AEAT/ENV/R/ 1013

Air Quality Review and Assessment - Stage 2

A report produced for Newtownabbey Borough Council

May 2002

AEAT/ENV/R/ 1013

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Title	Air Quality Review and Assessment - Stage 2
Customer	Newtownabbey Borough Council
Customer reference	ED20615172
Confidentiality, copyright and reproduction	
File reference	J/EQ/Stage3_R&A/Ireland
Report number	AEAT/ENV/R/1013
Report status	Issue 2
ISBN number	

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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. Newtownabbey 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:

- Sulphur dioxide
- PM_{10}

Emissions arising from road transport at 15 road junctions in the Newtownabbey Borough Council area may cause an exceedence of the nitrogen dioxide objective. It is recommended that diffusion tube monitoring is continued at the identified receptors and then consideration be given to proceeding to a Stage 3 review and assessment.

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.

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1.1 PURPOSE OF THE STUDY

NETCEN was commissioned by Newtownabbey 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 Newtownabbey Borough Council area
- Identifies any actions that are likely to be required by Newtownabbey Borough Council under Part IV of the GB Environment Act, 1995
- Recommends actions, if necessary, to control the subsequent air quality within the Newtownabbey 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 Newtownabbey Borough Council area.
2. Model expected present and potential future levels of pollutant concentrations in the Newtownabbey 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)).

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.

1.3 INFORMATION PROVIDED BY NEWTOWNABBEY BOROUGH COUNCIL TO SUPPORT THIS ASSESSMENT

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

- Local air quality monitoring data
- Proposed developments
- Traffic flow and speed data
- Transport strategy
- Large combustion sources

1.4 NEWTOWNABBEY AND ITS ENVIRONS

Newtownabbey borough has a population of over 80,000 and is situated on the north shore of Belfast Lough. The borough unites urban residential areas with traditional farming communities. Its major industries include electronics, software and telecommunications development and agriculture.

1.4.1 Local air quality monitoring data

1.4.1.1 Extent of data available

Newtownabbey Borough Council have been monitoring nitrogen dioxide at nine sites using passive diffusion tube samplers. There has been no monitoring of PM_{10} concentrations in the Newtownabbey Borough Council area. However, there has been monitoring of black smoke. There has been monitoring of sulphur dioxide in Newtownabbey Borough Council by bubblers in a dense domestic coal burning area. Appendix 1 gives more information about the local air quality monitoring.

1.4.1.2 Quality Assurance/Quality control of data

The diffusion tubes were analysed by Lambeth Scientific Services Limited, 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.

1.4.2 Traffic data

Appendix 2 summarises the traffic information used in the assessment. Planned developments in the Newtownabbey area include:

- Abbey Retail Park, Old Church Rd,
- Ballyhenry Business Park, adjacent to A8
- Maysfield Development, Hightown Road
- Nortel Factory extension
- Northcott development and Link Rd between Newtownabbey Rd and Ballyclare Rd
- Safeway, Main Street, Ballyclare.

At present there is no information available on how these developments will affect traffic flows in the borough. It is therefore suggested that when information does become available, attention is given to air quality in the region.

1.4.2.1 Flow and speed

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

1.4.2.2 Traffic growth

The national air quality objectives are targets for 2004 or 2005. Traffic growth forecasts were provided by the Newtownabbey Borough Council.

1.4.2.3 Fraction of HGVs

The model requires estimates of the fraction of HGVs on the roads to predict the pollutant concentrations. Some data was available from Newtownabbey Borough Council. For the majority of roads, the % of HDV on the roads was not measured and an estimate of 7.3% was provided by the NI Roads Service Division as a regional average.

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

The model which is used to predict the roadside concentrations requires estimates of both the distance of the receptor and the distance of the kerbside from the centrepoint of the road. This information was available from Newtownabbey Borough Council either directly or in the form of maps (scale 1:1250) on which the required distances could be measured.

1.4.3 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. Newtownabbey Borough Council provided a list of Part B processes that needed further assessment in a Stage 2. These were:

- James Boyd
- Home fuels

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 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 Borough. 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 NO_2 standards and objectives

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

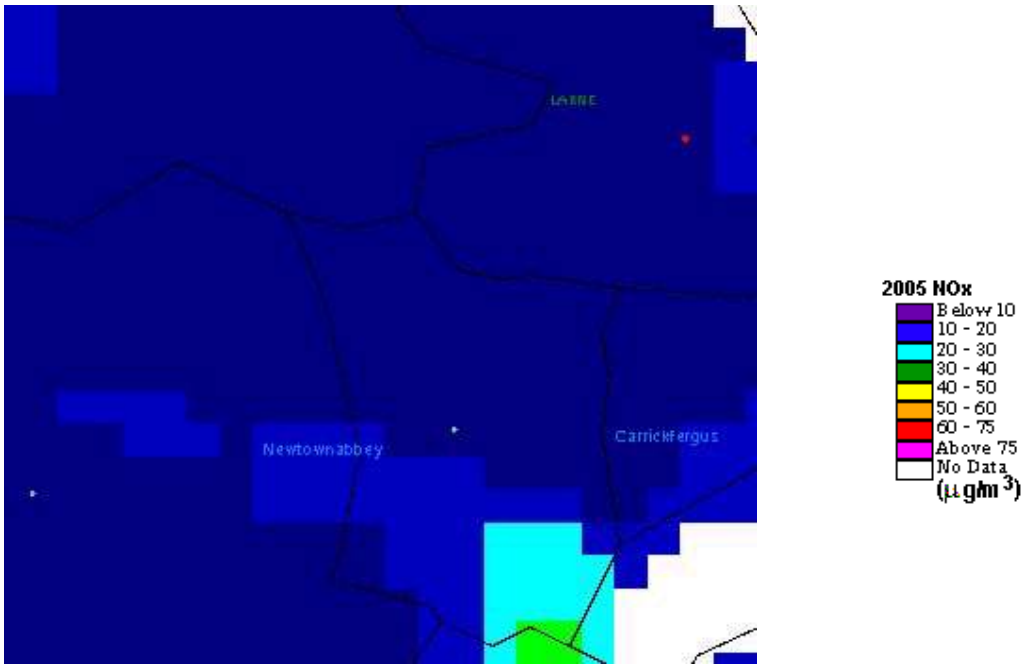
relevant locations, are expected to identify a need to progress to the second or third stage review and assessment for this pollutant.

~~1.2~~3.2BACKGROUND CONCENTRATIONS OF NITROGEN DIOXIDE

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

Figures 3.1 shows estimates of NO_x background concentrations for 2005. A maximum background NOx estimate of 32.1 μg/m^3 has been estimated for 2005 in the Newtownabbey Borough Council region. Where exceedences of the objective were predicted the use of the estimated background for that particular location was used in the modelling process.

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 nine sites in Newtownabbey during 2001. The data are summarised in Table 3.1a and monthly average data are presented 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. Analysis of the tubes was carried out by Lambeth Scientific Services Limited which was found to have a negative bias of 9.8% in 2001 relative to an automatic analyser (Loader 2002) (In 2001, diffusion tubes were compared

for two periods. Lambeth Scientific Services showed a marked difference between their results for the 2 exposure periods in the intercomparison; bias +8.8% in the 1st period, -28.4% in the 2nd. Therefore the mean bias of -9.8% has been used in this assessment as it is felt that this provides the best estimate.) Since December 2001 another 20 diffusion tubes have been exposed in the borough. Data at present are available for December only. For these sites the monitoring period is not representative of a full year and therefore the results cannot be compared against the annual mean objective. Therefore they are not displayed in the Table below but can be found in Appendix 1.

Table 3.1a. Annual average concentrations measured in 2001 at locations in the Newtownabbey area.

Site Name	Site Type	Average NO_2 μgm^{-3} uncorrected for bias	Average NO_2 μgm^{-3} corrected for bias	2005 Projections $\mu g/m^3$
1. 49 Main St, Ballyclare	K	33	35.9	32.6
2. Church Ave / Lenamore Avenue.	K	19	20.6	18.7
3. Carnmoney Rd	B	17	18.4	16.2
4. Mill Green Youth Centre	B	22	23.8	20.9
5. McMillian Hse, Glengormley	K	34	37.7	34.3
6. Doagh Rd, Abbots Cross	K	25	27.7	25.1
7. Jordanstown Rd	K	12	12.7	11.6
8. Doagh Rd, Newtownabbey	K	20	21.4	19.5
10. Shore Rd, Newtownabbey	K	29	31.9	28.9

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

None of the diffusion tubes placed at background and kerbside locations exceeded the annual mean standard for nitrogen dioxide of 40 $\mu g/m^3$. Therefore it is expected that none of the locations will exceed the objective in 2005.

Further monitoring of nitrogen dioxide commenced in December 2001. A number of the monitoring locations are close to sensitive receptors in areas where traffic flows are higher. Data for the period December 2001 to February 2002 are presented in Table 3.1b. No correction for laboratory bias has been made. At least 6 months of monitoring is required before comparison can be made to the air quality standard. Some monthly averages during December 2001 and January 2002 were particularly high and above the annual average standard for NO_2. However, meteorology during this time lead to poor dispersion and similar high concentrations were found throughout northern England particularly in December.

Table 3.1b Monthly average NO_2 concentrations measured at locations in the Newtownabbey area (μg m^{-3}).

Site Ref	Site	December 2001	January 2002	February 2002
1	Main Street, Ballyclare	18	46	27
2	Burnthill Road	30	20	15
3	St Bernard School, Antrim Rd	32	47	29
4	Prince Charles Way	26	28	11
5	McMillan House, Antrim Rd	47	38	25
6	Greenacre, Glebe Rd	19	13	11
7	Valley Leisure Centre	23	36	13
8	74 Shore Road	47	N/A	17
9	Merville Garden Village	16	41	23
10	M5 Shore Rd	29	28	26
11	44 Sandyknowles Av	39	56	3
12	Tudor Park, Mallusk	16	6	15
13	Scullions Road, Mullusk	31	34	7
14	Bottom Main St, Ballyclare	46	21	8
15	North End. Ballyclare	30	15	12
16	Doagh village	29	22	10
17	The Longshot, Doagh	30	29	20
18	Main Street, Ballynure	24	25	19
19	A8/Doagh Rd	22	16	18
20	A8/Mororway at Sandyknowles	28	43	5
21	Ballyclare Rd/Manse Rd	24	30	9
22	Manse Rd/Doagh Rd	N/A	N/A	N/A
23	Opp 189 Doagh Rd	19	19	8
24	O'Neill Rd/Doagh Rd	20	17	14
25	Station Rd	17	47	8
26	690 Shore Rd	19	22	15
27	Opp 1A Jordanstown Rd	23	20	9
28	Jordanstown Rd	17	28	11
29	174 Monkstown Rd	24	23	8

3.4 IMPACT OF ROAD TRAFFIC ON CONCENTRATIONS OF OXIDES OF NITROGEN

The Stage one Review and Assessment for Newtownabbey Borough Council identified various roads as needing further study in a Stage two assessment. The concentrations at these kerbside locations were estimated using the Design Manual for Roads and Bridges (DMRB) using the traffic flow data provided by Newtownabbey 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. A background NOx concentration of 32.1 μg m^{-3} has been used (see Section 3.2). This is a conservative estimate.

Concentrations have been assessed at traffic speeds as follows: 32 kph at road junctions and 48 kph on free flowing roads in the urban areas. On motorways an average speed of 80 kph has been used. The distance from the receptor to the centre of the road and from the receptor to the kerb of the road are required by DMRB. These distances were estimated from maps provided by Newtownabbey Borough Council. For the majority of roads, the % of HDV on the roads was estimated by the NI Roads Service Division as 7.3%.

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 Newtownabbey Borough Council area. Following advice given in the GB Government Guidance LAQM TG4(00), the 99.8th percentile of hourly averages has been estimated as 3.5 times the annual mean for roadside locations. For 2005, annual average concentrations of nitrogen dioxide are predicted to be over 40 μg m^{-3} at 15 of the road links.

Table 3.2 Nitrogen dioxide concentrations at roadside locations in Newtownabbey Borough Council

Description of Link	Distance to nearest receptor from kerbside (m)	NO_2 Annual mean (μg m^{-3}) 2005	NO_2 99.8th percentile of hourly averages (μg m^{-3}) 2005
Shore Rd south of Jordanstown Rd	4.4	**45.0**	157.6
Mallusk Rd west of Scullions Rd	5.0	**47.0**	164.5
Doagh Rd at Kings Rd	10.0	**41.4**	145.0
Church Rd	21.3	37.3	130.5
Station Rd at Old Station Rd	8.8	37.8	132.4
Old Carrick Rd, east of Monkstown Rd	3.5	34.5	120.9
Antrim Rd, northwest of Sandyholme Park	6.9	35.6	124.5
Ballyclare Rd, south of Manse Rd, Glengormley	7.5	31.8	111.4
Upper Market Square	7.5	37.8	132.4
South of Sandyknowes	11.3	**47.9**	167.6
Station Rd, Shore Rd (M5) Shore Rd (Jordanstown)	16.3	32.6	114.2
Sandyknowes Junction (link to A8 (M) & Ballyhenry Rd)	23.8	38.8	135.9
Sandyknowes Junction (link to M2 & Antrim Rd)	38.8	32.2	112.6
Shore Rd/Jordanstown Rd Junction	17.5	**50.6**	177.3
O'Neill Rd/Doagh Rd Junction	20	**42.8**	149.8
M5 Junction (M5 & Shore Rd)	47.5	30.6	107.0
A8 Mossley Junction	8.5	**47.5**	166.3
Ballyclare Rd/Antrim Rd/Hightown Rd Junction	10	35.3	123.4

Description of Link	Distance to nearest receptor from kerbside (m)	NO_2 Annual mean ($\mu g\ m^{-3}$) 2005	NO_2 99.8th percentile of hourly averages ($\mu g\ m^{-3}$) 2005
A8 Ballyclare Rd Junction	11.2	29.1	101.8
Mallusk Rd/Bernice Rd Junction	3	**50.3**	176.0
Monkstown Rd/Doagh Rd Junction	5	**50.2**	175.8
Ballynure Rd/Templepatrick Rd Junction	9.5	**41.6**	145.6
Manse Rd/Prince Charles Way Junction	13.8	**40.6**	141.9
Ballyclare Rd/Ballyhenry Rd Junction	12	39.2	137.2
Hillhead Rd/Ballynure Rd Junction	14.5	30.5	106.8
Doagh Rd/Carnmoney Rd North Junction	21	28.8	100.7
Shore Rd/Longwood Rd Junction	6.25	**52.2**	182.6
Carmoney Rd North/Manse Rd Junction	30	28.2	98.8
Ballyrobert Rd/Templepatrick Rd Junction	100	21.9	76.6
The Longshot/Templepatrick Rd Junction	9.2	35.1	122.9
Monkstown Rd/Old Carrick Rd Junction	3	**41.1**	143.9
Templepatrick Rd/Mill Rd Junction	6.7	35.3	123.5
Ballynure Rd/B58 Junction	5	**41.1**	143.7
Prince Charles Way/Ashgrove Rd/Burnthill Rd Junction	17.5	30.6	107.1
Manse Rd/Doagh Rd Junction	4	30.6	107.1
Monkstown Rd/Jordanstown Rd Junction	37.5	29.4	102.7
Templepatrick Rd/Station Rd Junction	9.2	30.5	106.7
Hightown Rd/Mallusk Rd Junction	7.5	**51.3**	179.5
Doagh Rd/North End/Market Square Junction	13.8	36.7	128.5
Main St/Mill Rd/Mill Rd Junction	2.0	37.8	132.4
Hillhead Rd/Mill Road/Mill Road Junction	2.5	34.5	120.8
Doagh - Main St/Doagh Rd/Ballymena Rd/Burn Rd Junction	2.5	26.9	94.1

At road junctions, the distance from the kerb to the nearest receptor has been given as the closest receptor to any of the road links.
The concentrations predicted by DMRB are much higher than any of the annual average diffusion tube results (Table 3.1a). For example on Shore Road in Newtownabbey diffusion tube results provide an annual average of 32 $\mu g/m^3$ in 2001. Using figures in the GB Government Pollutant Specific Guidance this gives an annual average of 29 $\mu g/m^3$ in 2005. DMRB however predicts a concentration of 45 $\mu g/m^3$ along this road in 2005. This overprediction is probably due to a combination of the conservative nature of the DMRB model together with conservative assumptions with the input data.

3.5 CONCLUSIONS FOR NITROGEN DIOXIDE CONCENTRATIONS IN THE NEWTOWNABBEY BOROUGH COUNCIL AREA

Emissions arising from road transport at 15 road junctions in the Newtownabbey Borough Council area may cause an exceedence of the nitrogen dioxide objective. It is recommended that diffusion tube monitoring is continued at the identified receptors and then consideration be given to proceeding to a Stage 3 review and assessment.

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.

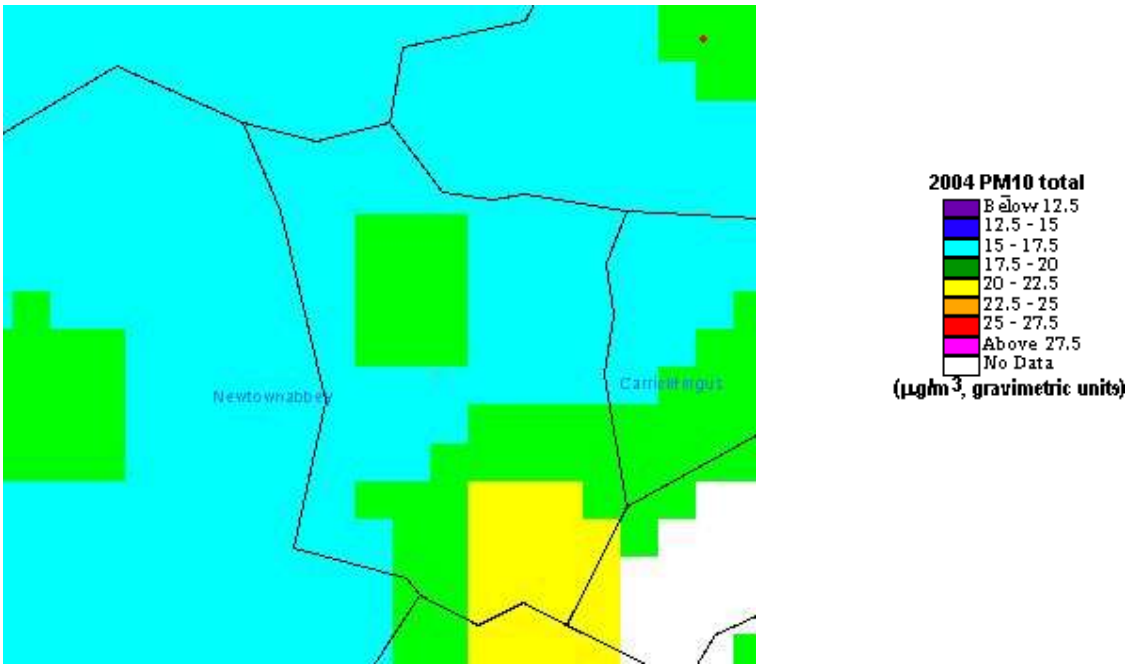
The Government established the Airborne Particles Expert Group (APEG) to advise on sources of PM_{10} in the UK and current and future ambient concentrations. Their conclusions were published in January 1999 (APEG, 1999)[5]. APEG concluded that a significant proportion of the current annual average PM_{10} 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~~4.2 BACKGROUND CONCENTRATIONS OF PM_{10}

Estimates of background concentrations of PM_{10} were obtained for the Newtownabbey 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. Figure 4.1 shows that the total estimated annual average background concentration for 2004 in the Newtownabbey Borough Council area was 22.5 μg/m^3 or lower.

Figure 4.1 Background total PM_{10} concentrations 2004 ($\mu g\ m^{-3}$)



4.3 MONITORING OF PM_{10}

There has been no monitoring of PM_{10} concentrations in the Newtownabbey Borough Council area. However, there has been monitoring of black smoke. The results are shown in Table 4.1 below.

Table 4.1: Average black smoke concentrations recorded in Newtownabbey borough (μg/m^3) during January to September 2001.

Site code	Black smoke
2412501 (Whiteabbey Hospital)	9.1
2412502 (Glengormley Health Centre)	9.9

4.4 IMPACT OF ROAD TRAFFIC ON PM_{10}

As recommended in TG4 (00) DMRB has been used to predict PM_{10} concentrations for 2004 from road traffic but the background concentrations given within the model have been ignored. The estimated maximum background concentration for 2004 of 22.5 μg m^{-3} for the Newtownabbey Borough Council area has then been added to provide total predicted PM_{10} concentrations. Estimated traffic flows for 2005 (as expected traffic flows in 2004 were not available) as supplied by Newtownabbey Borough Council were used in these calculations.

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 28 μg m^{-3}, gravimetric.

Table 4.2 shows the 2004 predictions that may be compared against the objectives. For 2004, the method predicts annual average concentrations of PM_{10} less than 28 μg m^{-3} at all of the locations modelled.

Table 4.2. Predicted PM_{10} concentrations at roadside locations in the Newtownabbey Borough Council region.

Description of Link	PM_{10} Annual mean (μg m^{-3}) 2004
Shore Rd south of Jordanstown Rd	23.36
Mallusk Rd west of Scullions Rd	22.90
Doagh Rd at Kings Rd	23.14
Church Rd	22.13
Station Rd at Old Station Rd	21.66
Longwood Rd hse at corner of 2 rds	26.89
Old Carrick Rd, east of Monkstown Rd	22.14
Newtownabbey Rd, northwest of Sandyholme Park	22.06
Ballyclare Rd, south of Manse Rd, Glengormley	21.33
Upper Market Square	22.28
South of Sandyknowes	22.45
Station Rd, Shore Rd (M5) Shore Rd (Jordanstown)	21.67
Sandyknowes Junction (link to A8 (M) & Ballyhenry Rd)	22.56
Sandyknowes Junction (link to M2 & Newtownabbey Rd)	21.41
Shore Rd/Jordanstown Rd Junction	24.22
O'Neill Rd/Doagh Rd Junction	23.15
M5 Junction (M5 & Shore Rd)	21.33
A8 Mossley Junction	24.38
Bally clare Rd/Newtownabbey Rd/Hightown Rd	22.03

Junction	
A8 Ballyclare Rd Junction	21.18
Mallusk Rd/Bernice Rd Junction	24.98
Monkstown Rd/Doagh Rd Junction	24.21
Ballynure Rd/Templepatrick Rd Junction	23.17
Manse Rd/Prince Charles Way Junction	22.59
Ballyclare Rd/Ballyhenry Rd Junction	22.48
Hillhead Rd/Ballynure Rd Junction	21.37
Doagh Rd/Carnmoney Rd North Junction	21.14
Shore Rd/Longwood Rd Junction	25.40
Carmoney Rd North/Manse Rd Junction	21.07
Ballyrobert Rd/Templepatrick Rd Junction	22.62
The Longshot/Templepatrick Rd Junction	21.82
Monkstown Rd/Old Carrick Rd Junction	23.52
Templepatrick Rd/Mill Rd Junction	21.31
Ballynure Rd/B58 Junction	23.07
Prince Charles Way/Ashgrove Rd/Burnthill Rd Junction	21.38
Manse Rd/Doagh Rd Junction	21.40
Monkstown Rd/Jordanstown Rd Junction	21.22
Templepatrick Rd/Station Rd Junction	23.71
Hightown Rd/Mallusk Rd Junction	24.69
Doagh Rd/North End/Market Square Junction	22.07
Main St/Mill Rd/Mill Rd Junction	22.46
Hillhead Rd/Mill Road/Mill Road Junction	22.13
Doagh - Main St/Doagh Rd/Ballymena Rd/Burn Rd Junction	20.89

4.5 IMPACT OF PART A PROCESSES IN THE NEWTOWNABBEY BOROUGH COUNCIL AREA.

There are two Part A processes in the surrounding boroughs identified in the Stage one Review and Assessment that might have the potential to impact on PM_{10} concentrations in the Newtownabbey Borough Council area. These are the AES Kilroot Power station in Carrickfergus and the DoE waste sludge incinerator in Belfast City Council.

4.5.1 AES Kilroot Power station

Kilroot Power station is a oil fired power station situated in Carrickfergus.

Table 4.3. Specifications of combustion processes at Kilroot Power station

	Kilroot Power Station
Temperature of emissions (^{0}C)	120
Stack height (m)	200
Stack diameter (m)	8
PM_{10} tonnes per annum	226

The height of the tallest building within 5 stack heights is 57 metres. The nomogram provided in Figure 8.5 in the PSG provides the annual PM_{10} emission which will give rise to a 90th percentile of the 24 hour ground level concentration of 1 $\mu g/m^3$. Using this nomogram, the permitted PM_{10} emission rate with an industry of the above dimensions is 1,800 tonnes per annum. This is well above the actual emission of 226 tonnes per annum and therefore there is no need to proceed to a Stage 3 Review and Assessment for this source.

4.5.2 Belfast sewage sludge incinerator

Table 4.4 Specifications of combustion processes at the Belfast sewage sludge incinerator.

	Sewage sludge incinerator
Temperature of emissions (^{0}C)	120
Stack height (m)	70
Stack diameter (m)	0.9
PM_{10} tonnes per annum	< 0.1

The nomogram provided in Figure 8.5 in the PSG provides the annual PM_{10} emission which will give rise to a 90th percentile of the 24 hour ground level concentration of 1 $\mu g/m^3$. Using this nomogram, the permitted PM_{10} emission rate with an industry of the above dimensions is 23 tonnes per annum. This is well above the actual emission of < 0.1 tonnes per annum and therefore there is no need to proceed to a Stage 3 Review and Assessment for this source.

4.6 IMPACT OF PART B PROCESSES IN THE NEWTOWNABBEY BOROUGH COUNCIL AREA.

4.6.1 James Boyd & sons

James Boyd & Sons is a quarry which extracts 500,000 tonnes of stone (basalt) a year which is then processed to aggregate.

The majority of dust emissions from quarrying tend to be within the larger particle size fractions, and correspondingly fall out from the atmosphere rapidly with increasing distance from the source. The nearest property to the James Boyd & Sons quarry is approximately 34 metres. Where properties lie closer than 200 metres to the source, the GB Pollutant Specific Guidance suggests that authorities investigate whether any dust nuisance complaints have been received. No such complaints have ever been received from activities arising at the quarry. The absence of complaints is however not conclusive evidence that the objective will not be exceeded. It is therefore recommended that a visual inspection is made by an environmental health officer and that they use their own professional judgement so decide whether they think it is necessary to proceed to a stage 3 review and assessment for this source.

4.6.2 Home fuels

Home Fuels Ltd stockpiles coal. The IPC authorisation states that it is their policy not to store more than 25 tonnes of loose slack at any time. There is the potential for dust emissions within the PM_{10} size fraction to arise from material stockyards. The nearest property to Home Fuels Ltd is 106 metres. Where properties lie closer than 200 metres to the source, GB Pollutant Specific Guidance suggests that authorities investigate whether any dust nuisance complaints have been received. No such complaints have ever been received from activities arising at the stockyard. The absence of complaints is however not conclusive evidence that the objective will not be exceeded. It is therefore recommended that a visual inspection is made by an environmental health officer and that they use their own professional judgement so decide whether they think it is necessary to proceed to a stage 3 review and assessment for this source.

4.7 CONCLUSIONS FOR PM_{10} CONCENTRATIONS IN THE NEWTOWNABBEY BOROUGH COUNCIL AREA

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

5 Review and assessment of sulphur dioxide

5.1 INTRODUCTION

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

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

5.1.1 Standards and objectives for sulphur dioxide

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

- 266 $\mu g\ m^{-3}$ 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 $\mu g\ m^{-3}$ 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 $\mu g\ m^{-3}$ as a 24 hour mean (maximum of 3 exceedences a year or equivalent to the 99th percentile) to be achieved by the 31st December 2004

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

5.1.2 The national perspective

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

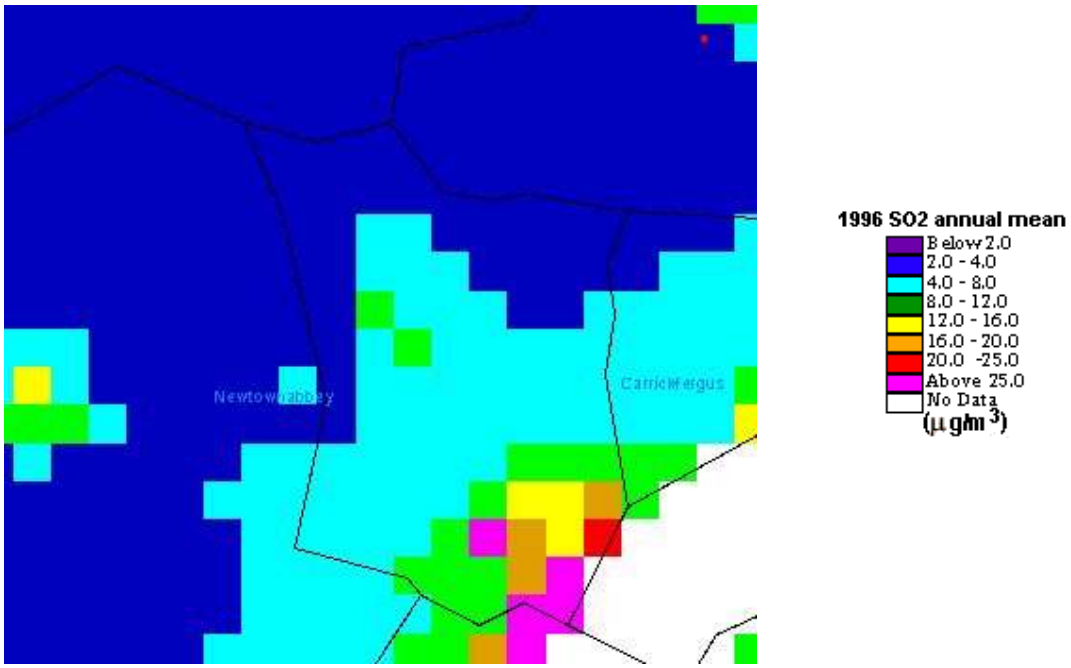
Exceedences of the 15-minute air quality standard currently occur near industrial processes for which the stack heights were designed to meet previous air quality standards and downwind of large combustion plant such as power stations. Exceedences are also possible in areas where significant quantities of coal are used for space heating. These large combustion plant are currently regulated under BATNEEC and the EPA 1990, and will come under the provisions of the IPPC. The

government considers that bearing in mind the envisaged change in fuel use, it does not expect exceedences of the 15-minute objective by 2005 from these sources. Sulphur dioxide concentrations are elevated at the kerbside but not sufficiently to exceed the air quality standard in the absence of other sources.

5.2 BACKGROUND CONCENTRATIONS OF SULPHUR DIOXIDE

Estimates of background concentrations were obtained for the Newtownabbey 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. Figure 5.1 shows the most recent estimates available, for 1996. The maximum estimated annual average background concentration for 1996 in the Newtownabbey Borough Council area was 59.8 μg m^{-3} and the average was 8.7 μg m^{-3}. Guidance TG4(00) assumes that the annual mean at the end of 2004 and 2005 will be half the 1996 annual mean. However, in Northern Ireland due to the high density of domestic coal burning, a figure of 0.75 times the 1996 mean has been used. Thus the maximum estimated annual mean background concentration in the Newtownabbey Borough Council area in 2004 will be 44.9 μg m^{-3} and the average will be 6.5 μg m^{-3}.

Figure 5.1 Background SO_2 concentrations 1996



5.3 CONCLUSIONS FOR SULPHUR DIOXIDE CONCENTRATIONS IN THE NEWTOWNABBEY BOROUGH COUNCIL AREA

There were no predicted exceedences of the Strategy objectives in the Newtownabbey Borough Council region due to industrial sources. There is no need to proceed to a Stage 3 Review and Assessment for this pollutant from industrial sources.

6 Conclusions and recommendations for each pollutant

6.1 NITROGEN DIOXIDE

Emissions arising from road transport at 14 road junctions in the Newtownabbey Borough Council area may cause an exceedence of the nitrogen dioxide objective. It is recommended that diffusion tube monitoring is continued at the identified receptors and then consideration be given to proceeding to a Stage 3 review and assessment.

6.2 PARTICULATE MATTER (PM_{10})

Emissions from traffic and the two Part A processes in surrounding boroughs and the two Part B processes in Newtownabbey Borough Council are not predicted to lead to an exceedence of the PM_{10} objectives in 2004.

6.3 SULPHUR DIOXIDE

It is concluded that the Strategy objectives for sulphur dioxide are likely to be achieved due to emissions from industrial sources. There is no need to progress to a more detailed Stage 3 review and assessment for this pollutant due to industrial emissions. No account has been made of domestic emission sources in this assessment

7 References

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Appendices

CONTENTS

Appendix 1
Diffusion tube monitoring data

CONTENTS

Newtownabbey Borough council
Nitrogen Dioxide diffusion tube data (ug/m3)

Bias = -9.8% in 2001

Site No.	Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Average	Average(after bias)
1	36	36	31	23	40	25	32	na	31	40	33	36
2	25	21	23	17	na	na	10	na	na	17	19	21
3	29	21	17	11	23	na	10	10	8	23	17	18
4	34	27	27	13	na	19	15	15	15	29	22	24
5	57	31	38	36	42	19	34	15	34	36	34	38
6	44	40	13	8	44	17	19	15	25	27	25	28
7	na	6	na	na	na	na	na	na	na	17	12	13
8	34	21	15	13	25	15	na	23	15	13	20	21
10	42	29	23	27	42	21	25	23	27	32	29	32

Sulphur dioxide data (ug/m3)

site code		Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Average
2412501		17	13	16	13	15	10	12	11	13	13.3
2412502		19	13	17	14	16	14	14	14	13	14.9

Black smoke data (ug/m3)

site code		Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Average
2412501		15	24	11	5	9	3	6	4	5	9.1
2412502		21	21	15	5	10	4	4	4	5	9.9

Appendix 2
Detailed traffic flow data

Newtownabbey Road data		
Description of Link	**annual average vehicle flow (AADT)**	
Shore Rd	37,876	south of Jordanstown Rd
Mallusk Rd	24,547	west of Scullions Rd
Doagh Rd	24,477	at Kings Rd
Church Rd	23,083	
Station Rd	19,182	at Old Station Rd
Longwood Rd	18,131	hse at corner of 2 rds
Shore Rd	37,876	hse at corner of 2 rds
Old Carrick Rd	15,246	Old Carrick Rd, east of Monkstown Rd
Antrim Rd	14,706	Antrim Rd, northwest of Sandyholme Park
Ballyclare Rd	14,228	Ballyclare Rd, south of Manse Rd, Glengormley
Upper Market Square	25,005	Upper Market Square
South of Sandyknowes Dual/Motorway	71,536	South of Sandyknowes
Station Rd Junction	11,944	Station Rd, Shore Rd (M5) Shore Rd (Jordanstown)
Shore Rd	26,972	
Sandyknowes Junction	3,787	Link to rdbt
Sandyknowes Junction	18,604	Link to A8(m)
Sandyknowes Junction	6,929	Link to Ballyhenry Rd
Sandyknowes Junction	32,775	Link to M2
Sandyknowes Junction	3,278	Link to M2 sliprd
Sandyknowes Junction	32,775	Link to M2
Sandyknowes Junction	14,706	Link to Antrim Rd
Sandyknowes Junction	3,787	Link to Rdbt
Shore Rd/Jordanstown Rd Junction	37,876	Link to Shore Rd
Shore Rd/Jordanstown Rd Junction	10,393	Link to Jordanstown Rd
O'Neill Rd/Doagh Rd Junction	24,477	Link to Doagh Rd
O'Neill Rd/Doagh Rd Junction	16,486	Link to O'Neill Rd
M5 Junction	43,317	Link to M5
M5 Junction	25,000	Link to Shore Rd
A8 Mossley Junction	34,362	Doagh Rd, A8
Bally clare Rd/Antrim Rd/Hightown Rd Junction	6,787	Link to Hightown Rd
Bally clare Rd/Antrim Rd/Hightown Rd Junction	10,891	Link to Ballyclare rd
Bally clare Rd/Antrim Rd/Hightown Rd Junction	11,256	Link to Antrim Rd
A8 Ballyclare Rd Junction	7,048	Link to Ballyclare rd
A8 Ballyclare Rd Junction	18,185	Link to A8
Mallusk Rd/Bernice Rd Junction	24,547	Link to Mallusk Rd
Mallusk Rd/Bernice Rd Junction	11,000	Link to Bernice Rd
Monkstown Rd/Doagh Rd Junc	10,000	Link to Monkstown Rd

Monkstown Rd/Doagh Rd Junc	24,477	Link to Doagh Rd
Monkstown Rd/Doagh Rd Junc	3,000	Link to link Rd
Ballynure Rd/Templepatrick Rd Junction	14,220	Link to Ballynure Rd,
Ballynure Rd/Templepatrick Rd Junction	9,322	Link to Templepatrick Rd
Manse Rd/Prince Charles Way Junction	10,875	Link to Manse Rd,
Manse Rd/Prince Charles Way Junction	11,521	Link to Prince Charles Way
Ballyclare Rd/Ballyhenry Rd Junction	14,228	Link to Ballyclare Rd,
Ballyclare Rd/Ballyhenry Rd Junction	6,929	Link to Ballyhenry Rd
Hillhead Rd/Ballynure Rd Junction	7,709	Link to Hillhead Rd,
Hillhead Rd/Ballynure Rd Junction	11,892	Ballynure Rd
Doagh Rd/Carnmoney Rd North Junction	13,406	Link to Doagh Rd (Earlford Hts)
Doagh Rd/Carnmoney Rd North Junction	5,780	Link to Carnmoney Rd North
Shore Rd/Longwood Rd Junction	25,000	Link to Shore Rd
Shore Rd/Longwood Rd Junction	18,131	Link to Longwood Rd
Carmoney Rd North/Manse Rd Junction	5,780	Link to Carmoney Rd North
Carmoney Rd North/Manse Rd Junction	10,875	Link to Manse Rd
Ballyrobert Rd	7,048	Link to Ballyrobert Rd
/Templepatrick Rd	9,322	
The Longshot/Templepatrick Rd Junction	6,635	Link to The Longshot
The Longshot/Templepatrick Rd Junction	9,322	Templepatrick Rd
Monkstown Rd/Old Carrick Rd Junction	10,000	Link to Monkstown Rd
Monkstown Rd/Old Carrick Rd Junction	15,246	Link to Old Carrick Rd
Templepatrick Rd/Mill Rd Junction	9,322	Link to Templepatrick Rd
Templepatrick Rd/Mill Rd Junction	5,189	Link to Mill Rd
Ballynure Rd/B58 Junction	14,220	Link to Ballynure Rd
Ballynure Rd/B58 Junction	8,000	Link to B58
Prince Charles Way/Ashgrove Rd/Burnthill Rd Junction	11,521	Link to Prince Charles Way,
Prince Charles Way/Ashgrove Rd/Burnthill Rd Junction	5,000	Link to Ashgrove RD
Prince Charles Way/Ashgrove Rd/Burnthill Rd Junction	5,000	Link to Burnthill Rd
Manse Rd/Doagh Rd Junction	10,000	Link to Doagh Rd
Monkstown Rd/Jordanstown Rd Junction	20,393	Link to Monkstown Rd
Templepatrick Rd	9,322	Templepatrick Rd, Station Rd
Hightown Rd/Mallusk Rd Junction	8,867	Link to Hightown Rd
Hightown Rd/Mallusk Rd Junction	5,000	Link to Mallusk Rd
Hightown Rd/Mallusk Rd Junction	38,761	Link to M2
Doagh Rd/North End/Market Square Junction	18,587	Link to Doagh Rd
Main St/Mill Rd/Mill Rd Junction	9,184	Link to Main St
Main St/Mill Rd/Mill Rd Junction	9,184	Link to Mill St
Hillhead Rd/Mill Road/Mill Road Junction	15,146	Hillhead Rd, Mill Road (Templepatrick), Mill Road (Main St)
Doagh - Main St/Doagh Rd/Ballymena Rd/Burn Rd Junction	5,857	Doagh - Main St, Doagh Rd, Ballymena Rd, Burn Rd