3 Review and Assessment is needed for one or more pollutants. If, as a result of estimations of ground level concentrations at suitable receptors, 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.

Table 2.3 (contd.) Brief details of Stages in the Review and Assessment process

Stage	Objective	Approach	Outcome
Third Stage Review and Assessment	• Accurate and detailed assessment of both current and future air quality. Assess the **likelihood** of the air quality objectives being exceeded.	• Use of validated modelling and quality-assured monitoring methods to determine current and future pollutant concentrations.	
	• Identify the geographical boundary of any exceedences, and description of those areas, if any, proposed to be designated as an AQMA.	• The assessment will need to consider all locations where public exposure is relevant. 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.	• Determine the location of any necessary Air Quality Management Areas (AQMAs). Once an AQMA has been identified, there are further sets of requirements to be considered. • 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 are expected to have completed review and assessment of air quality by December 2000. A further review will also need to be completed for the purposes of the Act before the target date of 2003.

2.3 LOCATIONS THAT THE REVIEW AND ASSESSMENT MUST 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. Table 2.4 summarises the locations where the objectives should and should not apply.

Table 2.4 Typical locations where the objectives should and should not apply

Averaging Period	Pollutants	Objectives *should* apply at …	Objectives should *not* generally apply at …
Annual mean	• 1,3 Butadiene • Benzene • Lead • Nitrogen dioxide • Particulate Matter (PM_{10})	• All background locations where members of the public might be regularly exposed.	• Building facades of offices or other places of work where members of the public do not have regular access.
		• Building facades of residential properties, schools, hospitals, libraries etc.	• Gardens of residential properties.
			• Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24 hour mean and 8-hour mean	• Carbon monoxide • Particulate Matter (PM_{10}) • Sulphur dioxide	• All locations where the annual mean objective would apply.	• Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
		• Gardens of residential properties.	

Table 2.4 (contd.) Typical locations where the objectives should and should not apply

Averaging Period	Pollutants	Objectives should apply at …	Objectives should generally not apply at …
1 hour mean	• Nitrogen dioxide • Sulphur dioxide	• All locations where the annual mean and 24 and 8-hour mean objectives apply.	• Kerbside sites where the public would not be expected to have regular access.
		• Kerbside sites (e.g. pavements of busy shopping streets).	
		• Those parts of car parks and railway stations etc. which are not fully enclosed.	
		• Any outdoor locations to which the public might reasonably expected to have access.	
15 minute mean	• Sulphur dioxide	• All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

It is unnecessary to consider exceedences of the objectives at any location where public exposure over the relevant averaging period would be unrealistic, and the locations should represent non-occupational exposure.

Key Points

- The GB 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.

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.

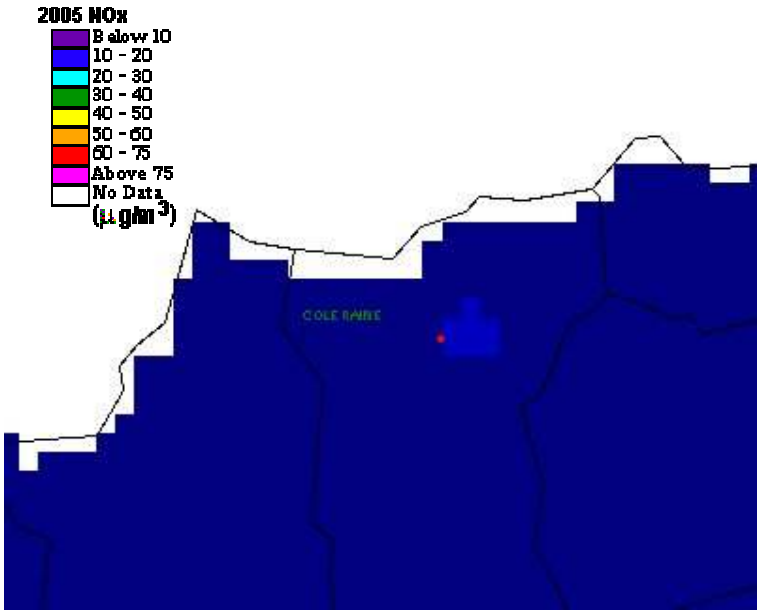
The results of the analysis set out in the National Air Quality Strategy suggest that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures will be required to ensure that air quality objectives are achieved everywhere by the end of 2005. Local authorities with major 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~~3.2BACKGROUND CONCENTRATIONS OF NITROGEN DIOXIDE

Background concentrations were obtained for the Coleraine area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html (See Figure 3.1).

Figure 3.1 Background NO_x concentrations 2005



~~1.3~~3.3MONITORING 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 Coleraine for the period November 2000 to October 2001. The data are summarised in Table 3.1 and presented in full in Appendix 1. According to the GB Government Pollutant Specific Guidance 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 the Ruddock and Sherratt Analyst laboratory, which was found to have a negative bias of 46.5% in 2001 relative to an automatic analyser. The projections are then made from 2001 to 2005 using correction factors as advised in GB Pollutant Specific Guidance.

Table 3.1 Annual average concentrations measured at kerbside locations in the Coleraine Borough Council area.

Site Name	00/01 annual average $\mu g/m^3$	corrected for lab bias $\mu g/m^3$	2005 projection $\mu g/m^3$
Lower Union St Coleraine	20.0	29.2	26.5
Upper Union St, Coleraine	13.6	20.0	18.1
Lodge Roundabout, Coleraine	12.3	18.0	16.3
Bridge St, Coleraine	16.0	23.4	21.3

Note: Kerbside = 1-5m from a busy road

The NO_2 concentrations recorded with these diffusion tubes do not exceed the annual mean objective of 40 $\mu g/m^3$ at any of the sites. The Government Guidance suggests that it is therefore likely that the NO_2 annual mean objective will be met by the end of 2005.

3.4 IMPACT OF ROAD TRAFFIC ON CONCENTRATIONS OF OXIDES OF NITROGEN

The Stage one Review and Assessment for Coleraine Borough Council identified areas in Coleraine and Portrush as needing further study in a Stage two assessment. The concentrations at these roadside locations were estimated using the Design Manual for Roads and Bridges (DMRB) using the traffic flow data provided by Coleraine Borough Council. 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 using background concentration of 11.5$\mu g/m^3$ NO_x, the highest value available in the mapped dataset.

Pollutant concentrations have been assessed at the given traffic speeds for each road. 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. This information was available from Coleraine Borough Council in the form of 1:1250 maps on which the required distances could be measured.

Table 3.2 lists the annual average and 99.8th percentile of maximum hourly average concentrations (equivalent to 18 exceedences per year) of nitrogen dioxide predicted for 2005 in the Coleraine Borough Council area at identified receptors. 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.

Table 3.2 Nitrogen dioxide concentrations at identified receptor locations in Coleraine

Description of Link	NO2 Annual mean ($\mu g/m^3$) 2005	NO2 99.8th percentile of hourly averages ($\mu g/m^3$) 2005
Coleraine Ring Road between A26-B67	20.3	70.9
Coleraine Ring Road between B67-B17	17.6	61.5
Coleraine - Limavady at Farrenlester	22.3	77.9
Union St	32.3	113.0
Millburn Rd	28.7	100.4
Railway Rd	29.9	104.8
Lodge Rd	23.3	81.5
Circular Rd	31.1	109.0
Crocknamack Rd	31.8	111.3
Millburn Rd/UnionSt/Circular Rd	36.8	128.9
Coleraine Bridge/Bridge St	37.7	131.9
Railway Station	37.1	130.0
Waterside Traffic Lights	29.6	103.7
Sandleford Roundabout	14.4	50.2
Lodge Rd Roundabout	21.4	75.0
Ballycastle Roundabout	19.0	66.5
Bushmills Roundabout	13.9	48.7
Metropole Roundabout	23.5	82.1
Dunlace Av/Crocknamack Roundabout	35.8	125.4
A29 Coleraine - Portrush	20.3	70.9
Castlerock Road - Hezlett House Junction	24.8	86.9
Strand Road	22.6	79.1
Bushmills Road - Ring Road	24.7	86.6
Long Commons	23.4	82.1
Beresford Road/Nursery Avenue	23.8	83.3
Ring Road, Lodge Road Roundabout	29.7	104.1

For 2005, annual average concentrations of nitrogen dioxide are not predicted to exceed 40 $\mu g\ m^{-3}$ at any of the locations modelled. These results are in accordance with the nitrogen dioxide diffusion tube results at sites in Coleraine, which also predicted no exceedance of the NO_2 objective. At all other locations the air quality objective is predicted to be met.

3.5 IMPACT OF INDUSTRY ON CONCENTRATIONS OF NITROGEN OXIDES

The Stage 1 Review and Assessment for Coleraine Borough Council concluded that there were no industrial processes that needed to be assessed at stage two level.

3.6 CONCLUSIONS FOR NITROGEN DIOXIDE CONCENTRATIONS IN THE COLERAINE BOROUGH COUNCIL AREA

Emissions arising from road transport are not predicted to lead to exceedance of the nitrogen dioxide objective. In addition, measurements of nitrogen dioxide with diffusion tubes also suggest it is likely that the Coleraine area will meet the objective. It is therefore recommended that a **Stage 3 Review and Assessment is not necessary for this pollutant**.

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.

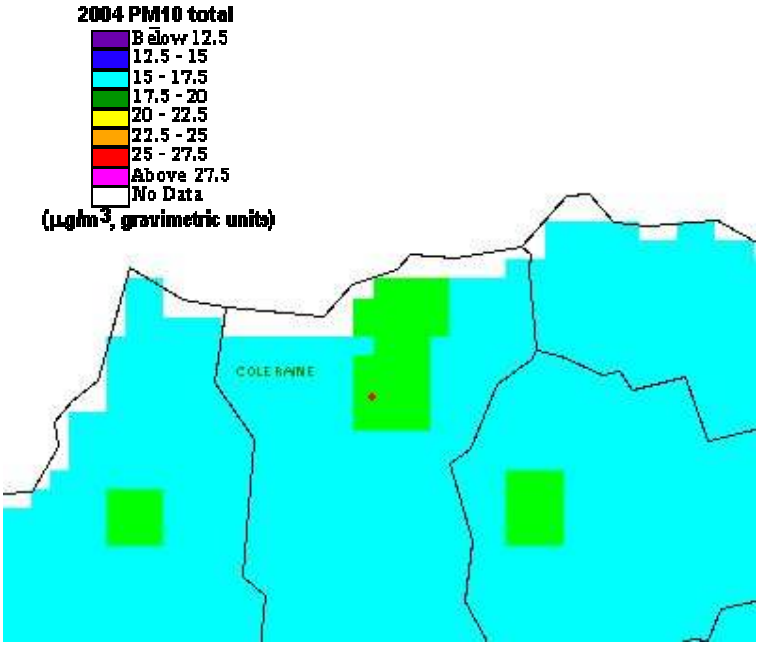
The Government established the Airborne Particles Expert Group (APEG) to advise on sources of PM_{10} in the UK and current and future ambient concentrations. Their conclusions were published in January 1999 (APEG, 1999)[5]. APEG concluded that a significant proportion of the current annual average PM_{10} 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.

~~1.3~~4.2BACKGROUND CONCENTRATIONS OF PM_{10}

Estimates of background concentrations of PM_{10} were obtained for the Coleraine Borough Council area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html. The dataset from Figure 4.1 shows that the highest background concentration for 2004 in Coleraine was 17.8μg/m^3 and this was used as the background figure for the assessment of the impact of traffic emissions.

Figure 4.1 Background PM_{10} concentrations 2004 (μg m^{-3})



4.3 IMPACT OF ROAD TRAFFIC ON PM_{10}

As recommended in the c Guidance LAQM.TG4 (00) DMRB has been used to predict PM_{10} concentrations for 2004 from road traffic. Estimated traffic flows for 2005 were used as supplied by Coleraine Borough Council were used in these calculations. This will provide a conservative estimate of concentrations for the objective year of 2004.

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

Table 4.1 shows the 2004 predictions that may be compared against the objectives. For 2004, the method predicts annual average concentrations of PM_{10} less than 28μg/m^3 at all of the locations modelled. With traffic data for 2004 these values would be likely to be lower still and therefore the PM_{10} objective will not be exceeded as a result of traffic emissions.

Table 4.1 Predicted PM_{10} concentrations at roadside locations in the Coleraine area.

Description of Link	PM10 Annual mean (μg/m^3) 2004
Coleraine Ring Road between A26-B67	19.7
Coleraine Ring Road between B67-B17	19.5
Coleraine - Limavady at Farrenlester	19.7
Union St	20.9
Millburn Rd	20.5
Railway Rd	20.7
Lodge Rd	20.1
Circular Rd	20.8
Crocknamack Rd	20.9
Millburn Rd/UnionSt/Circular Rd	21.7
Coleraine Bridge/Bridge St	21.9
Railway Station	21.8
Waterside Traffic Lights	20.7
Sandleford Roundabout	19.3
Lodge Rd Roundabout	19.8
Ballycastle Roundabout	19.6
Bushmills Roundabout	19.2
Metropole Roundabout	20.0
Dunlace Av/Crocknamack Roundabout	21.3
A29 Coleraine - Portrush	19.7
Castlerock Road - Hezlett House Junction	20.3
Strand Road	20.0
Bushmills Road - Ring Road	20.2
Long Commons	20.2
Beresford Road/Nursery Avenue	20.2
Ring Road, Lodge Road Roundabout	20.9

4.4 IMPACT OF INDUSTRY ON CONCENTRATIONS OF PM_{10}

According to the Coleraine Stage one review and assessment there are no industries needing further investigation.

4.5 CONCLUSIONS FOR PM_{10} CONCENTRATIONS IN THE COLERAINE BOROUGH COUNCIL AREA

Emissions from traffic or industrial sources are predicted not to lead to an exceedence of the PM_{10} objectives in 2004. Therefore a **stage 3 review and assessment is not recommended for this pollutant**.

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 depositions 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%.

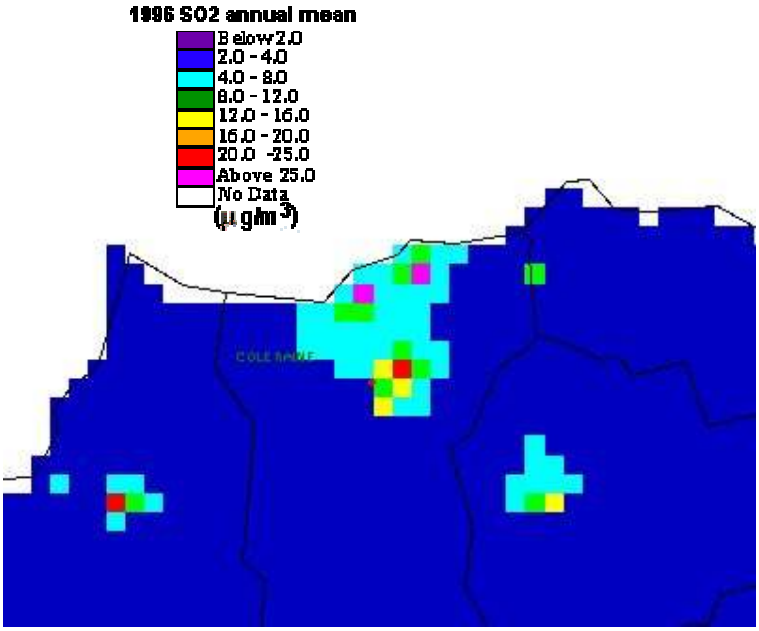
Exceedences of the 15-minute air quality standard currently occur near industrial processes for which the stack heights were designed to meet previous air quality standards and downwind of large combustion plant such as power stations. Exceedences are also possible in areas where significant quantities 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 of lead were obtained for the Coleraine Borough area using the maps on the UK National Air Quality Information Archive web site http://www.aeat.co.uk/netcen/airqual/home.html. Figure 5.1 shows the most recent estimates available, for 1996. The highest estimated annual average concentration for 1996 in the Coleraine Borough Council area was below 20-25µg m^3. GB Government Guidance LAQM.TG4(00) assumes that the annual mean at the end of 2004 and 2005 will be half the 1996 annual mean, however because of the high coal burning nature of the region it has been decided to assume the annual mean at the end of 2004 and 2005 will be ¾ the 1996 annual mean. Thus the estimated annual mean background concentration in the Coleraine Borough Council area in 2004 will be a maximum of 18.75µg m^3.

Figure 5.1 Background SO_2 concentrations 1996



~~1.2~~5.3 MONITORING OF SULPHUR DIOXIDE

5.3.1 SO_2 Diffusion Tubes

Monthly concentrations have been measured at three sites in the Coleraine Borough Council region for 10 months in 2001. Annual average data are summarised in Table 5.1 and the full data set is presented in Appendix 1.

Table 5.1 Annual average SO_2 diffusion tube concentrations in Coleraine

	2001 ppb	2001 $\mu g/m^3$
Castleton Park, Portstewart	8.1	21.5
Lyttlesdale, Garvagh	8.6	22.9
Drumkil Gardens, Kilrea	3.1	8.3

The data are presented here although sulphur dioxide diffusion tube measurements have limited application in the review and assessment process because the strategy objectives are for short-term exposure. They do however show relatively low concentrations of sulphur dioxide at their locations.

5.4 IMPACT OF INDUSTRY ON CONCENTRATIONS OF SULPHUR DIOXIDE

The Stage 1 Review and Assessment Report prepared by Coleraine Borough Council stated that there were two industrial combustion systems in the Coleraine Borough Council area needing further assessment:

- The new University of Ulster
- Spanboard Products Limited

These are potential significant sources of SO_2 and are likely to be in existence in 2005. Therefore they were assessed using GSS (Guidance for Estimating the Air Quality Impact of Stationary Sources) as advised by the GB Government Pollutant Specific Guidance. To proceed with the use of this model the sources must have:

- Stacks between 20metres and 200metres tall
- Stack exit velocities between 10m/s and 25 m/s
- Releasing buoyant plumes, i.e. temperature slightly above or greater than ambient.

5.4.1 Spanboard Products Ltd

As advised by the Guidance, GSS was used to assess the impact of Spanboard Products limited. The predicted concentration of the SO_2 15 minute mean from the Spanboard stack in combination with background SO_2 would be 141.3$\mu g/m^3$. This is well within the 15 minute mean objective of 266 $\mu g/m^3$ and therefore Spanboard Products Ltd does not need to be considered further in a stage 3 review and assessment.

5.4.2 The new University of Ulster

It was not appropriate to use the GSS model to assess the impact of emissions from the University of Ulster as the stack exit velocity was outside the required parameters. Government Guidance recommends that where this is the case it will be necessary to consider the use of alternative screening models or to proceed to a stage 3 Review and Assessment. Therefore the R91 model was used in this assessment which is a long established and well recognised model ("A Model for Short and Medium Range Dispersion of Radionuclides Released to the atmosphere" by the National Radiological Protection Board).

An emission rate of 21.7g/s of sulphur dioxide was calculated from information in the stage 1 review and assessment. This stack height was then used against the graphs in the model, in this case graph 75%D, representing the Meteorological conditions (D) in the Coleraine area, 75% of the time. This then gave a figure, $4 \star 10^{-7}$ by which to multiply the emission rate, 21.7 g/s. This figure was multiplied by 1,000,000 to give 8.68$\mu g/m^3$ representing the annual average SO_2 concentration. GB Pollutant Specific Guidance advises that to convert the annual mean to the 99th percentile of hourly means multiply by 10 and add the background concentration:

$=(8.68 \star 10)+(19)$ Background here is at least 19$\mu g/m^3$ (according to the netcen concentration maps)

$=105.8\ \mu g/m^3$

This calculation of hourly means is well below the 350 $\mu g/m^3$objective. The Pollutant Specific Guidance does not provide a conversion factor to predict the 99.9th percentile of 15 minute means from the 99th percentile of hourly means or the annual average. However, given the low predicted 99th percentile of hourly mean concentration it is anticipated that the 99.9th percentile of 15 minute mean objective would not be exceeded. Therefore, it is recommended that this site does not need to be investigated further in a stage 3 review and assessment.

5.5 CONCLUSIONS FOR SULPHUR DIOXIDE CONCENTRATIONS IN THE COLERAINE BOROUGH COUNCIL AREA

It is concluded that industrial sources of sulphur dioxide in the Coleraine Borough Council are likely to meet the air quality objective and therefore no further review and assessment of these is required.

6 Conclusions and recommendations for each pollutant

6.1 NITROGEN DIOXIDE

It is concluded that the UK Strategy objectives for nitrogen dioxide will be achieved by 2005 in the Coleraine Borough. Emissions arising from road transport are not predicted to lead to exceedance s. In addition, measurements of nitrogen dioxide concentrations by diffusion tubes also suggest it is likely that the Coleraine area will meet the objective. **It is therefore recommended that a Stage 3 Review and Assessment is <u>not</u> necessary for this pollutant**.

6.2 PARTICULATE MATTER (PM_{10})

Emissions from traffic are not predicted to lead to an exceedence of the PM_{10} objectives in 2004. Therefore, **a stage 3 review and assessment is <u>not</u> required for this pollutant.**

6.3 SULPHUR DIOXIDE

There were no predicted exceedences of the Strategy objectives in the Coleraine Borough Council region by industrial sources. Therefore, **it is <u>not</u> necessary to proceed to a stage 3 Review and Assessment.**

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. Clarke, 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

CONTENTS

Coleraine NO2 Diffusion Tubes
2000/2001

μg/m3	Nov-00	Dec-00	Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	average
Lower Union St Coleraine	18.5	27.7	23.5	25.5	17.5	9.9	22.9	17.6	13.4	22.5	19.0	21.4	19.9
Upper Union St, Coleraine	14.5	11.2	18.6	19.4	12.2	8.1		12.3	7.5	12.7	19.8	13.6	13.6
Lodge Roundabout, Coleraine	10.6	15.0	10.8	14.8	9.5	8.5	14.3	10.9	8.8	17.3		14.4	12.3
Bridge St, Coleraine	13.9		12.4	18.6	11.9	8.9	13.5	26.3	13.4	21.5	23.5	12.0	15.9

Coleraine SO2 Survey
ppb

	Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	average
Castleton Park, Portstewart	9.2	18.7	9.9	4.1	6.6		5.7	7.5	6.5	4.7	8.1
Lyttlesdale, Garvagh	2.2	10.5	12.7	8.7	6.2	2.1	32.4	1.5	2.8	7	8.61
Drumkil Gardens, Kilrea	5.5	9.2	1.9	1.9	2	1	2.9	1.5	1.3	4	3.12

	2001 ppb	2001 μg/m3
Castleton Park, Portstewart	8.1	21.546
Lyttlesdale, Garvagh	8.61	22.9
Drumkil Gardens, Kilrea	3.12	8.2

Appendix 2

CONTENTS

Description of Link	AADT	% HDV	Average Speed (km/hr)
Coleraine Ring Road between A26-B67	23393	5.0	96.0
Coleraine Ring Road between B67-B17	18318	5.0	89.0
Coleraine - Limavady at Farrenlester	19952	9.7	96.0
Union St	19453	7.7	32.0
Millburn Rd	18524	6.0	31.5
Railway Rd	15132	7.5	24.0
Lodge Rd	14632	5.7	37.0
Circular Rd	19760	8.2	28.5
Crocknamack Rd	18241	8.5	32.0
A29 Coleraine	10225	9.7	39.0
Castlerock Road	15368	6.0	34.0
Strand Road	11257	8.0	40.5
Bushmills Road	12106	7.5	30.0
Long Commons	12056	4.5	26.0
Beresford Road	10794	5.8	22.0
Lodge Road Roundabout	42622	5.0	32.0