Report

Air Quality Review and Assessment - Stage 2 and 3

Report to Banbridge District Council

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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. Banbridge District 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 and three 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:

Nitrogen dioxide

- Road traffic modelling using DMRB has predicted no exceedances of the nitrogen dioxide objectives. This correlates with the information from diffusion tubes. Domestic Fuel combustion was ruled out for potential exceedances at stage 1. It is therefore **not necessary to progress to a further stage of review and assessment for this pollutant**.

Particulate matter (PM_{10})

- Emissions from traffic and industrial sources are not predicted to lead to an exceedence of the PM_{10} objectives in 2004. It is therefore **recommended that Banbridge District Council do not proceed to a Stage 3 Review and Assessment for this pollutant.**

Sulphur dioxide

- It is concluded that there is unlikely to be an exceedance of the AQS Objectives for SO_2 by industrial sources and therefore there is **no need to proceed to a further stage of review and assessment for industrial sources.**

- The 15 minute mean SO_2 objective is predicted by the ADMS model (in the absence of monitoring data) to be exceeded as a result of domestic combustion sources. **It is therefore recommended that Banbridge District Council carry out SO_2 monitoring within the Banbridge District Council Region or calibrate the model using monitored data from a similar neighbouring LA.**

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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.

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1.1 PURPOSE OF THE STUDY

netcen was commissioned by Banbridge District Council to complete a Second and Third Stage Air Quality Review (SSAQR) within their area for road vehicular and industrial sources of air pollution and also a Stage 3 review of domestic fuel combustion. The review:

- Investigates present and potential future air quality in the Banbridge District Council area
- Identifies any actions that are likely to be required by Banbridge District Council under Part IV of the GB Environment Act, 1995.
- Recommends actions, if necessary, to control the subsequent air quality within the Banbridge District 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 Banbridge District Council area.
2. Model expected present and potential future levels of pollutant concentrations in the Banbridge District 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 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 Government Guidance has been used LAQM TG(03) in conjunction with the previous 'Pollutant Specific Guidance' (2000).

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 6 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 7 summarises all the findings and recommendations of the work.

1.4 INFORMATION PROVIDED BY BANBRIDGE DISTRICT COUNCIL TO SUPPORT THIS ASSESSMENT

The following information from Banbridge District Council 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 (Northern Ireland) Order 1997
- Traffic flow and speed data
- Transport strategy
- Large combustion sources
- Domestic combustion sources

1.4.1 Banbridge District and it's environs

Banbridge District Council is situated to the North West of County Down, Northern Ireland. Banbridge District covers a total of 175 square miles of unspoilt countryside. The A1 route through the picturesque drumlin landscape of Banbridge District connects Belfast and Dublin.

1.4.1.1 Industrial and Transport Development in Banbridge District Council

Some developments may have an important impact on air quality in the future. Therefore they need to be included in the Stage 2 Review and Assessment. There are no developments that need to be considered in Banbridge District Council area.

1.4.2 Local air quality monitoring data

1.4.2.1 Extent of data available

Banbridge District Council has carried out monitoring of nitrogen dioxide using diffusion tubes at four sites in the area and Sulphur Dioxide at one location. Appendix 1 gives more information about the local air quality monitoring.

1.4.2.2 Quality Assurance/Quality control of data

The analyst laboratory used by Banbridge District Council is Lambeth Scientific Services Ltd, which participate in the laboratory intercomparison exercises for the UK National NO_2 Diffusion Tube Network.

1.4.3 Traffic data

Appendix 2 summarises the traffic information used in the assessment, Banbridge District Council supplied traffic counts based on the Roads Service Annual Traffic Census Report and projections to the relevant years.

1.4.3.1 Flow and speed

Banbridge District Council provided traffic flow measurements at a range of locations within Banbridge and in the surrounding area (Appendix 2). Average traffic speeds were also supplied.

1.4.3.2 Traffic growth

The national air quality objectives are targets for 2004 or 2005. The predicted increase in traffic flows for the years 2004 and 2005 relative to the date of traffic counts have been supplied by Banbridge District 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. This data was available from Banbridge District Council for some of the links and where it wasn't default figures from the NAEI were used.

1.4.3.4 Distance of the receptor from the centre of the road and the kerbside.

The model used to predict the roadside concentrations requires estimates of the distance of the receptor from the centrepoint of the road. As a precautionary approach the minimum value permitted was entered into DMRB.

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. Banbridge District Council provided a list of Part A and B processes and >5 MW (thermal) combustion plants that needed further assessment in a Stage 2. The list includes:

- Edentrillick Quarry
- Gibson Brothers Quarry
- RMC Catherwood Ltd
- Armaghdown Creamery (>5 MW (thermal) combustion plant)

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.

Table 2.2 Air Quality Objectives in the Air Quality Strategy 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), LAQM.TG(00) May 2000, on 'Review and Assessment: Pollutant Specific Guidance' and the latest version LAQM.TG(03). 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.

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 $\mu g\ m^{-3}$ (21 ppb); to be achieved 31st December 2005
- 200 $\mu g\ m^{-3}$ (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 $\mu g\ m^{-3}$ 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.

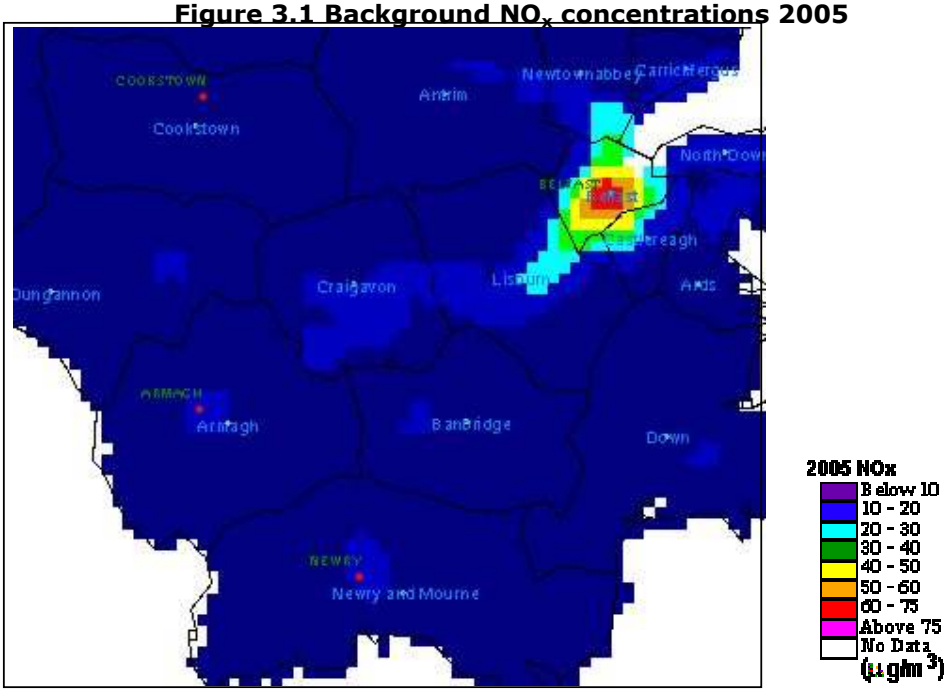
The results of the analysis set out in the National Air Quality Strategy suggest that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures will be required to ensure that air quality objectives are achieved everywhere by the end of 2005.

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.

3.2 BACKGROUND CONCENTRATIONS OF NITROGEN DIOXIDE

Background concentrations were obtained for the Banbridge area (see figure 3.1).

Figure 3.1 Background NO_x concentrations 2005



An estimated NO_x background concentration has been taken from data available on the **netcen** website (http://www.airquality.co.uk/archive/laqm/laqm.php) taking the highest background value in the dataset for a conservative estimate. A background NO_x estimate of 16.4µg/m^3 has been estimated for 2005 in the Banbridge District Council region.

3.3 MONITORING OF NITROGEN DIOXIDE

3.3.1 Diffusion tube data

Banbridge District Council has monitored monthly average concentrations of NO_2 with passive diffusion tube samplers at four sites in Banbridge. The results for 2001 are summarised in Table 3.1 and the data are presented in full in Appendix 1. The monitoring period is representative of a full year and therefore the period average concentrations can be compared with the annual mean objective. The Lambeth Scientifics laboratory carried out analysis of the tubes. The mean bias achieved by Lambeth Scientifics in 2001 was -8.9% with respect to

chemiluminescent analyser in the UK NO_2 intercomparison Report (http://www.airquality.co.uk/archive/reports/cat05/intercomp_2001_report.pdf).

Table 3.1 Annual average diffusion tube concentrations and projections for the Banbridge area.

Site type	Location	2001 Average	Lab Bias Correction (-9.8%)	2005 Projection
Rural Background	9 Fortfield	16.9	18.6	16.9
Urban Background	17 Springfields	14.8	16.2	13.4
Kerbside	Dromore St	25.7	28.2	22.9
Kerbside	A1 Fortfield Dromore	32.3	35.5	28.8

The diffusion tubes placed at the roadside locations do not exceed the annual mean in 2001 and are predicted to remain within the objectives in 2005. Therefore the diffusion tubes suggest it likely that the NO_2 annual mean objective will be met at all these locations in 2005.

3.4 IMPACT OF ROAD TRAFFIC ON CONCENTRATIONS OF OXIDES OF NITROGEN

The Stage one Review and Assessment for Banbridge District Council identified several roads in Banbridge 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 version 1.01) as recommended in LAQM.TG(03), and using the traffic flow data provided by Banbridge District 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.

Concentrations have been assessed at the traffic speeds relevant to each. The distance from the receptor to the centre of the road is required by DMRB. This distance was assumed to be 2 metres, the minimum allowed by the DMRB model as a worst case scenario.

Table 3.2 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 Banbridge District Council area. Following advice given in GB Government Guidance LAQM TG(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 roadside locations in the Banbridge District

Receptor	Link	2005 NO_2 $\mu g/m^3$	99.8th percentile
1	A1 Dromore to Banbridge	21.5	71.3
2	A50 Banbridge to Gilford at Lawrence town	20.8	72.8
3	A26 Banbridge - Lurgen North of Broken Bridge	17.4	60.9
4	A1 Banbridge Bypass	18.6	65.1

See appendix 2 for full DMRB results

The nitrogen dioxide objectives are not predicted to be exceeded at any of the modelled locations in Banbridge. This correlates with the information from the diffusion tubes. It is therefore not necessary to progress to a further stage of review and assessment.

3.5 IMPACT OF INDUSTRY ON CONCENTRATIONS OF NITROGEN OXIDES

The Stage 1 Review and Assessment for Banbridge District Council concluded that there were no processes needing further investigation for NO_2 and therefore it was not necessary to proceed to a further stage of Review and Assessment.

3.6 CONCLUSIONS FOR NITROGEN DIOXIDE CONCENTRATIONS IN THE BANBRIDGE DISTRICT COUNCIL AREA

Modelled within DMRB the nitrogen dioxide objectives are not predicted by DMRB to be exceeded at any of the modelled locations in Banbridge. This correlates with the information from the diffusion tubes. It is therefore not necessary to progress to a further stage of review and assessment 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 $\mu g\ m^{-3}$ (gravimetric);
- A maximum 24-hourly mean concentration of 50 $\mu g\ m^{-3}$ (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.

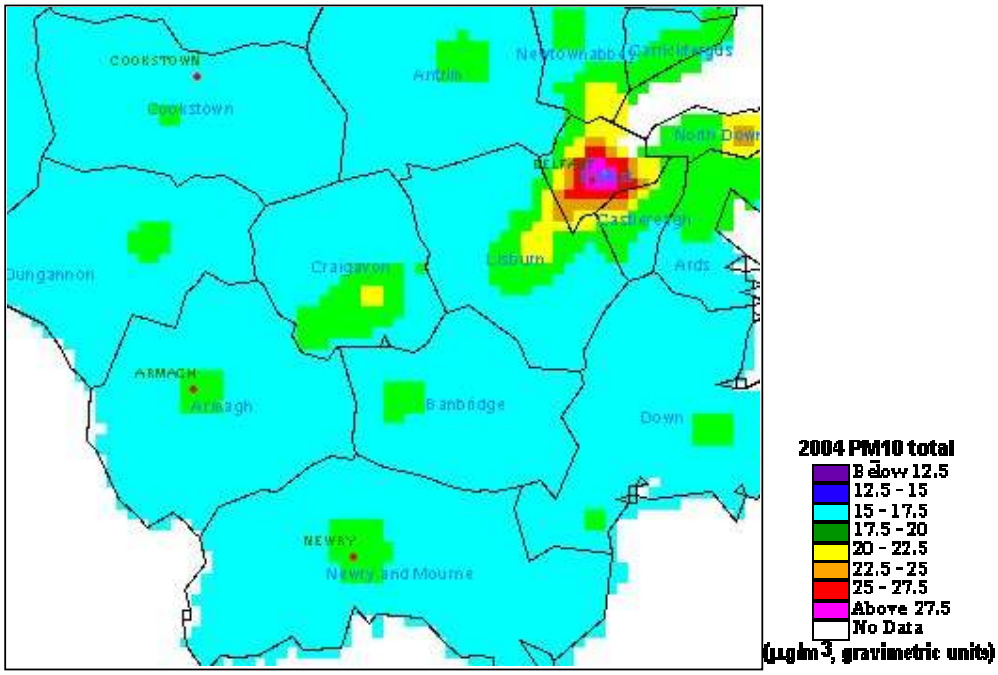
4.2 MONITORING OF PM_{10}

There is no PM_{10} monitoring data available for Banbridge District Council.

4.3 BACKGROUND CONCENTRATIONS OF PM_{10}

Estimates of background concentrations of PM_{10} were obtained for the Banbridge District Council area. Figure 4.1 shows that the estimated annual average background concentration for 2004 in Banbridge. Taking the highest value in the dataset as a conservative estimate the background concentration in 2004 is predicted to be 16.5 μg/m^3 or lower (http://www.airquality.co.uk/archive/laqm/laqm.php) in the Banbridge District Council region.

Figure 4.1. Background PM_{10} concentrations 2004



4.4 IMPACT OF ROAD TRAFFIC ON PM_{10}

4.4.1 Prediction for 2004

As recommended in GB Government Guidance LAQM.TG(03) DMRB has been used to predict PM_{10} concentrations for 2004 from road traffic. The estimated maximum background concentration for 2004 of 15.6μg m^{-3} (this value taken from the point of highest NO_x value in the NAEI dataset) for Banbridge has been used to provide total predicted PM_{10} concentrations. Estimated traffic flows were provided for 2005, as they were the nearest year available, and which will provide a conservative estimate of concentrations for the objective year of 2004.

GB Government Guidance LAQM.TG(03) states that the 24-hour objective is highly unlikely to be exceeded if the annual mean concentration is below 32 μg 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. Therefore the objectives are not likely to be exceeded.

Table 4.1. Predicted PM_{10} concentrations at roadside locations in the Banbridge District Council region.

Receptor	Link	PM10 Total Concentrations (μg/m³)	Number of PM10 exceedences
1	A1 Dromore to Banbridge	19.5	3
2	A50 Banbridge to Gilford at Lawrence town	19.1	2
3	A26 Banbridge - Lurgen North of Broken Bridge	17.4	1
4	A1 Banbridge Bypass	18.3	2

4.5 IMPACT OF INDUSTRY ON CONCENTRATIONS OF PM_{10}

4.5.1 Part A Processes

Banbridge District Council has no industrial processes requiring further consideration at the stage 2 Review and Assessment level.

4.5.2 Domestic Sources of PM_{10}

Banbridge District Council found in the Stage 1 Review and Assessment that there was no need to proceed to a second stage review and assessment and therefore domestic combustion, as a source of PM_{10} is not considered here.

4.6 CONCLUSIONS FOR PM_{10} CONCENTRATIONS IN THE BANBRIDGE DISTRICT COUNCIL AREA

Emissions from traffic and industrial sources are not predicted to lead to an exceedence of the PM_{10} objectives in 2004. It is therefore recommended that Banbridge District Council do not proceed to a Stage 3 Review and Assessment 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 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 $\mu g\ m^{-3}$ as a 15 minute mean (maximum of 35 exceedences a year or equivalent to the 99.9^{th} percentile) to be achieved by the 31^{st} December 2005
- 350 $\mu g\ m^{-3}$ as a 1 hour mean (maximum of 24 exceedences a year or equivalent to the 99.7^{th} percentile) to be achieved by the 31^{st} December 2004
- 125 $\mu g\ m^{-3}$ as a 24 hour mean (maximum of 3 exceedences a year or equivalent to the 99^{th} percentile) to be achieved by the 31^{st} 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%.

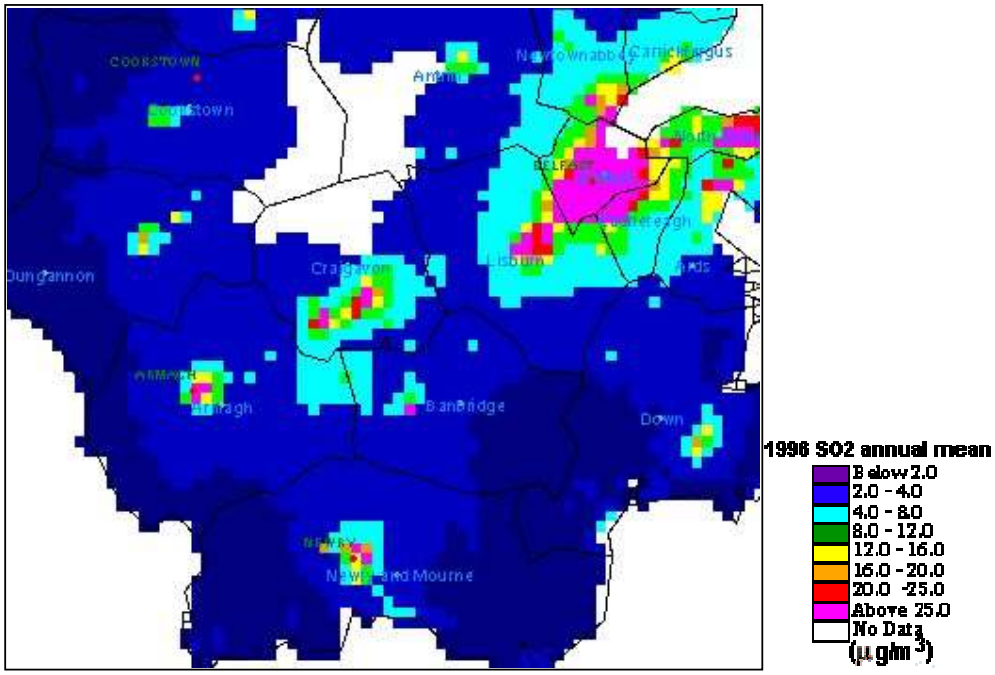
Exceedences of the 15-minute air quality standard currently occur near industrial processes for which the stack heights were designed to meet previous air quality standards and downwind of large combustion plant such as power stations. Exceedences are also possible in areas where significant quantities 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 SO_2 were obtained for the Banbridge District area. Figure 5.1 shows the annual mean estimates for 1996.

Figure 5.1. Background SO_2 concentrations 1996



Improved data is available for more recent years from the **netcen** website:
http://www.airquality.co.uk/archive/laqm/tools.php?tool=background
An estimated SO_2 background concentration has been taken from data available on this **netcen** website taking the highest background value in the dataset for a conservative estimate, 7.8µg/m^3 in 2001. As stated in TG(03) the Sulphur dioxide background in 2004 and 2005 can be assumed to be 75% that of 2001. Therefore a conservative background SO_2 estimation for 2004 and 2005 is 5.9 µg/m^3 in the Banbridge District Council region.

5.3 IMPACT OF INDUSTRY ON CONCENTRATIONS OF SULPHUR DIOXIDE

The Stage 1 Review and Assessment Report prepared by Banbridge District Council stated that there is one process needing further assessment:

- Armaghdown Creamery

5.3.1 Armaghdown Creamery

Armaghdown Creamery has a small combustion plant with a thermal capacity greater than 5MW. It has 3 boilers burning heavy grade fuel oil (assumed to be less than 1% Sulphur as since 1st January 2003 this is a legal requirement of combustion plants burning fuel oil, unless they have a permit otherwise). There are sensitive properties within about 150 metres of the two stacks.

Firstly the point source nomogram (http://www.airquality.co.uk/archive/laqm/tools.php) was used. As the radius is unknown the minimum value allowed in the tool has been used as a conservative approach. The result showed that the maximum emission rate could be 66t/a. A calculation based on the fuel use at the Creamery shows the likely annual emissions;

Table5.1 Armaghdown Creamery Emissions

Heavy Fuel Oil Usage:		
Boiler 1	977	kg/hr
Boiler 2	733	kg/hr
Boiler 3	511	kg/hr
Total	2221	kg/hr
Total	19455960	kg/yr
Total	19456	tonnes/year
Emissions Estimate:		
	8.98	kt/mt Emission Factor*
	8976000	kg/mt
	8.98	kg/tonne
	174637	kg sulphur/year
Total Annual Emission	175	t/yr Sulphur**

*Source: NAEI Other Industry Combustion
**(all assumed to be SO_2)

As the emission of 175 tonnes per year exceeds the emission rate of 66t/a allowed to pass the nomogram then further assessment is required. From this information it is possible to estimate an emission rate of 5.5g/sec.

The emission rate of 5.5g/sec was used in the Environment Agency model GSS (Guidance on Stationary Sources) along with the stack profile and it was found that the likely concentrations resulting from the stack for 15 minute means would be 17.5$\mu g/m^3$. This is well within the 15 minute objective of 266 $\mu g/m^3$, which is the most stringent of the objectives.

Banbridge District Council can be confident that emissions arising from Armaghdown Creamery will not cause an exceedance of the Air Quality SO_2 Objectives.

5.4 IMPACT OF DOMESTIC FUEL COMBUSTION ON CONCENTRATIONS OF SULPHUR DIOXIDE

5.4.1 Domestic Sources Stage 1 Conclusions

Solid fuel burning for domestic heating is still relatively common in parts of Northern Ireland. Where solid fuel burning is predominant it may have the potential to cause exceedances of the objectives. According to PSG (LAQM TG(00)), ' the risk of exceedance within an area can be considered significant where the density of coal burning (or solid smokeless fuel burning) houses exceeds 300 properties per 1km^2. In such cases PSG recommends an authority proceed to a 2nd or third stage review and assessment.

For the first stage of the Review and Assessment, Banbridge District Council was provided with information by the Northern Ireland Housing Executive which suggested an area to the North West of Banbridge Town was found to have 446 coal burning properties per 1km^2. It was therefore necessary to proceed to a second stage review and assessment.

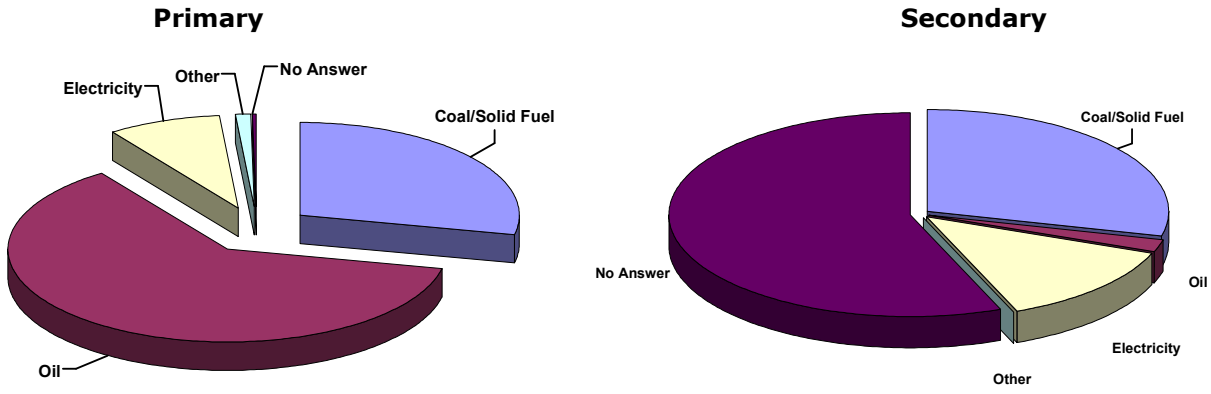
5.4.2 Banbridge District Council Fuel Use Survey

Banbridge district council has, since the first stage review and assessment, conducted a fuel use survey of properties within the 1km2 identified in the 1st stage review and assessment. There were a total of approximately 867 houses within the 1km^2 targeted, of which 300 participated in the study, 35%. Table 5.2 and Fig 5.2 show the results of some of the key questions.

Table 5.2. Fuels for heating purposes

	Primary		*Secondary*	
	Number Properties	% of Properties	Number Properties	% of Properties
Oil	185	61.6	4	1.3
Coal/Solid Fuel	85	28.3	55	18.3
Electricity	25	8.3	25	8.3
Economy 7	2	0.6	0	0
None	1	0.3	105	35
No Answer	1	0.3	107	35.6
Bottled Gas	1	0.3	3	1
Mains Gas	0	0	1	0.3
Total	**300**	**100**	**300**	**100**

Fig5.2 Primary and Secondary Fuel Use in the 1km^2 identified by Banbridge District Council.



5.4.3 Domestic Sources Stage Two Review and Assessment

As Stated in PSG, Second Stage Review and Assessment should focus upon a review of monitoring data within the local area. Based upon that, if local concentrations exceed the air quality objectives (or in the absence of monitoring data) then a third stage review and assessment should be carried out.
There is very limited monitoring data available but the results are detailed in table 5.3 Ideally the monitoring location would be in the 'hot spot' location but in this case it is situated a just a few hundred metres away, at the Civic Building, Downshire Road, Banbridge.

Table 5.3 SO_2 Monthly Averages

Month	$\mu g/m^3$
Dec 97	52
Jan 98	20
Feb 98	99
Mar 98	42
Apr 98	41
Jun 99	99

The monitoring data is not a complete data set and not directly comparable to the objectives. As there is not enough monitoring information to determine any likely exceedance of the SO_2 objectives it has been decided by Banbridge District Council to proceed to a Stage 3 Review and assessment for domestic combustion sources of SO_2 based on more detailed modelling.

5.4.4 Domestic Sources Stage Three Review and Assessment

The Fuel use survey undertaken by Banbridge District Council has been used in combination with the Air Dispersion Model ADMS 3.1 to determine whether domestic fuel combustion in Banbridge local authority is likely to cause exceedances of the objectives. The 15 minute mean SO_2 objective is 266$\mu g/m^3$ and the most stringent of the three SO_2 objectives. Therefore the ADMS modelling was carried out relevant to this objective because if that objective is met the other objectives will also be met.

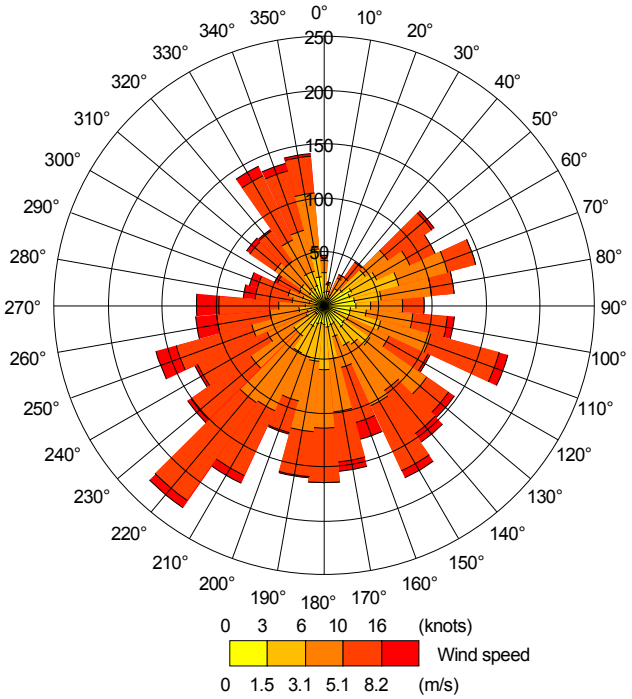
The emission rate for 4 areas within the 1 km^2 were calculated based on the number of properties within each area. The emission rate was calculated in grams/$metre^3$/second. This enabled them to be entered directly into the ADMS model as a volume source.
The assumptions made were,

- Height 10m.
- Temperature 15 °C.
- Varying emission rates for 4 discrete areas based on the number of properties.
- Surface Roughness 1m
- Time varying Emission factors adjusted to reflect normal fuel use scenarios (burning of fuels for 3 hours in the morning and 6 hours in the evening, assuming burning in winter months not summer months) providing a conservative estimate.
- Assumed properties with the ability to burn the fuel, will do so.
- Meteorological data from Aldergrove 1999.
- Concentrations concentrated for every 50m

The background concentration was then added onto the modelled concentrations. A background concentration of 5.9 $\mu g/m^3$ has been estimated for the Banbridge District Council region. To make this relevant to the 15 minute mean PSG (LAQM TG(00) recommends that the

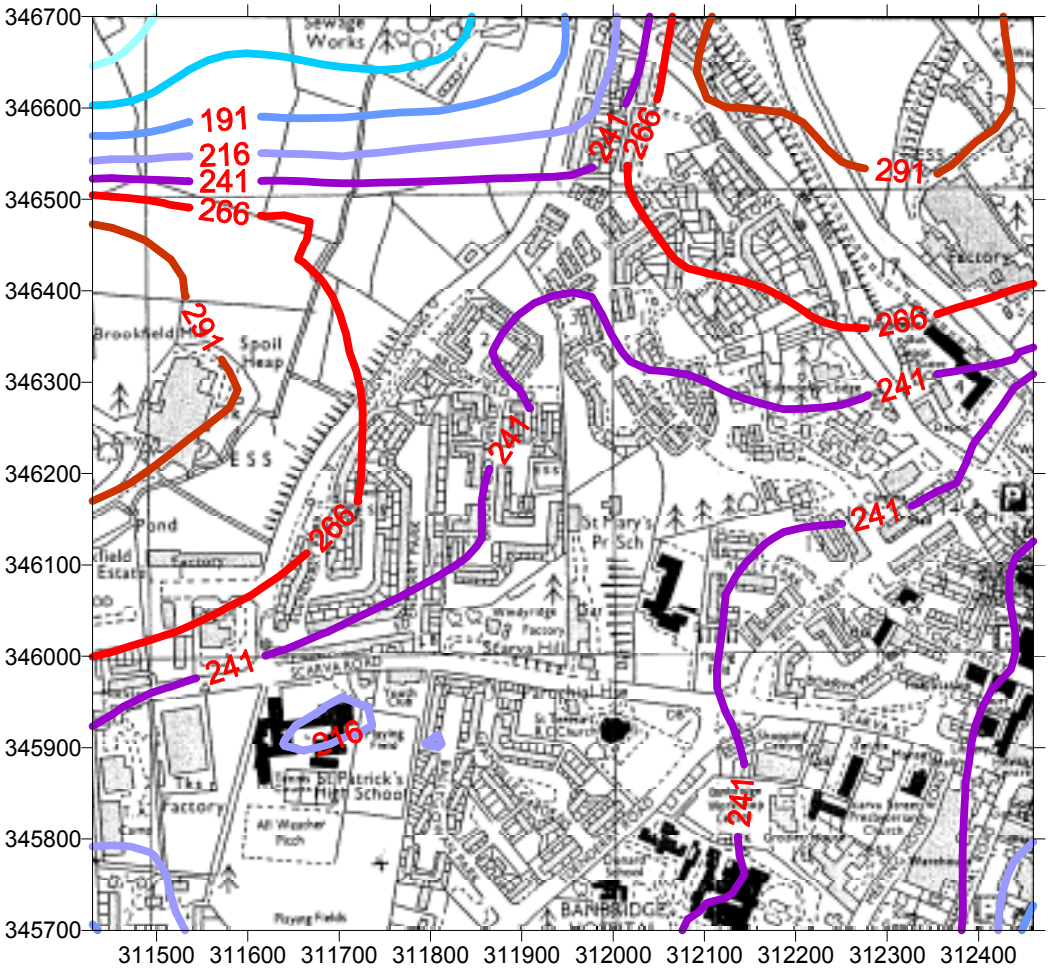
background for 2005 is doubled. Therefore the background contribution that has been added on to the 15 minute mean concentrations is 12 $\mu g/m^3$.
Figure 5.3. shows the wind rose that ADMS produces from the met data supplied to the model.

Fig 5.3 Wind rose for the Aldergrove 1999 met data



The model results provide the 99.8th percentile (as it has been run for winter 6 months) and these can be plotted as contours relevant to a map of the area. See Figure 5.4.

Figure 5.4. A contour plot of concentrations predicted by the ADMS model relevant to the 15 minute mean.



It can be seen from the contour plot in Figure 5.4 that the 15 minute mean Air Quality Objective for SO_2 is predicted by the model to be exceeded at two areas, one to the West of the grid and one to the North East of the 1km^2 grid.

As there is no monitoring data with which to calibrate the model there is no evidence to suggest that this model may be over predicting. Therefore it is recommended that Banbridge District Council carrying out SO_2 monitoring in the areas identified as predicted to exceed the objectives. With such data the model could then be calibrated to determine if the modelled concentrations are a true representation of concentrations in Banbridge District Council. Alternatively if it is not possible to monitor the data of a similar neighbouring local Authority could be used.

5.5 CONCLUSIONS FOR SO_2 CONCENTRATIONS IN THE BANBRIDGE DISTRICT COUNCIL AREA

It is concluded that there is unlikely to be an exceedance of the AQS Objectives for SO_2 by industrial sources and therefore there is no need to proceed to a further stage of review and assessment for industrial sources.
However exceedances of the 15 minute mean SO_2 objective can not be ruled out and are predicted by the ADMS model (in the absence of substantial monitoring data) to be exceeded. It is therefore recommended that Banbridge District Council carries out SO_2 monitoring within the Banbridge District Council Region or calibrate the model using monitoring data from another applicable Local Authority.

6 Other Pollutants

6.1 BENZENE

The main sources of benzene in the United Kingdom are petrol-engine vehicle exhaust, petrol refining, distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems. Measurements at UK national network monitoring sites are already below the 2003 objective, even close to heavily trafficked roads. The increasing numbers of vehicles equipped with three way catalysts will significantly reduce emissions of benzene in future years. Recently agreed additional reductions in vehicle emissions as part of the Auto-Oil programme are expected to further reduce emissions of benzene from vehicle exhausts, and proposals to control emissions from petrol station forecourts during vehicle refuelling are expected to lead to significant reductions in uncontrolled emissions. These existing and proposed measures are expected to deliver the revised air quality objective by the end of 2003, and no further measures are thought to be needed (DETR, 2000).

Only those authorities with major industrial processes in the near vicinity which handle, store or emit benzene are expected to be at risk of exceeding the objective for benzene. There were no major industrial processes which either handled, stored or emitted benzene, which had the potential, in conjunction with other sources, to result in elevated concentrations of benzene in relevant locations in the Banbridge area. Therefore, it is likely that national policies will deliver the prescribed air quality objective for benzene by the end of 2005.

6.2 1,3 BUTADIENE

The main source of 1,3 butadiene in the United Kingdom is from motor vehicle exhausts. 1,3-butadiene is also an important industrial chemical and is handled in bulk at a small number of industrial premises. Measurements at UK national network monitoring sites are already well below the 2003 objective at all urban background/centre and roadside locations. The increasing numbers of vehicles equipped with three way catalysts will significantly reduce emissions of 1,3-butadiene in future years. Recently agreed additional reductions in vehicle emissions as part of the Auto-Oil programme are expected to further reduce emissions of 1,3-butadiene from vehicle exhausts. These measures are expected to deliver the revised air quality objective by the end of 2003, and no further measures are thought to be needed (DETR, 1999).

Only those authorities with major industrial processes in the near vicinity which handle, store or emit 1,3-butadiene are expected to be at risk of exceeding the revised objective. There are no major industrial processes which either handle, store or emit 1,3-butadiene, which have the potential, in conjunction with other sources, to result in elevated concentrations of 1,3-butadiene in relevant locations in the Banbridge area. Therefore, it is likely that national policies will deliver the prescribed air quality objective for 1,3 butadiene by the end of 2005.

6.3 CARBON MONOXIDE

The main source of carbon monoxide in the United Kingdom is currently road transport, in particular petrol-engine vehicles. The contribution from major roads to carbon monoxide concentrations was assessed in the Stage 1 Review: exceedence of the objective for 2005 was considered unlikely. Recently agreed reductions in vehicle emissions as part of the Auto-Oil programme are expected to deliver the revised air quality objective by the end of 2003, even at roadside locations, and no further measures are considered necessary (DETR, 1999).

The Stage 1 Review did not identify any significant industrial sources of carbon monoxide in Banbridge District Council area.

6.4 LEAD

The agreement reached between the European Parliament and the Environment Council on the Directive on the Quality of Petrol and Diesel Fuels (part of the Auto-Oil programme) has lead to the ban on the sale of leaded petrol in the United Kingdom with effect from 1 January 2000. Emissions of lead are now restricted to a variety of industrial applications, for example in the manufacture of batteries, pigments in paints and glazes, alloys, radiation-shielding, tank lining and piping. No sites were identified at Stage 2 as having the potential to emit lead in significant quantities and there are no new developments which would lead to lead emissions in Banbridge District Council. No further assessment was therefore considered necessary.

7 Conclusions and recommendations for each pollutant

7.1 NITROGEN DIOXIDE

Road traffic modelling using DMRB has predicted no exceedances of the nitrogen dioxide objectives. This correlates with the information from the diffusion tubes. It is therefore not necessary to progress to a further stage of review and assessment for this pollutant.

7.2 PARTICULATE MATTER (PM_{10})

Emissions from traffic and industrial sources are not predicted to lead to an exceedence of the PM_{10} objectives in 2004. It is therefore recommended that Banbridge District Council do not proceed to a Stage 3 Review and Assessment for this pollutant.

7.3 SULPHUR DIOXIDE

It is concluded that there is unlikely to be an exceedance of the AQS Objectives for SO_2 by industrial sources and therefore there is no need to proceed to a further stage of review and assessment for industrial sources.
the 15 minute mean SO_2 objective is predicted by the ADMS model (in the absence of substantial monitoring data) to be exceeded. It is therefore recommended that Banbridge District Council carry out SO_2 monitoring within the Banbridge District Council Region or calibrate the model (perhaps using data from another LA).

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Appendices

CONTENTS

Appendix 1

NO_2 Monitoring Data
SO_2 Monitoring Data

NO_2 Monitoring results for Banbridge District $\mu g/m^3$

Banbridge District Council - N02 Results (January 2001 - December 2001)

Site No.	7		8		10		11	
	ug m^{-3}	ppb	ug m^{-3}	ppb	ug m^{-3}	ppb	ug m^{-3}	ppb
Month								
Jan-01	20	10	3	1	26	14	27	14
Feb-01	14	7	16	8	19	10	30	16
Mar-01	14	7	16	8	19	10	30	16
Apr-01	41	21	43	22	34	18	24	13
May-01	17	9	16	8	39	21	42	22
Jun-01	8	4	14	7	21	11	22	11
Jul-01	12	6	5	3	32	17	36	19
Aug-01	11	6	14	8	17	9	30	16
Sep-01	13	7	12	6	29	15	34	18
Oct-01	24	12	16	8	34	18	51	27
Nov-01	11	5	7	4	18	9	21	11
Dec-01	18	9	15	8	20	10	41	21

Banbridge District Council - N02 Results (January 2002 - September 2002)

Site No.	7		8		10		11	
	ug m^{-3}	ppb	ug m^{-3}	ppb	ug m^{-3}	ppb	ug m^{-3}	ppb
Month								
Jan-02	19	10	24	13			37	19
Feb-02	15	8	13	7	39	20	38	20
Mar-02	3	2	11	6	35	18	18	10
Apr-02	13	7	20	10	17	9	27	14
May-02	4	2	x	x	27	14	34	18
Jun-02	15	8	15	8	22	11	9	5
Jul-02	27	14	20	10	57	30	26	13
Aug-02								
Sep-02	27	14			45	23	15	8

Site No.	Site Description
7	Rural Background
8	Urban Background
10	Kerbside
11	Kerbside

2001 Monthly NO_2 diffusion tube concentrations used in Table 3.1.

Site	Site type	Location	Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01
7	Rural Background	9 Fortfield	20	14	14	41	17	8	12	11	13	24	11	18
8	Urban Background	17 Springfields	3	16	16	43	16	14	5	14	12	16	7	15
10	Kerbside	Dromore St	26	19	19	34	39	21	32	17	29	34	18	20
11	Kerbside	A1 Fortfield Dromore	27	30	30	24	42	22	36	30	34	51	21	41

SO_2 Monitoring results for Banbridge District $\mu g/m^3$

Banbridge District Council - S02 Results (December 1997 - June 1998)

Site - Civic Building, Downshire Road, Banbridge

Month	ug m^{-3}	ppb
Dec-97	52	20
Jan-98	20	8
Feb-98	99	37
Mar-98	42	16
Apr-98	41	15
Jun-99	99	37

Appendix 2

Traffic Data

Data provided by Banbridge District Council

1999

Road	COUNT LOCATION	OS REFERENCE	24 HOUR AADT*	% HDV	SPEED LIMIT
A1	DROMORE-BANBRIDGE	J319353	21,220	NA	60MPH
A1	BANBRIDGE BY-PASS	J313345	16,610	NA	60MPH
A26	BANBRIDGE-LURGAN NORTH OF BROKEN BRIDGE	J311349	6,490	9	60MPH
A50	BANBRIDGE-GILFORD AT LAWRENCETOWN	J310349	7,190	10	40MPH

*Based on data taken from the Road Service Annual Traffic Census Report 1999

Traffic Growth Predictions

Road	Location	1997*	2004**	2005**
A1	DROMORE-BANBRIDGE	18,810	22,821	23,460
A1	BANBRIDGE BY-PASS	14,050	17,046	17,524
A26	BANBRIDGE-LURGAN NORTH OF BROKEN BRIDGE	6,170	7,485	7,695
A50	BANBRIDGE-GILFORD AT LAWRENCETOWN	7,460	9,051	9,304

*Automatic monitoring carried out by the Roads Service, an Agency of the D.O.E. (N.I.)
** Predicted traffic flows based on 2.8% annual increase.

Detailed DMRB Results

Year 2004	Background Concentrations (µg/m^3)													
x 131500	CO	Benzene	1,3-butadiene	NOx	NO2	PM10								
y 511500	0.2	0.3	0.1	16.8	13.5	15.6								
Receptor	Link	Distance from link centre to receptor (m)	AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B)	Total % HDV	Total Concentrations (µg/m^3) CO	Benzene	1,3-butadiene	NOx	NO2	PM10	Number of PM10 exceedences
1	A1 Dromore to banbridge	2	21220	60	A	5.8	0.3	0.5	0.2	53.9	23.1	19.5	3
2	A50 Banbridge to Gilford at Lawrence town	2	16610	60	A	5.8	0.3	0.5	0.2	50.4	22.3	19.1	2
3	A26 Banbridge - Lurgen North of Broken Bridge	2	6490	60	A	9.0	0.2	0.4	0.1	34.8	18.7	17.4	1
4	A1 Banbridge Bypass	2	7190	40	A	10.0	0.2	0.4	0.2	39.7	19.9	18.3	2
Year 2005	Background Concentrations (µg/m^3)													
x 131500	CO	Benzene	1,3-butadiene	NOx	NO2	PM10								
y 511500	0.2	0.3	0.1	15.9	12.5	15.5								
Receptor	Link	Distance from link centre to receptor (m)	AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B)	Total % HDV	Total Concentrations (µg/m^3) CO	Benzene	1,3-butadiene	NOx	NO2	PM10	Number of PM10 exceedences
1	A1 Dromore to banbridge	2	21220	60	A	5.8	0.3	0.5	0.2	50.3	21.5	19.2	2
2	A50 Banbridge to Gilford at Lawrence town	2	16610	60	A	5.8	0.3	0.4	0.2	47.1	20.8	18.8	2
3	A26 Banbridge - Lurgen North of Broken Bridge	2	6490	60	A	9.0	0.2	0.4	0.1	32.6	17.4	17.2	1
4	A1 Banbridge Bypass	2	7190	40	A	10.0	0.2	0.4	0.2	37.4	18.6	18.0	1