DRAFT UPDATING AND SCREENING ASSESSMENT REPORT ON AIR QUALITY IN THE CARLISLE CITY COUNCIL AREA

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UPDATING AND SCREENING ASSESSMENT REPORT ON AIR QUALITY IN THE CARLISLE CITY COUNCIL AREA

1.0 INTRODUCTION

1.1 Aims and Objective

This is an updating and screening assessment report on local air quality for the Carlisle City Council area, and forms the first stage of the second round of review and assessment.

The purpose of this updating and screening assessment is to identify those matters that have changed since the first round of Review and Assessment, completed by this Authority in March 2000, which might lead to a risk of an air quality objective being exceeded. The updating and screening assessment will cover:

- A review of the first round of air quality review and assessment for each pollutant
- New monitoring data
- New air quality objectives
- New sources or significant changes to existing sources
- Other local changes which may affect air quality

If there is a risk that these changes may be significant, then a simple screening assessment will be carried out based on available monitoring data and/or screening models.

Where on completion of the updating and screening assessment, a risk is identified that an air quality objective may be exceeded at a location relevant to public exposure, the authority will be required to go on to the second stage of review and assessment and undertake a detailed assessment.

It is important to emphasise that likely exceedences of the objectives will be considered only in relation to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. The following approach is recommended: -

- For objectives with short averaging times (SO_2 and hourly NO_2) reviews and assessments should be focused on any non-occupational, near ground level outdoor location given that exposures over such short averaging times are potentially likely.
- For objectives with longer averaging times (benzene, carbon monoxide, PM_{10} and the annual objective for NO_2) reviews and assessments should be focused on the following near ground level outdoor non-occupational locations: background locations, roadside locations and other areas of elevated pollutants concentrations where a person might reasonably be exposed (e.g. in the vicinity of housing, schools or hospitals, etc) over the relevant averaging time of the objective.

1.2 Legislative Background

The Air Quality Strategy establishes the framework for air quality improvements. Measures agreed at the national and international level are the foundations on which the strategy is

based. It is however recognised that despite these measures, poor air quality will remain, and that these will be best dealt with using local measures.

The Environment Act 1995 lays the foundation for a nationwide system of local air quality management. It requires local authorities to periodically review and assess the current and future quality of air for their geographical areas against national pollution objectives laid down in the air quality regulations. Where assessed levels are likely to exceed these objectives an Air Quality Management Area (AQMA) must be declared and an action plan published.

The first round of review and assessment which was a 3 stage process, was completed by this Authority in 2000 and a brief summary is given in section 1.5.

1.3 The Air Quality Standards and Objectives

The air quality objectives are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS). The standards are set on the basis of medical and scientific evidence on how each pollutant effects human health. The standards and objectives are subject to regular review to take account of the latest information on the health effects of air pollution. Since the last round of review and assessment new regulations, the Air Quality (England) (Amendment) Regulations 2002 have come into force. These amend the Air Quality (England) Regulations 2000 and set the air quality objectives for England as follows: -

Table 1: Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002[a] for the purpose of Local Air Quality Management

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene			
All authorities	16.25 μg/m^3	Running annual mean	31.12.2003
Authorities in England and Wales only	5.00 μg/m^3	Annual mean	31.12.2010
1,3 Butadiene	2.25 μg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Maximum daily 8-hour mean	31.12.2003
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3 not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	40 μg/m^3	annual mean	31.12.2005

Particles (PM_{10}) (gravimetric)[d] All authorities	50 μg/m³ not to be exceeded more than 35 times a year 40 μg/m³	24 hour mean annual mean	31.12.2004 31.12.2004
Sulphur Dioxide	350 μg/m³ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 μg/m³ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 μg/m³ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

Commentary

The following changes are made as a result of the Air Quality (Amendment) Regulations 2002:-

1. A second air quality objective is created for Benzene, with an air quality objective level of 5μg/m³ or less, when expressed as an annual mean, and an air quality objective date of 31.12.10.

2. The level of the air quality objective for Carbon Monoxide is lowered to 10mg/m³ or less, expressed as a maximum daily running 8 hour mean.

1.4 Local Air Quality Management - Policy Guidance LAQM.PG(03) and Technical Guidance LAQM.TG(03)

Local Authorities are required to take account of the revised Local Air Quality Management Policy Guidance (LAQM.PG(03)) and Technical Guidance (LAQM.TG (03)) when carrying out their duties under part IV of the Environment Act 1995. The Guidance introduces a new two phased approach to reviews and assessment; the first stage is an updating and screening assessment, the second stage is a detailed assessment.

The first screening assessment deadline is the end of May 2003, and requires all local authorities to carry out an audit of air quality to establish whether assumptions in the first round remain valid.

Where screening assessments reveal that an authority might breach air quality objectives, the authority has a further year to carry out a detailed assessment. A series of yearly progress reports are required for those local authorities not involved in detailed assessments. The timetable for submission of reviews and assessments is shown below.

Table 2: Recommended timescales for submission of reviews and assessments and progress reports		
LAQM activity	**Completion Date**	**Which Authorities?**
Updating & Screening Assessment	End of May 2003	All authorities[a]
Detailed Assessment	End of April 2004	Those authorities[a] which have identified the need for a detailed assessment in their May 2003 updating and screening assessment
Progress Report	End of April 2004	Those authorities[a] which have identified no need for a detailed assessment in their May 2003 updating and screening assessment
Progress Report	End of April 2005	All authorities
Updating and screening equipment	End of April 2006	All authorities
Detailed assessment	End of April 2007	Those authorities which have identified the need for a detailed assessment in their April 2006 updating and screening assessment
Progress report	End of April 2007	Those authorities which have identified **no need** for a detailed assessment in their April 2006 updating and screening assessment
Progress report	End of April 2008	All authorities
Updating and screening assessment	End of April 2009	All authorities
Detailed assessment	End of April 2010	Those authorities which have identified the need for a detailed assessment in their April 2009 updating and screening assessment
Progress report	End of April 2010	Those authorities which have identified **no need** for a detailed assessment in their April 2009 updating and screening assessment
a)	All local authorities except those in Northern Ireland and London local authorities that have designated AQMAs. London local authorities that have designated AQMAs will be expected to submit a Updating and Screening Assessment by the end of 2003 or earlier if possible, and to complete Detailed Assessments (where required by the end of 2004.	

1.5 Summary of First Round of Review and Assessment

Carlisle City Council completed all three stages during round one of the review and assessment process. The final third stage report was produced in March 2000. At Stage 1 levels of Benzene, 1,3 butadiene, Carbon Monoxide, Lead and Sulphur Dioxide were all expected to meet the Air Quality objectives laid down in the Air Quality Regulations 2000, and no further assessment was undertaken. Levels of Nitrogen Dioxide and fine particulates from road traffic sources were assessed during stage one and two to be at risk of exceeding the objectives in the Air Quality Regulations.

A further Stage 3 detailed assessment was undertaken of these latter two pollutants. It concluded that the annual objective limit for Nitrogen Dioxide was exceeded at some inner city road side sites. However projections for 2005 indicated that all of these sites were expected to fall under the objective limit; other urban and suburban sites were already under the maximum objective levels. The hourly levels were less than half the objective and were not predicted to exceed the 2005 objective. It was therefore considered that there was no significant risk of either the annual or hourly Nitrogen Dioxide objective being exceeded by December 2005.

The annual mean for particulates at roadside monitoring locations was substantially below the 2004 objective. The 24-hourly mean also fell significantly beneath its objective. It was therefore considered that there was no significant risk of either the annual or 24 hourly fine particulate objective being breached by December 2004.

As a result of the 2½-year review and assessment of local air quality it was not considered necessary to declare an air quality management area within the Carlisle City Council area.

2.0 CONSULTATION

Schedule 11 of the Environment Act 1995 requires local authorities to consult externally as part of their review and assessment exercises. This is to gather external information on pollution matters and publicise the exercise to non-governmental organisations that may wish to contribute. The following bodies have been contacted: -

- Eden District Council
- Copeland Borough Council
- Allerdale Borough Council
- Tynedale District Council
- Dumfries and Galloway District Council
- Environment Agency (Penrith Office)
- Scottish Environmental Protection Agency
- Carlisle Business Forum
- Carlisle Association of Parish Councils

3.0 REVIEW AND ASSESSMENT OF CARBON MONOXIDE

3.1 Introduction

Carbon Monoxide (CO) is a toxic gas which is emitted into the atmosphere as a result of incomplete combustion of carbon fuels. Exposure to CO results in the formation of carboxyhaemoglobin in the blood. This reduces the bloods capacity to carry oxygen. Moderate exposure (around 10%) causes headaches and dizziness, with high levels leading to unconsciousness and death.

3.2 Standard And Objectives For Carbon Monoxide

A new objective has been set at a slightly tighter level of 10mg/m^3 (previously 11.6mg/m^3) as a maximum daily 8 hour mean concentration, to be achieved by the end of 2003.

The focus of the authority's review and assessment for CO should be on occupational, near ground level outdoor locations; background locations; roadside locations and other areas of elevated CO concentrations where a person might reasonably be expected to be exposed over an 8 hour period.

3.3 What Factors Might Lead To Risk Of Exceeding The Objective? – The National Perspective

The main source of carbon monoxide in the UK is road transport, which accounted for 67% of total releases in 2000. Annual emissions of carbon monoxide have been falling steadily since the 1970's and are expected to continue to do so. Current projections indicate that road transport emissions will decline by a further 42% between 2000 and 2005.

Studies at a national level, based on both measured and modelling data, suggest that there is little likelihood of the new objective for carbon monoxide being exceeded by 2003.

There have been no AQMA's declared in the UK as a result of the first round of review and assessment in respect of the 2003 previous air quality objective (11.6 mg/m^3) for carbon monoxide which supports the studies carried out at a national level.

Guidance suggests that if exceedences are possible then they will be close to very busy roads or junctions.

3.4 Updating And Screening Assessment For Carbon Monoxide In The Carlisle City Council Area

The following sources, locations and data will be considered as part of the updating and screening assessment for Carbon Monoxide.

a) Review of first round of review and assessment for Carbon Monoxide
b) New monitoring data
c) Identification of very 'busy roads' and junctions likely to give rise to exceedences

3.4.1 Review Of First Round Of Review And Assessment For Carbon Monoxide

There were no significant industrial sources of Carbon Monoxide identified within the authorities area or in neighbouring authorities during the last round of review and assessment.

No monitoring was undertaken within the authority for Carbon Monoxide because it was not assessed to be a pollutant at risk of breaching the national objective. Annual mean CO levels in Carlisle based on national data, were estimated to be between 0.232 - 0.464 mg/m^3 with a maximum 8 hour mean of 2.32 – 4.64 mg/m^3.

It was concluded that there was no risk of the objective being exceeded and therefore unnecessary to undertake a Stage 2 assessment for Carbon Monoxide.

3.4.2 New Monitoring Data

Local Data

Monitoring of carbon monoxide has not been undertaken by the authority for the same reason as above.

UK National Network Sites

A summary of measured maximum 8 hour mean carbon monoxide concentrations at UK national network sites is shown in Appendix (1) for the period 1999-2001. There were no measured exceedences of the objective at any site during this period. In general, concentrations at kerbside and roadside sites were higher than at urban background or urban centre sites.

3.4.3 Identification Of 'Very Busy' Roads And Junctions

Guidance suggests that Authorities need only undertake a screening assessment for road traffic sources in respect to the 2003 objective where the daily average (AADT) flows exceed;

- 80,000 vehicles per day in single carriageway
- 120,000 vehicles per day on dual carriageway
- 140,000 vehicles on motorways

Data supplied by the Highways Agency indicates that there are no roadways or junctions in the Carlisle City Council area which approach these daily traffic flows.

3.5 Conclusion

This updating and screening assessment has considered the government guidance for Carbon Monoxide.

Carbon monoxide concentrations within the authorities area are not thought to be problematic. Whilst monitoring at a local level is not undertaken, monitoring at national level show that there are no exceedences of the 2003 objective at any location.

Traffic data indicates that traffic counts on the busiest roads in the local area are well below the threshold considered to cause a risk of exceeding the 2003 objective. The assessment of the councils area has indicated that the risk of the Carbon Monoxide air quality objective being exceeded by the end of 2003, in locations where there might be exposure, is negligible.

Therefore Carlisle City Council need not undertake a detailed assessment of Carbon Monoxide.

4.0 REVIEW AND ASSESSMENT FOR BENZENE

4.1 Introduction

Benzene is a recognised genotoxic human carcinogen.

4.2 Standards And Objectives For Benzene

The Government has adopted a running annual mean concentration of 16.25μg/m^3 as the air quality standard to be achieved by the end of 2003.

In addition a new tighter objective has also been set for a fixed annual mean of 5μg/m^3 to be achieved by the end of 2010. This addresses health advice from EPAQ's and the Department of Health to reduce concentrations of benzene in air to as low a level as possible.

The focus of this authorities review and assessment for benzene will be non occupational near ground level outdoor locations with elevated benzene concentrations in areas where a person might reasonably be expected to be exposed over a year e.g. in the vicinity of housing, schools or hospitals.

4.3 What Factors Might Lead To A Risk Of Exceeding The Objectives? – The National Perspective

The main atmospheric sources of benzene in the UK are petrol engined vehicles, petrol refining and the distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems.

There are a number of policy measures already in place, or planned for future years, which will continue to reduce emissions of benzene. For example since January 2000 EU legislation has reduced the maximum benzene content of petrol to 1% from a previous limit of 5%. The European Auto-Oil Programme will further reduce emission limits for cars and light duty and heavy duty vehicles sold from 2001 and 2006. Emissions from petrol vapour are being reduced by existing legislation which controls emissions during storage and distribution of petrol.

Forecasts suggest that the policy measures currently in place will be sufficient to achieve the 2003 objective at all urban background and roadside/kerbside locations. There is consequently no requirement in the technical guidance for authorities to consider road traffic emissions in their review and assessments in respect of the 2003 air quality objective. The guidance does however suggest that those authorities with relevant locations in the vicinity of major industrial processes which store, handle or emit benzene may need to progress beyond the updating and screening assessment for the 2003 objective.

In the UK no AQMA's were declared as a result of the last round of reviews and assessments in respect of the 2003 air quality objective which supports the studies

carried out at a national level.

Whilst the new 2010 objectives are expected to be met at all urban background, and most roadside locations, assessments carried out by DEFRA indicate that there is the possibility for some remaining exceedences of the 2010 objective which will require additional measures at local level.

Data collected during the first round of reviews and assessments has indicated that there are current exceedences of the 2010 objective at locations in close vicinity to industrial sites (petrochemical processes), and in close proximity to 'very busy' roads. Studies carried out in the vicinity of a major refinery have also measured current exceedences of the objectives, but not in an area of relevant exposure.

In addition since the last round of review and assessment the potential impact of emissions from petrol stations has also been investigated by DEFRA. The study concluded that the presence of a petrol station without Stage 2 vapour recovery may have a significant influence on the concentrations of benzene close to residential properties where:-

- The petrol throughput is more than 2000m^3/annum
- The petrol distribution pumps are within 10m from residential properties

Guidance suggests that where petrol stations fall into the above categories and are adjacent to a 'busy road', they may be a risk of the 2010 objective being exceeded.

4.4 Updating and Screening Assessment for Benzene in the Carlisle City Council Area

The following data, locations and sources will be considered for the updating and screening assessment for benzene

1. Summary of first round review and assessment for benzene
2. New monitoring data
3. Very busy roads or junctions in built up areas
4. Industrial sources with the potential to emit significant quantities of benzene
5. Petrol stations with annual throughputs of more than 2000m^3 of petrol and with a busy road (30,000 vehicles per day) nearby
6. Major fuel storage depots

4.4.1 Summary Of First Round Review And Assessment Of Benzene

No significant industrial sources of benzene were identified during the last round of assessment either within the authority boundaries or in neighbouring authorities. The main source of benzene emissions was considered to be road traffic.

Monitoring of Benzene using diffusion tubes took place over consecutive months from January 1997 to April 1998 at the following 5 roadside and 1 urban centre sites:

- 2 arterial roads (Wigton Road & Scotland Road)
- 3 inner city roads (Shaddongate; Hardwicke Circus & Botchergate)
- Tourist Information Office (urban centre site)

The monthly data showed the presence of benzene across the urban area with levels elevated during the winter months. The annual mean (equivalent to the running annual mean) for 1997 for most sites fell into the 3.25μgm^{-3} to 6.5μgm^{-3} band well below the 2003 objective. It was estimated that the 2003 annual mean for benzene would be approximately 6.5μgm^{-3} well below the objective level and was not considered for a stage 2 review and assessment.

4.4.2 New Monitoring Data

National Monitoring Data

The results of measured benzene concentrations at UK national network sites is shown in Appendix (2) for the period 1999 to 2001. These show that the measured concentrations at all urban background and roadside sites were significantly below the 2003 running annual mean objective of 16.25 $\mu g/m^3$. In more recent years (2001) the concentrations measured at urban background locations were also below the tighter 2010 objectives.

Local Monitoring Data

It was decided to resume monitoring at the same sites used during the first round of review and assessment for a 6 month period August 2002 to Feb 2003.

The diffusion tubes used are manufactured and analysed by Casella CREAir which is accredited to UKAS. An outline of Casella CREAir's quality assurance/control systems are shown in Appendix (2).

The roadside monitoring sites were chosen as appropriate due to their proximity to the busiest roads within the urban area. The site locations are shown on a map in Appendix (3).

Ideally monitoring should be carried out for a period of 1 year and cover at least three summer months and three winter months. Where monitoring is short term guidance suggests comparisons with data from long term monitoring sites located within a 50 mile radius can be used to obtain annual running annual mean objectives. Unfortunately there are no suitable long term sites nearby to make a reliable comparison. However the results shown in the table below are sufficient to demonstrate that the risk of exceedence of the objective is negligible.

Table 3: 6 Monthly Mean and Estimated 2003 and 2010 Annual Means of Benzene ($\mu g/m^3$)

Monitoring Location	Site Type	(a) Current 2002 6 monthly mean	(b) Estimated 2003 annual mean concentration	(c) Estimated 2010 annual mean concentration
Wigton Road	Roadside	1.45	1.356	1.00
Scotland Road	Roadside	2.28	2.132	1.585
Hardwicke Circus	Roadside	2.35	2.197	1.633
Botchergate	Roadside	1.83	1.711	1.272

Tourist Information Centre	Urban centre	1.28	-	-
Shaddongate	Roadside	1.67	1.561	1.161

At sites which are roadside locations, the results in column (a) can be adjusted to provide the estimated annual average benzene concentrations in the relevant objective years 2003 and 2010 using correction factors (0.935) and (0.695) respectively (provided in the guidance). These take account of the expected reduction in vehicle emissions. Results indicate that the current end estimated annual mean levels for 2003 and 2010 are well below the 2003 and 2010 objectives.

4.4.3 Very Busy Roads Or Junctions In Built Up Areas

Guidance suggests that there may be a few locations close to 'very busy' roads, in areas with high background concentrations, that may be at risk of exceeding the 2010 objective. A 'high' background concentration is given to be above $2\mu gm^{-3}$.

Estimated annual mean background concentrations for 2010 have been mapped for the UK. Within Carlisle City Council boundaries the estimated background concentration for 2010, shown in Appendix (5), is less than 0.3 $\mu g/m^3$ throughout the district.

In addition data supplied by the Highways Agency indicates that predicted traffic flows in 2010 on all roads within the authority are well below the definition of 'very busy' roads and junctions. A 'very busy' road is defined as:-

- Single carriageway roads with daily average traffic flows which exceed 80,000 vehicles per day
- Dual carriageway road with daily average traffic flows which exceed 120,000 vehicles per day
- Motorway with daily average traffic flows which exceed 140,000
- Flows are added at junctions

4.4.4 Identification Of Industrial Sources Which Are Significant Emitters Of Benzene

A list of industrial processes with the potential to emit significant quantities of benzene are set out in Appendix (4).

There are no Part A_1, A_2 or B prescribed processes within the district or on its boundaries with other authorities, which are significant sources of benzene.

4.4.5 Petrol Stations With 'Busy' Roads Nearby

Guidance advises that a 'busy' road can be taken to be one with more than 30,000 vehicles per day. There are three petrol stations with an annual throughput of more than $2000m^3$ of petrol located near to a 'busy' road, i.e. Esso, Filling Station, Church Street, Caldewgate; BP Moss Filling Station, Todhills, A74 and Shell (North) Filling Station, Todhills, A74 in Carlisle. However there are no locations of relevant exposure of residential property within 10 metres of the petrol pumps.

4.4.6 Major Fuel Storage

Within the district there is one medium sized fuel storage depot, BP Oil, (UK) Ltd, Dalston (an authorised A_2 process). This is in a rural location on the outskirts of Dalston village adjacent to a B road and is 1.8km from nearest location of relevant exposure. It is not considered a significant risk to exceeding the 2010 objective.

4.5 Conclusion

This updating and screening assessment has considered the Government's guidance for benzene. The assessment of the Council area has indicated that the risk of the benzene air quality objectives being exceeded by the end of 2003 and 2010 is negligible in locations where there might be exposure over a year. Therefore Carlisle City Council need not undertake a detailed assessment of benzene.

5.0 REVIEW AND ASSESSMENT OF 1,3-BUTADIENE

5.1 Introduction

1,3-butadiene is a VOC emitted into the atmosphere principally from fuel combustion of petrol and diesel vehicles. 1,3-butadiene is also an important chemical in certain industrial processes, particularly the manufacture of synthetic rubber. 1,3-butadiene is a human carcinogen.

5.2 Standard And Objectives

The Government has adopted a maximum running annual mean concentration of 2.25μg/m^3 as an air quality standard for 1,3 butadiene. The objective is for the standard to be achieved by the end of 2003.

The air quality objective remains unchanged since the last round of review and assessment.

The focus of this authority's review and assessment for 1, 3-butadiene will be non occupational near ground level outdoor locations with elevated concentrations in areas where a person might reasonably be expected to be exposed over a year e.g. in the vicinity of housing, schools or hospitals.

5.3 What Factors Might Lead To A Risk Of Exceeding The Objectives? – The National Perspective

Other than in the vicinity of specific industrial locations the dominant source of 1,3-butadiene in the UK atmosphere is the motor vehicle.

The increasing numbers of vehicles equipped with three way catalysts will significantly reduce emissions of 1,3-butadiene in future years. Recently agreed further reductions in vehicle emissions and improvement to final quality, including those as part of the Auto-Oil programme, are expected to further reduce emissions of 1,3-butadiene from vehicle exhausts. Guidance suggests that these measures are expected to deliver the air quality objective by the end of 2003, and no further measures are thought to be needed.

Only those authorities with relevant locations in the vicinity of major industrial processes, which handle, store of emit 1,3-butadiene are expected to proceed beyond the updating and screening assessment.

There were no AQMA's declared in the UK as a result of the first round of reviews and assessments in respect of the air quality objective for 1,3-butadiene. This supports the studies carried out at national level.

5.4 Updating and Screening Assessment for 1,3-butadiene

The following sources, locations and data will be considered as part of the updating and screening assessments.

a) Summary of first round review and assessment for 1,3-butadiene
b) New monitoring data
c) Details of new potentially significant industrial sources
d) Details of industrial sources with significantly increased emissions

5.4.1 Summary of First Round Review and Assessment for 1,3-butadiene

No major industrial sources of 1,3-butadiene were identified during the last round of review and assessment. Local monitoring was not conducted for 1,3-butadiene, as it was not assessed to be a pollutant at risk of breaching national objectives. It was not considered for a stage 2 review and assessment.

5.4.2 New Monitoring Data

Local Monitoring

Monitoring of 1,3-butadiene has not been undertaken by the authority for the same reason as above.

National Network Site

1,3-butadiene is monitored nationally at 13 national network sites.

A summary of maximum running annual mean concentrations of 1,3-butadiene (μgm^{-3}) measured at national network monitoring sites (1999 – 2001) is shown in Appendix (1).

The maximum running annual mean concentration of 1,3-butadiene measured at all urban background/ centre and roadside locations are already well below the 2003 objective of 2.25.μgm^{-3}.

5.5 New Industrial Sources

Processes likely to be a significant polluter of 1,3-butadiene are given in Appendix (4). There have been no new industrial sources introduced into the authority's area, or into neighbouring authorities, since the first round of review and assessment.

5.6 Industrial Sources With Substantially Increased Emissions

There were no sources identified during the first round of review and assessment as being potentially significant emittors of 1,3-butadiene within the authority area.

5.7 Conclusion

This updating and screening assessment has considered the government guidance for 1,3-butadiene.

No potentially significant industrial emission source of 1,3-butadiene are located within the local authority area or in neighbouring authority areas.

Whilst monitoring of 1,3-butadiene at a local level is not undertaken, monitoring at national level shows that there are no exceedences of the 2003 objective at any roadside and urban background / centre locations.

This updating and screening assessment of the council area has confirmed that the risk of the air quality objective for 1,3-butadiene being exceeded by the end of 2003 in locations where there might be exposure is negligible. Therefore Carlisle City Council need not undertake a detailed assessment of 1,3-butadiene.

6.0 REVIEW AND ASSESSMENT OF LEAD

6.1 Introduction

As a heavy metal, lead accumulates in the body and is known to produce neurological effects including reduced IQ in children.

6.2 Standard And Objectives For Lead

The Government has adopted an annual mean concentration of O.5μg/m^3 as the air quality standard for lead, with an objective for the standard to be achieved by the end of 2004.

In addition, a new lower air quality objective of 0.25μg/m^3 to be achieved by the end of 2008 has also been set.

The focus of this Authorities review and assessment for lead will be on non occupational near ground level outdoor locations where a person might reasonably be expected to be exposed over a year.

6.3 What Factors Might Lead To A Risk Of Exceeding The Objectives? – The National Perspective

There has been a ban on sales of leaded petrol in the UK since 1 January 2000. Emissions of lead are now restricted to a variety of industrial activities such as battery manufacture, pigments in paints and glazes, alloys, radiation shielding tanks, lining and piping.

Detailed assessments of the potential impact of lead emissions from industrial processes have been undertaken by the Government. This included a 12 month monitoring survey in the vicinity of 30 key industrial sites in the UK. Results indicated no exceedence of the 2004 and 2008 objectives were likely, although locations in proximity to non-ferrous metal productions and foundry process were deemed to be at risk and further monitoring is being undertaken.

There were no AQMA's declared in the UK in respect of the 2004 and 2008 objectives during the first round of review and assessment.

Guidance suggests that only those authorities with relevant locations in the vicinity of major industrial processes that emit significant quantities of lead are likely to progress to a detailed assessment. A list of industrial processes which may emit lead are shown in Appendix (4).

6.4 Updating and Screening Assessment for Lead in the Carlisle City Council Area

The following sources, locations and data will be considered as part of the updating and screening assessment for lead.

a) Summary of the first round review and assessment for lead
b) New monitoring data
c) New potential significant industrial sources

d) Industrial sources with significantly increased emissions

6.4.1 Summary Of First Round Review And Assessment For Lead

There were no potentially significant industrial sources of lead within the authority or on its boundaries with other local authorities identified during the first round of review and assessment. The review therefore concentrated on road traffic sources. A monitoring site (roadside) was established at Caldewgate in 1996 and produced data for 1997.

The annual mean level in 1997 was 0.075μg/m^3.

It was predicted that with the withdrawal of leaded petrol in 2000 there would be a noticeable reduction in airborne lead levels to less than 0.05μg/m^3 by 2005, well below the objective level. It was concluded that there was no risk of the objective being exceeded and therefore it was unnecessary to undertake a stage 2 assessment for lead.

6.4.2 New Monitoring Data

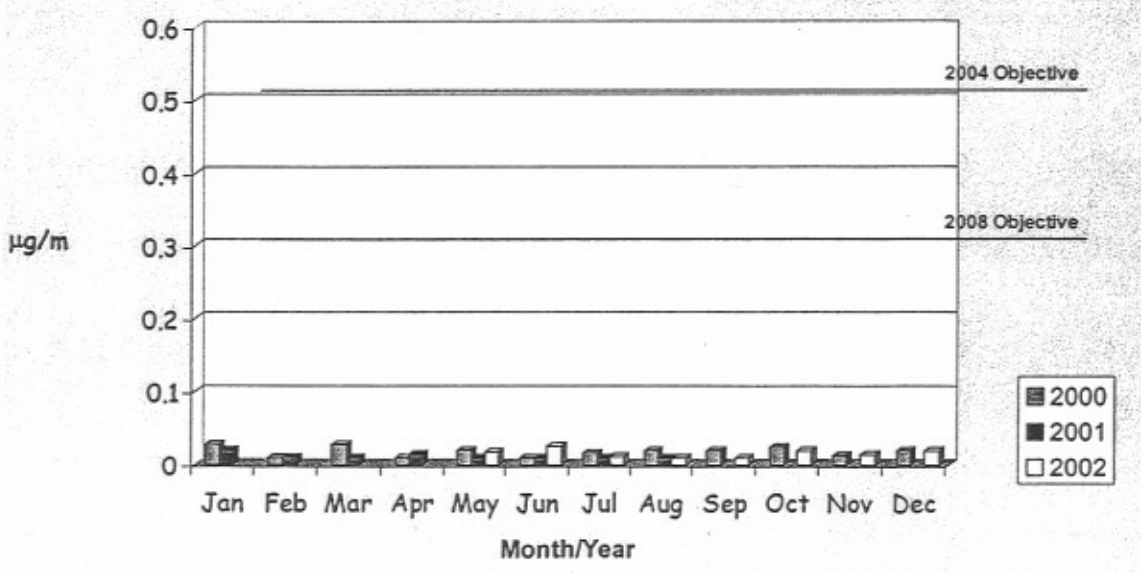
National Network Monitoring

A summary of measured lead in air concentrations at UK national network sites is shown in Appendix (1) for the period 1997-2001. Concentrations at all urban background and kerbside sites are well below the objectives for 2004 and 2008.

Local Monitoring

Monitoring of lead in air has continued at the same site used during the first round of assessments. The monitoring site is located at the roadside of Church Street, adjacent to a busy junction, where the source of traffic exceeds 40,000 vehicles per day. Sampling for lead is carried out using an M type sampler, which captures ambient particulate matter as air is drawn through the filter media. Sampling is undertaken over consecutive 7-day periods. Analysis and subsequent reporting of results is undertaken by Lancashire County Laboratory. Results are shown in graph (1) below.

Graph 1 Lead Monthly Mean 2000-2002



Results indicate that levels have fallen since 1997. The annual mean for 2000, (the only full set of data) is 0.018μg/m^3, well below the 2004 and 2008 objectives.

6.4.3 New Industrial Sources With Potential To Emit Significant Quantities Of Lead

There have been no new relevant industrial sources introduced into the area since the last round of review and assessment.

6.4.4 Industrial Sources With Substantially Increased Emissions

There were no industrial sources with the potential to emit significant quantities of lead identified during the last round of review and assessment.

6.5 Conclusion

This updating and screening assessment has considered the Government's guidance for lead.

There are no major industrial sources which emit significant quantities of lead located within the authority area, or in neighbouring authorities. The major source of lead in air within the Authorities area prior to 01/01/2000 was road traffic. It was predicted in the first round of review and assessment that lead concentration which was already well below the 2004 and 2008 objectives, would fall further following the ban on leaded petrol. Monitoring undertaken at local level and nationally validate this assumption.

This updating and screening assessment of the Council's area has indicated that the risk of the lead air quality objective being exceeded by the end of 2004 and 2008 in location where there might be exposure is negligible, and therefore there is no need for Carlisle City Council to undertake a further detailed assessment of lead.

7.0 REVIEW AND ASSESSMENT FOR PARTICULATE MATTER

7.1 Introduction

Particulate matter (PMs) consists of solid matter and is categorised according to its size PM_{10} are particulates which are 10 microns or less in diameter. This very fine dust is minute enough to be inhaled into the lungs and can lead to an increased risk of heart and lung disease. In addition the particulates may carry surface absorbed carcinogen compounds into the lungs.

7.2 Standards and Objectives for Particulate Matter

The Government has adopted two Air Quality objectives for PM_{10}. The objectives are $40\mu gm^{-3}$ as the annual mean and $50\mu gm^{-3}$ as the fixed 24 hour mean to be exceeded on no more than 35 days per year, to be achieved by the end of 2004.

The objectives are based upon measurement carried out using the European gravimetric transfer sampler or equivalent.

The Government has also introduced new provisional objectives to be achieved by the end of 2010. The provisional objectives are a 24 hour mean of $50\mu gm^{-3}$ not to be exceeded more than 7 times per year, and an annual mean of $20\mu gm^{-3}$ to be achieved by the end of 2010. (slightly less stringent provisional objectives for London have been set).

Only those authorities in Scotland have a statutory duty to undertake a review and assessment for the 2010 objective during this second round, although all authorities in the UK are encouraged to do so.

Carlisle City Council will consider the 2010 objective as part of its updating and screening exercise.

The focus of this Authorities review and assessment for PM_{10} will be non occupational, near ground level outdoor locations with elevated PM_{10} concentrations in areas where a person might reasonably be expected to be exposed over a 24 hour period.

7.3 What Factors Might Lead To A Risk Of The Objective Being Exceeded? – The National Perspective

Unlike the other individual gaseous pollutants which are single, well defined substances, particles (PM_{10}) come from a wide range of materials arising from a variety of sources. These can however be divided into 3 main categories.

- **Primary particle emissions** – derived from combustion sources and are emitted directly to the atmosphere.

- **Secondary particle emissions** – these comprise mostly of sulphates or nitrates and are formed by chemical reactions in the atmosphere. Their production is generally not locally controllable.

- **Course particles** – these comprise of a wide range of particles including suspended dust from road traffic, construction work, mineral extraction processes, wind blown sea salt and soil.

The expected reduction in particle emissions in future years is different for each source type.

Concentrations of PM_{10} are reducing across the country and will continue to reduce due to policies introduced at EU and national level. There has been significant progress in reducing emissions of particles from both the transport and industrial section, and total national annual UK emissions declined by nearly 40% between 1990 – 1999.

Further reductions are expected in future years as a result of agreed additional policies; within the industrial sector, particle emissions will be controlled through Integrated Pollution Prevention (IPPC) and the EU Waste Incineration Directive. In addition, significant reductions in emissions of pollutants that lead to the formation of secondary particles is expected as a result of EU legislation on the Acidification Strategy. Emissions from road transport will also be reduced as a result of tightening emissions control and by the reduction of the sulphur content of diesel fuel, which affects the emissions of particles from vehicles.

More than 50% of the AQMA's declared in the UK as a result of the first round of review and assessment were due to exceedences of the 2004 24 hour mean PM_{10} objective and arose mainly from road traffic sources. A few PM_{10} AQMA's were however declared due to industrial and fugitive sources. The declaration of an AQMA due to domestic coal burning is also under consideration.

Guidance suggests that with existing national policies to reduce PM_{10} emissions, and a typical meteorological, exceedences of the 2004 objectives might be found in the following areas.

- Urban background sites in central London
- Areas adjacent to busy roads particularly within major urban areas
- Areas which have significant emissions from the domestic burning of solid fuels
- Areas in the vicinity of industrial plant
- Areas near to processes which may have significant uncontrolled or fugitive emissions (e.g. quarrying)

The Guidance also indicates that Exceedences of the 2010 annual mean objective at background locations are only likely to occur in SE England. Although exceedences of the annual mean objectives are still expected at some busy roadside sites throughout the UK.

7.4 Updating and Screening Assessment for PM_{10} in the Carlisle City Council Area

The following sources, locations and data will be used in this updating and screening exercise

- Summary of last round of review and assessment for PM_{10} in the authority area
- New Monitoring Data
- Roads with a high flow of buses and/or Heavy Goods Vehicles.

- New roads constructed or proposed since the last round of review and assessment.
- Roads close to the objective during the last round of review and assessment
- Roads with significantly changed traffic flows
- New industrial sources
- Industrial sources with substantially increased emissions
- Areas with significant domestic solid fuel heating
- Quarries, opencast coal, handling of duty cargoes at ports
- Aircraft

Background Concentration

Estimated annual mean background PM_{10} concentrations for 2004 and 2010 have been mapped for this authority and are shown in Appendix 5. Background maps for annual mean secondary PM_{10} in 2001 are also shown.

7.4.1 Summary Of The First Round Of Review And Assessment For PM_{10} In The Carlisle City Council Area

There were no local industrial activities, uncontrolled or fugitive emissions identified as being potentially significant to the Council's area.

The main local contributing source of PM_{10} was considered to be road traffic. Current and future concentrations of PM_{10} were predicted using the DETR's basic screening model "Design Manual for Roads and Bridges" (DMRB). Results from this screening exercise showed that along the main roads in the urban area both the current (1999) and projected (2004) annual mean levels and 24 hour 90^{th} percentiles were well below the 2004 objectives, the highest PM_{10} levels being along Scotland Road.

Monitoring using Tapered Element Oscillating Microbalance (TEOM) equipment was undertaken to verify the modelled results. The unit, which also houses the chemiluminescence analyser for NO_2 measurement, was located alongside one of the busiest sections of Scotland Road (location is shown in Appendix (6)).

The measured PM_{10} (gravimetric) annual mean in 1999 was 25.61 μgm^{-3} and the 24 hour 90^{th} percentile was 35.8 μgm^{-3}, both are significantly below the 2004 objectives.

It was concluded that no parts of the City Council area were at risk of exceeding the 2004 objectives.

7.4.2 New Monitoring Data

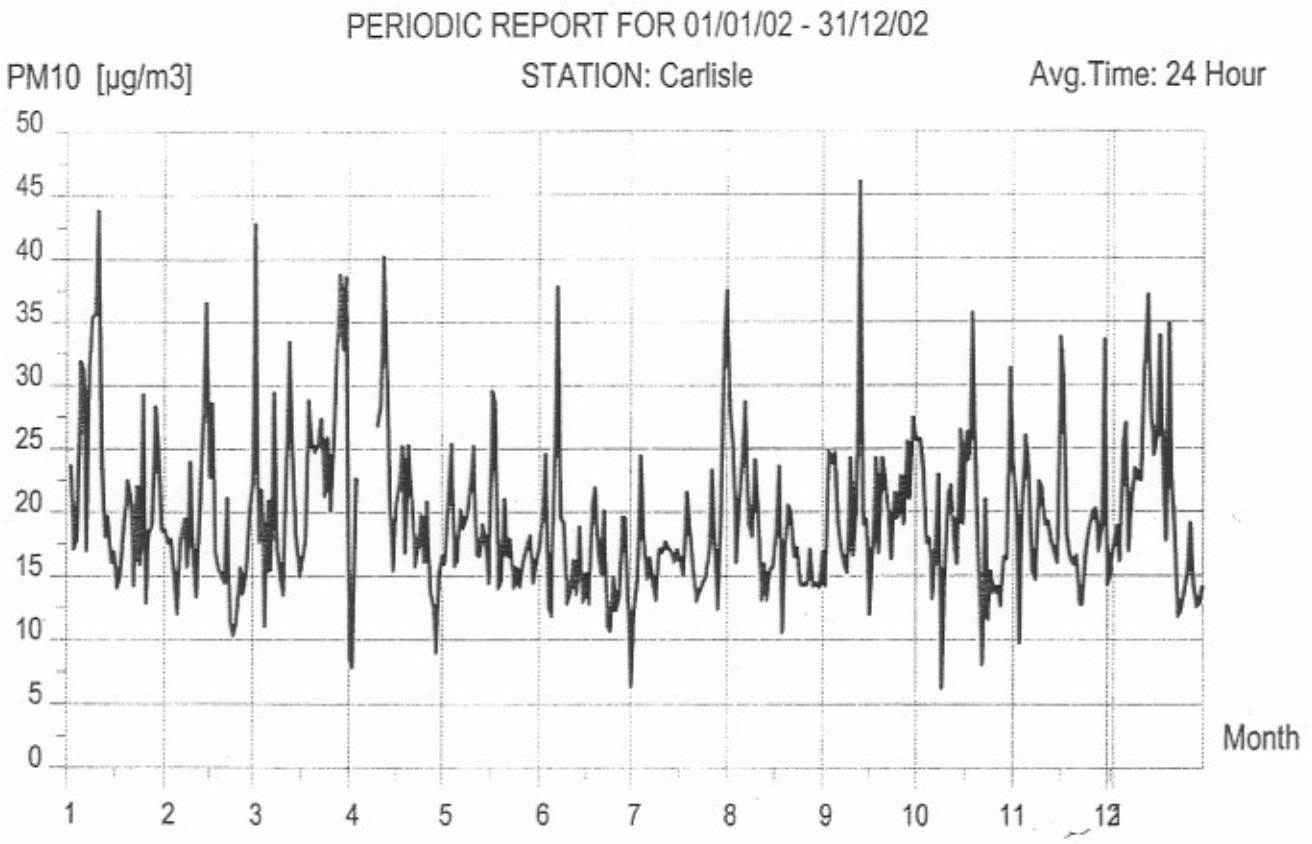
Monitoring for PM_{10} has continued at the same roadside site, Scotland Road, used during the first round of review and assessment. The site was chosen as it presents the 'worst case scenario' for traffic related pollution with an AADT of approximately 30,000 and residential properties close by.

Monitoring is undertaken using TEOM equipment in common with most national PM_{10} monitoring stations. This gives a different (lower) result compared to gravimetric measurement. It is therefore necessary to apply a correction factor of x 1.3 to convert (increase) from PM10 (teom) to PM_{10} (gravimetric), to allow direct comparison between our data and the national objectives.

The QA/QC procedures for the operation of the unit and the management of data are shown in Appendix (6).

Results from the TEOM are shown in graph (2) below.

Graph (2)



The measured PM_{10} concentrations can be projected to 2004 and 2010. The procedure is shown in Appendix (7). The estimated 2004 and 2010 concentrations are shown below.

Table 4: PM_{10} Gravimetric (μgm^{-3})						
	Measured 2002 concentrations		Estimated 2004 concentrations		Estimated 2010 concentrations	
Location	Annual mean	No of days >50$\mu g/m^3$	Annual mean	No of days >50$\mu g/m^3$	Annual mean	No of days >50$\mu g/m^3$
Scotland Road	25.61	6	24.87	3	22.9	0

The annual mean and the number of exceedences above 50$\mu g/m^3$ measured in 2002 are well below the 2004 objective levels.

The predicted annual mean and the predicted number of exceedences in 2004 are estimated to be below the 2004 objectives.

However, whilst the predicted number of exceedences in 2010 is estimated to be below the provisional 2010 objective, the predicted annual mean in 2010 is estimated to be slightly above the provisional annual mean 2010 objective. This will clearly have to be closely monitored. However it is worth noting that planning permission has been granted for a new route which links the north of the city to the west via a two-way carriageway. The effect of this proposed route will be to reduce traffic flows along the major roads in Carlisle including Scotland Road, which in turn will reduce vehicle emissions of PM_{10}. The proposed route and its effect on traffic flows is discussed in more detail in section 7.4.4.

7.4.3 Roads With A High Flow Of Buses And/Or HGV's

Guidance suggests that where streets have an unusually high proportion of buses and/or HGV's there may be a risk of exceeding the 2004 and 2010 objectives. An unusually high proportion is taken to be greater than 20% of the AADT flow.

Data supplied by The Highways Agency has indicated that there are no roads which meet this criteria within the Authority area.

7.4.4 New Roads Constructed or Proposed Since The Last Round of Review and Assessment

Planning permission for a new proposed road, the Carlisle Northern Development Route, was granted in 2000. The proposed route is shown in Appendix (8). It will start at the A595 Newby West crossroads and finish at the A6 junction 44, and runs to the west of the city outskirts. The road will be a single two way carriageway 7.3m wide, with 3.5 m wide verges and is 5.13 miles in length.

The main purpose of the route is to facilitate the development of a new Regional Strategy Employment Site at Kingmoor Park by improving road links to the M6, West Cumbria and South West Scotland. Work is due to commence in December 2004 and the proposed opening year is December 2006.

As part of this assessment it is necessary to establish whether the new route and its effects on other existing roads in respect to traffic flows present a risk of exceeding the PM_{10} objectives. Guidance suggests that where traffic flows are in excess of 10,000 on the new road, there may be a possibility of an objective being exceeded.

In addition where there is an increase in traffic flow on existing roads previously identified as being close to the objective, these may also now be at risk of exceeding the objective.

Estimated Traffic Flow on Proposed Route

The estimated traffic flow figures for the new route are shown below for the opening year 2006 and 2010. Traffic flows expected to be in excess of 10,000 vehicles can be identified on the map (in Appendix 8). Along the sections where the AADT is expected to be above 10,000, there are no locations of relevant exposure within 10 metres of the roadside.

Table 5: Proposed CNDR Route – AADT Flows 2006 and 2010		
Link	2006 AADT Flows	2010 AADT Flows
C1022 Parkhouse Road North of Asda	1629	1726
CNDR Northern Link near J44	22368	23710
CNDR Northern Link near Asda	13439	14245
CNDR Northern Link near Kingmoor	13564	14378
CNDR Eden Bridge Link	10651	11290
CNDR South of Burgh Road	7967	8445
CNDR Sandsfield Park Link	6769	7175
CNDR North of Peter Lane	7784	8251
Kingstown Broadway	5471	5799
CNDR Railway Bridge Link	13844	14675
CNDR Southern link near Kingmoor	15449	16376

Impact of Route on Existing Traffic Flows

The following figures show the Average Annual Daily Traffic Flows both with and without the development route for main roads in Carlisle in the opening year 2006 and in 2010. The overall effect of the route will be to reduce traffic flows along the main roads into the city, most importantly on Scotland Road, Longtown Road and Wigton Road.

Table 6: Impact of Route on Existing Traffic Flows				
Road	With CNDR 2010 AADT	Without CNDR 2010 AADT	With CNDR 2006 AADT	Without CNDR 2006 AADT
Eden Bridge	41972	50034	39596	47202
Castle Way	42616	50200	40204	47358
Georgian Way	37794	39296	35655	37072
Warwick Road	32294	33126	30466	31251
London Road	19748	18677	18630	17620
A7	12004	11462	11324	10813
A689	9208	8881	8687	8379
A74	50584	48788	47720	46027

M6	51313	47541	48408	44850
Kingstown Road North	10781	25991	10171	24519
Kingstown Road South	17304	22719	16324	21433
Scotland Road	22617	28263	21336	26664
C1016 Rockcliffe Road	2794	2788	2636	2630
Etterby Street	6391	6510	6029	6141
Burgh Road South	4262	2562	4021	2417
Burgh Road North	1188	996	1121	939
Newtown Road East	16131	17134	15218	16164
Newtown Road Central	4694	5538	4428	5224
B5307	4242	3666	4002	3458
C2051	1079	1005	1018	948
Orton Road West	1605	1937	1514	1827
Orton Road East	6707	6279	6327	5924
A595	21058	20170	19866	19029
Wigton Road West of Orton Road	7156	14097	6751	13299
Wigton Road East of Orton Road	15037	20741	14186	19567
Wigton Road near Newtown Road	16011	21150	15105	19953
Peter Lane	10575	7064	9976	6665
Parkhouse Road, North of Kingstown Broadway	10233	7949	9653	7499

There is an expected increase in traffic along the following existing roads; Burgh Road, London Road, B5037, C2051, A591 and Peter Lane. None of these roads have been previously identified as being at risk of exceeding the objectives and the increase of traffic on these roads is not considered to be a risk to the objective being exceeded.

7.4.5 Roads Close to the Objective during the First Round of Review and Assessment

New vehicle emissions factors were produced in 2002. Emission factors are used in the DMRB screening model for predicting exceedences of the objective from road traffic sources. Technical guidance suggests that the new factors might make a difference in locations which were predicted to be close (more than thirty 24 hour exceedences or where the 90th percentile falls between 45 to 50 μgm^{-3}) to the objective during the first round of review and assessment.

The DMRB modelling undertaken by this authority in 1999 demonstrated that there were no roads close to the PM_{10} objectives at any roadside locations shown in the table.

Table 7: Modelled PM_{10} annual and 24-hourly means

Site	1999 means ($\mu g/m^3$)		2005 mean ($\mu g/m^3$)	
	Annual	24-hr 90th percentile	Annual	24-hr 90th percentile
(column)	(a)	(b)	(c)	(d)
225 Wigton Road	20.99	37.6	17.9	32.0

45 Scotland Road	25.16	45.0	19.79	35.4
328 London Road	21.78	39.0	18.28	32.7
215 Warwick Road	23.22	41.6	18.95	33.9
46 Warwick Road	20.89	37.4	17.86	32.0
53 Lowther Street	24.79	44.4	19.6	35.1
Average	**22.8**	**40.8**	**18.73**	**33.5**

7.4.6 Roads with Significantly Changed Traffic Flows

Guidance suggests that where roads with more than 10,000 vehicles per day have experienced a large (25% or more) increase in traffic, there may be a risk of exceeding the objective.

Data supplied by the Highways Authority indicate that there are no roads which meet this criteria.

7.4.7 New Significant Industrial Sources

There have been no new potentially significant industrial sources introduced into the authorities area or into neighbouring authorities since the last round of review and assessment.

7.4.8 Industrial Sources With Substantially Increased Emissions (Greater Than 25%)

The following part B processes were identified during the last round of review and assessment as potential sources of PM_{10}. None of them were assessed to be significant emitters of PM_{10} during the last round of review and assessment.

Table 8: Part B processes which may emit PM_{10}	
Site address & process number	**Process**
Carlisle Coated Stone Ltd, Stephenson Ind. Estate, Carlisle EPA/023	Roadstone coating
Esk Building Products Ltd, Brisco, Carlisle EPA/024	Brickworks
Carrs Billington Feeds Ltd, Kingstown Ind. Estate, Carlisle EPA/036	Animal feeds manufacture
Tilcon Ltd, Willowholme Ind. Estate, Carlisle EPA/027	Concrete batching
ARC Northern Premix Ltd, Willowholme Ind. Estate, Carlisle EPA/020	Concrete batching
Willowholme Mini-mix, Stephenson Ind. Estate, Carlisle EPA/031	Concrete batching
Readymix Concrete Ltd, Kingstown Ind. Estate, Carlisle EPA/022	Concrete batching
Pirelli Ltd, Dalston Road, Carlisle City Council EPA/039	Rubber process
Hargreaves Industrial Services Ltd, London Road, Carlise EPA/026	Coal distribution
W & M Thompson (Quarries) Ltd, Hallbankgate, Brampton EPA 045	Stone Quarry

None have experienced a 'substantial' increase in emissions.

7.4.9 Areas of Domestic Solid Fuel Burning

Guidance suggests that local authorities examine their areas and identify where 'significant' solid fuel burning may occur. The term 'significant' has been revised and is now taken to be an area of 500m x 500m with more than 50 houses burning solid fuel as their primary source of heating.

Since the 1970's the installation of central heating and the convenience of mains gas has resulted in a drastic reduction in the consumption of solid fuel within the city. Monitoring during winter months has not indicated any particular smoke problem, as a result of solid fuel burning, within the city area. However there are some settlement areas within the authority which are not served by mains gas, namely:

Hallbankgate	52	Small village
Thurstonfield	83	Small village
Castle Carrock	77	Small village
Great Orton	66	Small village
Irthington	53	Small village
Longtown	353	Small town

Visits to all of the above villages during cold periods have not indicated a particular smoke problem. Questionnaires were however sent out to 350 householders of a small section of Longtown (classified as a small town), 41% (143) were returned. The majority of solid fuel burning houses lie in a single 500m x 500m grid, with open-space and non-solid fuel burning premises taking up approximately 70% of the 500m x 500m area. Of the solid fuel burning houses, it is estimated that 46.6% burn coal, 46.6% burn anthracite, 6.8% burn smokeless fuel as their primary source of heating; none burn wood.

The screening assessment for domestic solid fuel burning is given in Appendix (3). The density of effective coal burning houses per 500 x 500 grid is 157. The estimated annual mean background concentration for the area is $13.5\mu gm^{-3}$ for 2004 and $12.8\mu gm^{-3}$ for 2010. It is therefore estimated that the density of coal burning households in the 500m x 500m area will not give rise to an exceedence of the 2004 objective.

However the density of effective coal burning premises does exceed the criterion for 2010, there is therefore a potential that the provisional 2010 annual mean objective will be exceeded.

7.5 Fugitive and Uncontrolled Sources

Guidance suggests that there is a potential for dust emissions within the PM_{10} size fraction to arise from a number of uncontrolled and fugitive sources. These include quarrying and mineral extraction sites; landfill sites; coal and material stockyards or materials handling.

Premises located within the authority with a potential to emit PM_{10} and considered for screening are shown below.

Table 9: Processes with potential to emit significant PM_{10}			
Site Address (a)	Process (b)	Background PM_{10} Concentrations ($\mu g/m^{-3}$) (c)	
		2004	2010
Carlisle Coated Stone Ltd, Stephenson Industrial Estate, Carlisle	Roadstone coating	14.8	13.8
Esk Building Products Ltd, Brisco, Carlisle	Brickworks	14.2	13.3
Carrs Billington Feeds Ltd, Kingstown Industrial Estate, Carlisle	Animal feeds manufacture	14.2	13.4
Tilcon Ltd, Willowholme Industrial Estate, Carlisle	Concrete batching	14.8	13.9
ARC Northern Premix Ltd, Willowholme Industrial Estate, Carlisle	Concrete batching	14.8	13.9
Willowholme Mini-mix, Stephenson Industrial Estate, Carlisle	Concrete batching	14.8	13.9
Readymix Concrete Ltd, Kingstown Industrial Estate, Carlisle	Concrete batching	14.2	13.4
Pirelli Ltd, Dalston Road, Carlisle	Rubber Process	14.3	13.4
Hargreaves Industrial Services Ltd, London Road, Carlisle	Coal distribution	15.1	14.1
Hespin Wood Landfill Site, Todhills, Carlisle	Landfill site	13.6	12.8
W & M Thompson (Quarries) Ltd, Hallbankgate, Brampton, Carlisle	Stone quarry	13.5	12.7

Local monitoring for PM_{10} is not undertaken at any of these locations. The sites are all located on either industrial estates or in rural locations. There are no locations of relevant public exposure within 400 metres of the sites. Guidance suggests if there are relevant locations for public exposure within 400 to 1000 metres of the dust emission source there should be no need to proceed further if the 2004 PM_{10} background is less than $27\mu gm^{-3}$, and the 2010 background is less than $17\mu gm^{-3}$. The estimated background concentrations for 2004 and 2010 at each site are given in column C. These are well below $15\mu g/m^{-3}$, and therefore below the threshold for exceeding the objectives.

7.6 Aircraft

Aircraft can be significant sources of nitrogen oxide emissions especially during take-off. Emissions from aircraft once they are above 200m will make negligible contributions to ground level concentrations.

Guidance suggests that there may be a risk of exceeding the objective for PM_{10} where there are locations of relevant exposure within 500m of the airport boundary and where the predicted total equivalent passenger throughput in million passengers per annum (mppa) is greater than 10mppa in 2004 and greater than 5mppa in 2010.

Carlisle airport is a small, privately operated site. At present the airport's use is restricted to three main areas:-

- business jet flights
- private training activities
- army training

There are presently no scheduled, chartered or cargo flights and, in its current capacity, the risk of exceeding the PM objectives in 2004 and 2010 is negligible.

However the airport management hopes to develop the site into an international regional airport and has commissioned several studies in order to assess feasibility.

The first study, on scheduled flights, has been completed and the following 'potential' passenger numbers have been provided:-

2004 - 69,000
2010 - 104,800

No figures are available yet for chartered or cargo flights.

Indications are that even when developed as an international airport, the total equivalent passenger throughput will be substantially less than the threshold likely to give rise to an exceedence.

The future development of the airport will be considered as part of future air quality review and assessments.

7.7 Conclusion

This updating and screening exercise has followed the Government's guidance for PM_{10} through the use of the recommended screening tools and methodology.

The assessment has indicated that the risk of the 2004 PM_{10} air quality objective being exceeded by the end of 2004 is negligible, and there is no need for Carlisle City Council to undertake a detailed assessment for PM_{10}.

Provisional objectives for PM_{10} have been set for 2010. Whilst there is no statutory requirement to undertake the updating and screening assessment for the 2010 objectives, Carlisle City Council has considered the provisional objective as part of this review.

The assessment has indicated that there is a risk of the objective being exceeded in an area where 'significant' coal burning takes place and alongside Scotland Road. As this is a provisional objective only, there is no need to go on to a detailed assessment. However further consideration will be given to these potential exceedences in the next updating and screening assessment (scheduled for 2004).

8.0 REVIEW AND ASSESSMENT OF SULPHUR DIOXIDE

8.1 Introduction

Sulphur Dioxide is an irritant when inhaled because of its acidic nature. This can cause coughs, irritation, and chest tightness. Because health effects may be noticeable after only a few minutes the objectives are set over short periods of time.

8.2 Standard and Objectives for Sulphur Dioxide

These remain unchanged since the last round of review and assessment.

The Government has adopted a 15 minute mean of 266 ugm^{-3} as an air standard for sulphur dioxide, with an objective for the standard not to be exceeded more than 35 times in a year by the end of 2005. In addition there is a 1 hour mean objective of 350 ugm^{-3} to be exceeded no more than 24 times per year, and a 24 hour objective of 125 ugm^{-3} to be exceeded no more than 3 times per year, to be achieved by the end of 2004.

The focus of the authorities review and assessment should be on any non occupational, near ground level outdoor location given that exposures over 15 minutes are potentially likely in these locations.

8.3 What Factors Might Lead to a Risk of the Objectives Being Exceeded? - The National Perspective

In the first half of the century, emissions of sulphur dioxide were dominated by the combustion of coal, not only in the domestic sector, but also in commercial and industrial premises, and in power stations which were predominately located within built up areas. Following the smogs of the 1950s and the introduction of the Clean Air Act, this pattern has changed as cleaner fuels have replaced coal.

Annual mean concentrations of sulphur dioxide have reduced significantly since 1960's. Nationally emissions of SO_2 fell by 55% between 1990-1997. The main source of sulphur dioxide in the UK is fossil-fuelled power stations, these accounted for more than 71% of emission in 2000. Forecasts suggest that with current measures in place to control emission from combustion plants greater than 20 MW, most areas in the UK will achieve the objective in 2005.

However significant emissions can occur locally from other smaller combustion sources less that 20 MW, these are listed in Appendix (4). Domestic sources can also be locally significant. Road transport currently accounts for less than 1% of emissions.

There have been a small number of AQMA's declared in the UK as a result of the first round review and assessment. These relate to emissions from coal fired boilers at a cellophane process plant and hospital, areas where significant coal burning takes place, and shipping at a major port.

Guidance suggests that exceedences, principally of the 15 minutes objectives, may occur in areas in the immediate vicinity of combustion plants which burn coal or oil, in areas where coal is extensively used for domestic heating, shipping at major ports and at locations where diesel and coal-fired locomotives regularly remain stationary for 15 minutes or more.

8.4 Updating and Screening Assessment of Sulphur Dioxide in the Carlisle City Council Area

The following sources, locations and data will be considered as part of the updating and screening exercise:

1. Summary of first round of review and assessment for sulphur dioxide.
2. New monitoring data.
3. New industrial sources with potential to emit significant quantities of sulphur dioxide.
4. Existing industrial sources with substantially (taken to be 30% or more) increased emissions.
5. Areas where significant domestic coal burning takes place.
6. Identification of small boilers >5MW (thermal) which burn coal or oil.
7. Shipping.
8. Identification of locations where diesel and coal-fired locomotives are regularly stationary for 15 minutes or more.

8.4.1 Summary of the First Round of Review and Assessment for SO_2

There were no significant industrial processes which emit SO_2 identified within the authority's boundaries or in neighbouring authorities.

There were no significant areas identified within the authority where domestic 'coal' burning took place.

The authority has maintained a SO_2 and smoke monitoring station (urban background site) at Denton Holme, Carlisle since 1987. This uses an 8 port sampler to bubble air through a peroxide solution to remove SO_2. Results up to the end of 1997 indicated a steady declining trend in both annual means and the 98th percentile of daily concentrations. The annual mean in 1997 measured 5.32$\mu g/m^{-3}$, and the maximum daily level measured 25.8$\mu g/m^{-3}$.

The 99.9th percentile of 15 minute means was calculated to be 48.93$\mu g/m^{-3}$, and the 99.7th percentile of 1 hour means was calculated to be 35.32$\mu g/m^{-3}$. Measured and calculated levels were all well below the air quality objective for SO_2.

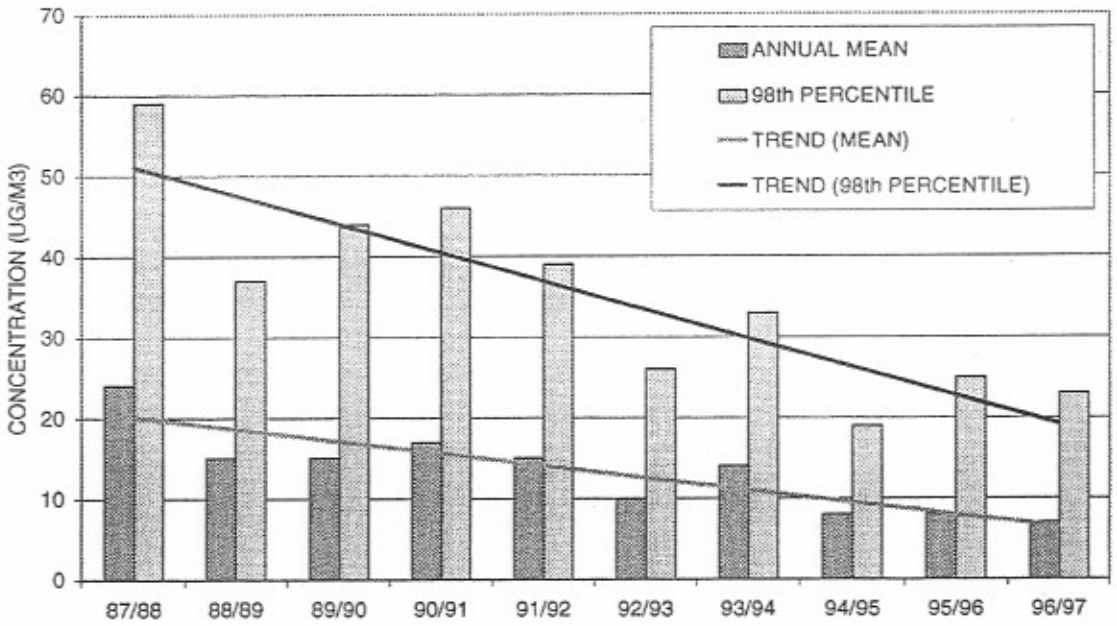
It was concluded that the risk of the SO_2 objectives being exceeded by the end of 2004 and 2005 was negligible and no further assessment was undertaken.

8.4.2 New Monitoring Data

Local Monitoring Data

Unfortunately due to a succession of technical difficulties and vandalism to the SO_2 monitoring station, sufficient recent monitoring data is not available for the purposes of this updating exercise. However it is useful to refer back to monitoring data shown in graph (3) obtained since 1987. This clearly indicates a definite long term trend of falling annual means and daily level 98th percentile SO_2 concentrations in the Carlisle area.

Graph 3 SO_2 Annual Means and Daily Level 98th Percentile



National Monitoring Data

A summary of measured sulphur dioxide concentration at UK national network sites is shown in Appendix (1) for the period 1999-2001. This also provides useful information of SO_2 concentrations at a mixture of roadside, urban centre and urban background sites. Concentrations have fallen at all sites in recent years, and the objectives were only exceeded at only one site in Belfast which is associated with domestic coal burning (widespread in that area).

8.4.3 Industrial Sources with a Substantial Increase of Emissions

There were no significant industrial sources identified during the last round of review and assessment which could give rise to significant emissions of SO_2.

8.4.4 New Industrial Sources

There have been no new significant industrial sources introduced into the area since the last round of review and assessment.

8.4.5 Areas of Significant Domestic Coal Burning

Coal and smokeless fuel burning for domestic heating has now been largely replaced by alternative fuels throughout the UK. However there are areas where domestic coal burning can still be significant, particularly in areas where there is an absence of mains gas supplies. Previous guidance suggested that sulphur dioxide emissions from domestic coal burning would be significant where there are more than 300 houses per square kilometre area that burn 'coal'. Revised guidance suggests that the risk of exceedences in an area can be considered significant where the density of 'coal' burning (including Coal, anthracite and smokeless fuels) houses exceeds 100 properties per 500m by 500m area.
Settlements which are not supplied with mains gas are listed below together with the maximum number of houses within a 500m x 500m area.

Area	Max No of dwellings in 500 x 500m grid	Classification
Hallbankgate	52	Small village
Thurstonfield	83	Small village
Castle Carrock	77	Small village
Great Orton	66	Small village
Irthington	53	Small village
Longtown	353	Small town

Only Longtown, categorised as a small town, was considered a possible location where a risk of exceeding the objective may occur.

Questionnaires were subsequently sent to 350 householders in a small housing estate located at the North Eastern corner of town during December 2002 requesting details of fuel consumption in the home. 145 (41%) questionnaires were returned. Of these, 20% indicated that 'coal' was used as the predominant form of fuel to heat their home. It is therefore estimated that approximately 70 homes within the 500m x 500m area use coal as the predominant source of heating, which is well below the threshold for exceeding the objective.

8.4.6 Identification of Small Boilers Greater than 5MW using Coal or Oil

The new Regulations limiting the sulphur content of fuel oil to less than 1% from 01/01/2003 means that boilers using fuel oil are unlikely to be significant on their own. Guidance does however suggest that particular attention is given to the combined impact of several sources including those outside the local authority area.

All medium/large institutional and commercial buildings within the district where larger boiler plant may be utilised have been contacted as part of this updating exercise to determine boiler size and fuel used. All, with the exception of Carlisle Hospitals, use gas. Carlisle Hospitals was found to use oil as part of a 'duel fuel' system in 12 boilers (6 rated at 575kw and 6 rated at 405kw). All are served by one stack which is in excess of 20 m. However the oil used is 35 second gas oil which has an even lower sulphur content, 0.2%, when compared to fuel oil.

Data supplied by Carlisle Hospitals indicate that the total throughput of gas oil in 2002 was 27 tonnes/annum. As the maximum sulphur content in gas oil is

0.2%, the estimated 'worse case scenario' of sulphur dioxide emitted to the atmosphere is 0.108 tonnes. Comparing this figure to the nomogram in the guidance, it is clear that this is well below the threshold for exceeding the 15 minute objective.

8.4.7 Shipping

Not applicable to this area.

8.4.8 Railway Locomotives

Local knowledge and information supplied by Railtrack and the Rail companies, who use the lines within the local authority area, indicate that there are no locations within the authorities area where diesel and coal fired locomotives regularly remain stationary for more than 15 minutes.

8.5 Conclusion

This updating and screening assessment has followed the Government's guidance for sulphur dioxide.

The assessment has indicated that the risk of sulphur dioxide air quality objectives being exceeded in 2004 and 2005 in localities where there might be exposure, is negligible and therefore there is no need for Carlisle City Council to undertake a further detailed assessment of sulphur dioxide.

9.0 REVIEW AND ASSESSMENT OF NITROGEN DIOXIDE

9.1 Introduction

Nitrogen dioxide (NO_2) is a gas produced by the reaction between nitrogen and oxygen during high temperature combustion. The reaction usually takes place in two stages; one atom each of nitrogen and oxygen combine during combustion to form nitric oxide (NO) which then oxides at a later stage in the atmosphere to produce NO_2. The combustion of NO and NO_2 is collectively known as oxides of nitrogen (NO_x).

Nitrogen dioxide is a respiratory irritant, and may exacerbate asthma and possibly increase susceptibilities to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. Ozone can irritate eyes and air passages causing breathing difficulties and may also increase susceptibility to infection.

9.2 Standards And Objectives For Nitrogen Dioxide

The Government has adopted two air quality objectives for nitrogen dioxide as an annual mean concentration of $40\mu g/m^{-3}$ and a 1 hour mean concentration of $200\mu g/m^{-3}$ not to be exceeded more than 18 times per year.

The objectives are to be achieved by the end of 2005.

9.3 What Factors Might Lead To A Risk Of Exceeding The Objectives? – The National Perspective

The principal source of nitrogen oxide is road transport which accounted for about 49% of total UK emissions in 2000.

The contribution of road traffic to nitrogen oxide emissions has declined significantly in recent years as a result of various policy measures and further reductions are expected up to 2010 and beyond. However major roads carrying large volumes of high speed traffic (e.g. motorways and other primary routes) are still expected to be a significant source, as are conurbations and city centres with congested traffic.

Other significant sources of nitrogen oxides emissions include the electrical supply industry and other industrial and commercial sections (these are listed in Appendix (1)) which accounted for approximately 24% and 23% respectively in 1999. Emissions from both sources have also declined dramatically, due to the fitting of low nitrogen oxides burners, and the increased use of natural gas plants.

More than 100 AQMAs have been declared nationally from the last round of review and assessment. The vast majority are related to road traffic emissions, where attainment of the annual mean objective is considered unlikely. Exceedences of the objective have been identified within major conurbations, within smaller town centres

with congested traffic and alongside dual carriageways and motorways in more rural locations.

Whilst industrial sources may make a contribution to local pollutant levels, no exceedences of the objective have been identified as a direct result of these emissions.

Following analysis of monitoring data and results from the last round of review and assessment, guidance suggests that, outside major conurbations, exceedences of the annual mean objective may occur within 10 metres of the kerbside of single carriageway roads, this includes roads with relatively low traffic flows (10,000 – 20,000) vehicles per day, if they are in congested town centres, and is particularly significant where towns have narrow streets with residential properties within 5 metres or so of the kerb. In addition guidance suggests that roads with high flows of buses and/or HGVs may also be at risk of exceeding the objectives.

9.4 Updating And Screening Assessment For NO_2 In The Carlisle City Council Area

The following locations, sources and data will be considered as part of the updating and screening assessment: -

- Summary of first round review and assessment for NO_2.
- New monitoring data.
- Busy streets where people may spend 1 hour or more close to traffic.
- Roads with a high flow of buses or HGVs.
- New roads constructed or proposed since the first round of review and assessment.
- Roads with significantly increased traffic flows.
- Bus stations.
- New significant industrial sources.
- Existing significant industrial sources with substantially increased emissions.
- Aircraft movements.

9.4.1 Summary Of First Round Of Review And Assessment

There were no Part A or B prescribed processes in the authority's area identified as being significant emitters of NO_2.

There were two Part A processes identified in neighbouring authorities that are significant emitters of oxides of nitrogen, located within 25km of this authority's boundaries: UCB films Ltd, Wigton and Chirax Ltd, Annan. However it was determined during the stage 2 review and assessment of these sources that neither plants emissions presented a significant risk of the NO_2 objectives being exceeded.

It was considered that the major source of local NO_2 within the district came from road traffic sources. A stage 3 detailed assessment was undertaken on road traffic sources, using a combination of monitoring data and DRMB model screening.

Monitoring was undertaken at 22 monitoring sites using diffusion tubes and one continuous monitoring unit. The tubes were distributed to cover different relevant location types, including roadsides, shopping areas, urban and suburban areas and two rural towns. The roadside sites are deemed to be the most heavily trafficked roads around the city. The monitoring programme was structured to assess areas of highest pollution concentrations, 'the hot spots' where there is the highest likelihood of the objectives being exceeded.

Results over the period 1995 – 1999 showed the measured annual means to be above the 2005 objective for the majority of roadside sites. However it was predicted that with existing national policies in place to reduce NO_2 emissions, projected levels in 2005 would fall below the 2005 objective. At the busiest roadside site, Scotland Road, the predicted annual mean in 2005 at the most polluted site was $34.2\mu g/m^{-3}$.

The only source of long-term hourly data is from the air quality monitoring unit on Scotland Road. Ratified data from the unit for the period 24.04.99 to 27.02.03 showed the 99.8 percentile level (the level which allows 18 hourly exceedences per year) for Carlisle to be $93\mu g/m^{-3}$; less than half the hourly objective level of $200\mu g/m^{-3}$. As this was alongside a busy road it was concluded that even the busiest roadside sites in the city can be expected to be under the annual objective by 2005.

9.4.2 New Monitoring Data

Monitoring has continued at the same locations used during the first round of review and assessment, using both diffusion tube samplers and a chemiluminescent real time analyser. The QA/QC procedures for both measurement techniques are shown in Appendix. The NO_2 diffusion tube site locations and classifications are shown below (and are marked on the maps in Appendix (9)). The chemiluminescent analyser is located adjacent to the busiest section of Scotland Road (A7).

9.5 Assessment Of Achieving The Annual Mean Objective

9.5.1 NO_2 Diffusion Tube Sites

9 diffusion tube sites are maintained alongside main roads (roadside sites) around the city. These measure the highest concentrations of nitrogen dioxide to which people may be exposed over an hour and over a year.

A further 10 sites (urban centre, background and suburban) are distanced from busy roads but are in locations where exposure to pollution is prolonged.

The remaining two sites are maintained at roadside locations in the centre of the two largest settlements outside Carlisle City, Brampton (population 4000) and Longtown (population 2000).

A summary of the results of the diffusion tube survey 2000 – 2002 is shown in the table below.

Table 10: Annual Mean NO_2 Concentrations ($\mu g/m^3$) 2000 – 2002

Site N°	Site	Annual mean 2000	Annual mean 2001	Annual mean 2002	Site type
1	225 Wigton Road	21.01	20.475	20.055	Urban Roadside
2	Hardwicke Circus	39.728	39.537	36.481	Urban Roadside
3	45 Scotland Road	46.184	49.125	42.593	Urban Roadside
4	Shaddongate	32.279	34.189	31.897	Urban Roadside
5	328 London Road	23.608	26.549	22.92	Urban Roadside
6	215 Warwick Road	28.841	29.338	27.886	Urban Roadside
7	45 Warwick Road	42.784	44.789	36.672	Urban Roadside
8	Botchergate	38.888	40.11	35.717	Urban Roadside
9	20 Palmer Road	10.238	14.134	12.988	Suburban
10	5 Sanderson Close	15.089	17.381	17.19	Suburban
11	Tourist Information Centre	16.235	15.853	19.959	Urban Centre
12	Fusehill Street	29.796	25.594	25.021	Urban Background
13	Crosshill Drive	19.291	22.156	23.302	Suburban
14	Dale Street	19.291	20.628	20.246	Urban Background
15	Montreal Street	20.055	21.965	18.336	Suburban
16	Croft Terrace	26.931	22.71	20.819	Suburban
17	Silverdale Road	19.864	20.055	20.055	Suburban
18	Strand Road	25.785	23.684	22.92	Urban Background
19	Lowther Street	38.009	35.087	39.537	Urban Roadside

20	Brampton	17.954	17.19	16.426	Urban Roadside
21	Longtown	22.729	22.347	25.594	Urban Roadside

Results show the substantial and marked presence of NO_2 at all roadside sites within the city area with the annual mean 2005 objectives currently being exceeded at two sites: Scotland Road and Warwick Road.

The urban centre, background and suburban sites are all under the 2005 annual mean objectives as are the two main towns outside the city area.

Due to policies brought in at national level, NO_2 levels are expected to decline. The results for the roadside and kerbside sites can be adjusted to estimate the annual mean levels using correction factors provided in the technical guidance, which take account of the expected decline in NO_2 levels.

The estimated annual mean concentrations for each site in 2005 are shown in table (11). The results have been projected forward from each year of monitoring to show the range of estimated future concentrations.

Table 11: Estimated 2005 Annual Mean NO_2 Concentrations ($\mu g/m^3$) – Roadside Sites

Site	Estimated NO_2 2005 Concentrations ($\mu g/m^3$)		
	Projected from 2000 (Correction factor 0.863)	Projected from 2001 (Correction factor 0.892)	Projected from 2002 (Correction factor 0.92)
225 Wigton Road	18.13	18.26	18.45
Hardwicke Circus	34.28	35.27	33.56
Scotland Road	39.86	43.82	39.18
Shaddongate	27.86	30.5	29.34
328 London Road	20.37	23.68	21.09
215 Warwick Road	24.89	26.17	25.65
45 Warwick Road	36.92	39.95	33.74
Botchergate	33.56	35.78	32.86
Lowther Street	32.80	31.30	36.37
Brampton	15.49	15.33	15.11
Longtown	19.61	19.93	23.55

Results indicate that there is a risk of the annual mean 2005 objective being exceeded at the Scotland Road site, based on projections from levels measured in 2001.

However, it should be noted that the data provided by the diffusion tube survey has not been bias adjusted, i.e. it is original data. A recent study revealed a considerable difference in the performance of tubes prepared by different laboratories, and showed that there is a need to determine and allow for the laboratory bias, i.e. to carry out a bias adjustment. Guidance suggests that the bias adjustment factor should be based on collocation of tubes (triplicate) with a chemiluminescence monitor.

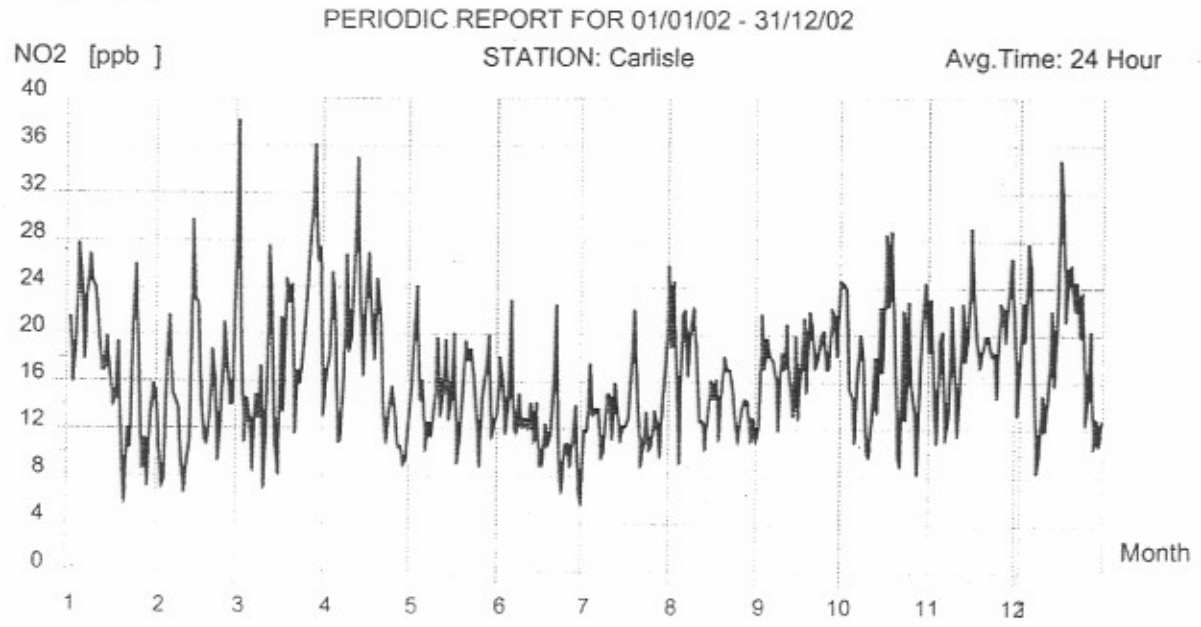
A collocation study was initiated 3 months ago. However with only two months of data obtained so far, there is insufficient information to calculate a bias adjustment. It is the Council's intention to continue with the collocation study in order to determine the bias adjustment, which can then be applied to the diffusion tube measurement data, to correct for any systematic bias.

Data provided by the NO_2 diffusion tubes give a good 'general' indication of average pollution levels for annual mean concentrations and are particularly useful for screening 'hot spots'. Data supplied from their use, during the last round of review and assessment, concluded that Scotland Road was the road most at risk of exceeding the NO_2 objective. For this reason the real time chemiluminescent analyser was placed alongside the busiest section of Scotland Road, approximately 50 yards away from the diffusion tube site.

9.5.2 Chemiluminescent Analyser

NO_2 concentrations measured in 2002 by the chemiluminescent analyser are shown in the graph below.

Graph (4)



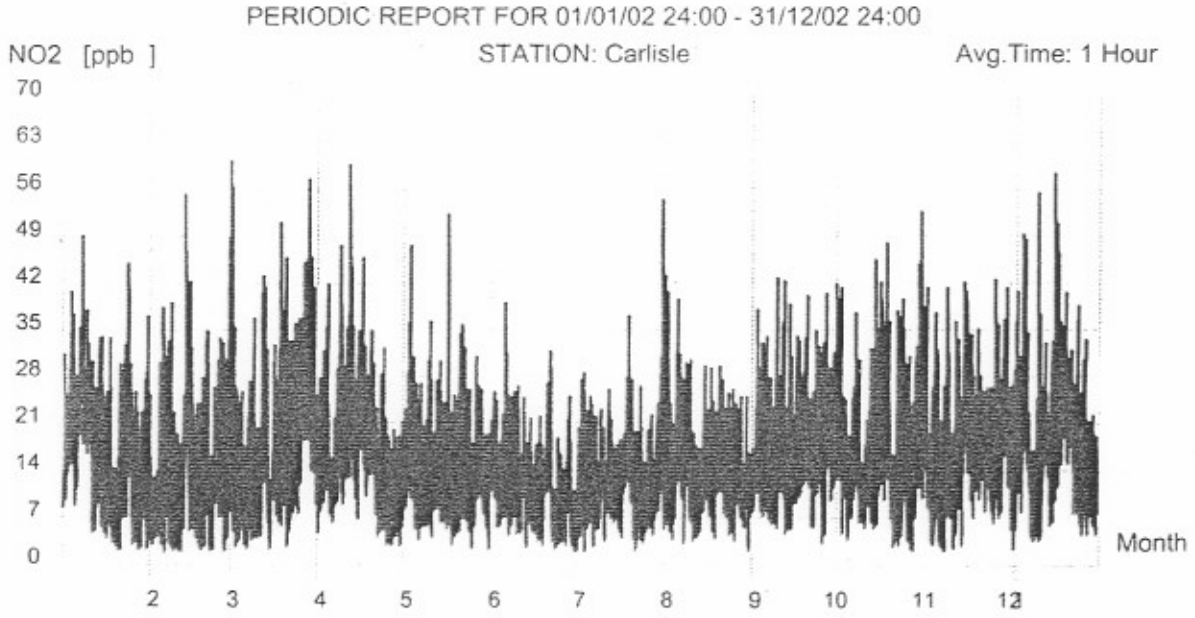
Measurements are in ppb. The annual mean is 16.7ppb, which is equivalent to 31.9 $\mu g/m^3$. The annual mean level in 2002 is therefore well below the 2005 objective.

9.6 Assessment Of Likelihood Of Achieving NO_2 Hourly Objective

Measurements to assess the likelihood of achieving the nitrogen dioxide hourly objective can only be undertaken using a continuous monitor, and therefore has only taken place at Scotland Road.

However, as discussed the unit is alongside a very busy road and at a junction. Results are shown in the graph below.

Graph (5)



Again, measurements are in ppb. The hourly objective not to be exceeded is 200$\mu g/m^{-3}$ which is equivalent to 105ppb. Measurements indicate that there were no exceedences of the hourly objective. It is therefore considered unlikely that there is a significant risk of any parts of the authority area exceeding the hourly objective.

9.6.1 Busy Streets Where People Spend 1 Hour Or More Close To Traffic

Guidance suggests that 'busy' street locations, where members of the public regularly spend 1 hour or more within 5 metres of the kerb, e.g. streets with many shops or with outdoor cafes/bars, may be at risk of exceeding the 1 hour objective. A 'busy' street is taken to be one with more than 10,000 vehicles per day. There are no street locations outside the city area where vehicle flows exceed 10,000.

Within the city, the main shopping area is both centralised and pedestrianised. Whilst there are a number of shops and café/bars along roads leading in to the city centre, including Botchergate and Lowther Street, there are no locations outside the pedestrianised shopping area where it is considered that members of the public are likely to spend 1 hour or more.

9.6.2 Roads With A High Flow Of Buses And/Or HGVs

As with PM_{10}, guidance suggests that there may be a risk of exceeding the NO_2 objectives alongside roads with an unusually high proportion of heavy duty vehicles. An unusually high proportion is taken to be greater than 25%. Data supplied by the Highways Agency indicates that there are no roads which meet this criteria in locations where there is relevant exposure.

9.6.3 Assessment

As with PM_{10}, guidance suggests that there is a risk of exceedences alongside new roads where traffic flows are greater than 10,000 per day and alongside roads with significant changes in flow, due to the proposed route.

The proposed CNDR route and its effect on resulting traffic flows is discussed in detail in section 7.4.4. It is considered unlikely that the proposed road presents a risk of exceeding the NO_2 objectives.

9.6.4 Roads With Significantly Changed Traffic Flows

Data supplied by the Highways Agency indicate that there are no roads within the authority's area which have experienced a 'significant' increase in traffic flows. 'Significant' is taken to be more than 25% increase in traffic flow.

9.6.5 Bus Stations

There is only one bus station located within the authority's area, at Lonsdale Street in Carlisle. Guidance suggests concentrated bus movements (greater than 1000 buses a day) may lead to a risk of exceedence of the 1 hour objective. A bus coming into the bus station then going out is treated as two movements.

Information supplied by the Station operators, Stagecoach, indicates that there are no greater than 400 vehicle movements per day to and from the Station.

The vehicle flow is therefore well below the threshold likely to give rise to an exceedence.

9.6.6 New Industrial Sources

There have been no new industrial sources introduced into the authority's area or in neighbouring authorities which may release significant quantities of nitrogen dioxide.

9.6.7 Industrial Sources With Substantially Increased Emissions

There were no sources identified during the first round of review and assessment as being potentially significant emitters of nitrogen dioxide.

9.6.8 Aircraft

Guidance suggests that there may be a risk of exceeding the 2005 objective for NO_2 where there is relevant exposure within 1000m of the airport boundary and the expected total equivalent passenger throughput in 2005 is more than 5mppa.

The current and future use of Carlisle airport and locations of relevant exposure is discussed in section 7.6. Predicted scheduled flight passenger numbers for 2005 are 93,956. It is considered unlikely that the total equivalent passenger throughput in 2005 will exceed the threshold likely to give rise to an exceedence.

The development of the airport will however be considered as part of future air quality review and assessments undertaken by the authority.

9.7 Conclusion

This updating and screening assessment has followed the Government's guidance for nitrogen dioxide.

Results for NO_2 diffusion tube monitoring has indicated that there may be a risk of the 2005 annual mean objective being exceeded alongside Scotland Road: However these results have not yet been bias adjusted to take account of any systematic laboratory bias error. A collocation exercise is currently in progress in order to obtain a bias adjustment factor. This will then be used to correct NO_2 diffusion tube results for any systematic error. The outcome of the bias adjustment exercise will determine whether it will be necessary to progress onto a detailed assessment.

Results from the continuous chemiluminescent analyser, which is a more accurate method of monitoring air pollution, and is also located alongside Scotland Road, but 50 yards away from the diffusion tube monitoring site, indicates the NO_2 concentrations are below the annual mean objective.

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2. The Environment Act 1995, The Stationary Office 1995
3. The Air Quality Regulations 2000
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10. Design Manual for Roads and Bridges Screening Model (V1-01), Highways Agency

APPENDIX (1)

Benzene

Summary of maximum running annual mean concentration of benzene ($\mu g/m^3$) measured at national network monitoring sites (1999-2001)				
		Maximum running annual mean concentration		
Site	**Site Classification**	**1999**	**2000**	**2001**
London Marylebone Road	Kerbside	12.8	10.8	6.29
London UCL	Roadside	3.99	3.62	-
Harwell	Rural	1.08	0.88	0.63
London Eltham	Suburban	2.81	2.52	-
Belfast South	Urban Background	2.34	2.15	-
Birmingham East	Urban Background	3.06	2.41	-
Bristol East	Urban Background	3.11	2.62	-
Cardiff East	Urban Background	3.62	3.24	1.79
Edinburgh Medical School	Urban Background	1.98	1.72	1.38
Leeds Potternewton	Urban Background	3.62	2.90	-
Liverpool Speke	Urban Background	2.43	2.54	-
Southampton Centre	Urban Centre	5.10	4.25	-
Middlesborough	Urban Industrial	2.86	2.58	-

Carbon Monoxide

Summary of maximum daily running 8-hour mean carbon monoxide concentration measured at national network monitoring sites (1999-2001)				
		Maximum daily running 8-hour mean concentration		
Site	**Site Classification**	**1999**	**2000**	**2001**
		mg/m^3	**mg/m^3**	**mg/m^3**
West London	Urban background	4.3	4.4	3.8
Wirral Tranmere	Urban background	-	-	2.8
Belfast Centre	Urban centre	4.3	3.5	-
Bradford Centre	Urban centre	6.5	3.8	8.6
Bristol Centre	Urban centre	3.0	5.2	3.2
Cardiff Centre	Urban centre	2.7	2.9	1.9
Coventry Centre	Urban centre	-	1.9	-
Edinburgh Centre	Urban centre	1.7	2.4	5.5
Glasgow Centre	Urban centre	4.5	4.2	8.6
Hull Centre	Urban centre	2.9	2.4	2.2
Leeds Centre	Urban centre	3.9	2.9	4.8
Leicester Centre	Urban centre	2.8	4.5	3.1
Liverpool Centre	Urban centre	2.1	1.6	3.1
London Bloomsbury	Urban centre	3.8	4.9	4.1
London Hackney	Urban centre	5.5	6.3	4.2
London Southwark	Urban centre	4.8	4.9	4.1
Manchester Piccadilly	Urban centre	4.1	2.4	6.1
Newcastle Centre	Urban centre	2.2	1.9	2.1
Plymouth Centre	Urban centre	2.8	3.5	3.4
Sheffield Centre	Urban centre	2.7	3.6	4.9
Southampton Centre	Urban centre	3.4	5.3	4.6

Stoke on Trent Centre	Urban centre	5.9	4.5	9.7
Swansea	Urban centre	2.6	2.8	3.2
Wolverhampton Centre	Urban centre	2.8	3.0	3.7
Middlesborough	Urban industrial	2.0	1.3	4.1
Salford Eccles	Urban industrial	5.1	3.6	5.0
Sheffield Tinsley	Urban industrial	3.4	2.8	3.6
Glasgow Kerbside	Kerbside	4.4	5.0	6.7
London Marylebone Road	Kerbside	8.5	7.5	6.5
Bath Roadside	Roadside	5.2	4.9	3.8
Brighton Roadside	Roadside	4.1	-	3..5
Bristol Old Market	Roadside	5.7	5.7	6.7
Bury Roadside	Roadside	4.4	4.8	5.3
Exeter Roadside	Roadside	6.0	5.6	4.2
Hounslow Roadside	Roadside	5.8	6.3	5.0
Hove Roadside	Roadside	3.6	3.5	2.9
London A3 Roadside	Roadside	3.8	5.5	6.4
London Bromley	Roadside	6.0	5.1	6.4
London Cromwell Rd 2	Roadside	5.1	5.3	4.1
Oxford Centre	Roadside	3.6	2.9	2.6
Southwark Roadside	Roadside	6.5	5.5	5.6
Sutton Roadside	Roadside	4.3	4.1	7.5
Tower Hamlets Roadside	Roadside	6.5	4.6	3.1
London Bexley	Suburban	-	3.5	3.0
London Hillingdon	Suburban	3.0	6.1	4.2
Redcar	Suburban	2.8	1.4	4.5
Aberdeen	Urban background	-	2.3	5.1
Birmingham East	Urban background	4.4	4.4	3.7
Blackpool	Urban background	-	-	5.7
Bolton	Urban background	4.8	5.8	9.6
Coventry Memorial Park	Urban background	-	-	2.0
Derry	Urban background	3.0	2.3	2.4
Glasgow City Chambers	Urban background	4.2	3.9	7.3
Leamington Spa	Urban background	2.9	3.4	2.3
London Brent	Urban background	5.1	7.2	3.9
London Bridge Place	Urban background	3.5	-	-
London N. Kensington	Urban background	3.9	5.8	3.4
Manchester Town Hall	Urban background	4.1	2.8	6.0
Preston	Urban background	-	-	2.7
Reading	Urban background	3.2	2.9	2.7
Sandwell West Bromwich	Urban background	2.2	2.2	-
Southend-on-Sea	Urban background	-	-	2.9
Stockport	Urban background	3.8	3.5	5.9
Thurrock	Urban background	3.4	5.2	3.7

Lead

Summary of annual mean lead-in-air concentrations at national network monitoring sites,1999-2001 (μg/m^3)				
		Annual mean lead-in-air concentration (μg/m^3)		
Site	**Site Classification**	**1999**	**2000**	**2001**
London Cromwell Road 2	Kerbside	0.068	0.032	0.031
Cardiff	Kerbside	0.074	0.029	0.028
Central London	Urban Background	0.036	-	-
Glasgow	Urban Background	0.020	0.017	0.025
Leeds	Urban Background	0.039	0.027	0.031
London Brent	Urban Background	0.049	0.024	0.030
Motherwell	Urban Background	0.016	0.009	0.016
Manchester	Urban Background	0.051	0.022	0.023
Newcastle	Urban Background	0.013	0.008	0.032
Brookside 1	Industrial	0.079	0.034	0.045
Brookside 2	Industrial	0.203	0.524	0.419
Elswick 1	Industrial	0.040	0.023	0.042
Elswick 2	Industrial	0.056	0.046	0.080
Elswick 6	Industrial	0.135	0.110	0.168
IMI 1	Industrial	0.367	0.055	0.043
IMI 2	Industrial	1.432	0.075	0.048

1,3-butadiene

Summary of maximum running annual mean concentrations of 1,3butadiene (μg/m^3) measured at national network monitoring sites (1999-2001)				
		Maximum running annual mean concentration		
Site	**Site classification**	**1999**	**2000**	**2001**
London Marylebone Road	Kerbside	2.25	1.92	1.63
London UCL	Roadside	0.55	0.52	-
Harwell	Rural	0.12	0.10	0.11
London Eltham	Suburban	0.39	0.35	-
Belfast South	Urban background	0.26	0.22	-
Birmingham East	Urban background	0.39	0.34	-
Bristol East	Urban background	0.36	0.29	-
Cardiff East	Urban background	0.46	0.36	0.29
Edinburgh Medical School	Urban background	0.21	0.19	0.20
Leeds Potternewton	Urban background	0.41	0.31	-
Liverpool Speke	Urban background	0.40	0.35	-
Southampton Centre	Urban centre	0.60	0.55	-
Middlesbrough	Urban industrial	0.32	0.22	-

APPENDIX (2)

The Quality System Assurance of the Analysis of Diffusion Tubes

GMSS has a defined quality system which forms part of the UKAS accreditation that the laboratory holds. All accredited methods are fully documented.
UKAS assessors visit on an annual basis and review all aspects of the analysis from sample handling to analysis and reporting.
As a condition of accreditation the laboratory is required to participate in any suitable external proficiency schemes in operation. GMSS participates in the WASP scheme organised by the Health and Safety Laboratory.
Any result from such a scheme that falls outside the relevant limits is immediately investigated and steps taken to rectify the situation. All external proficiency scheme results are also assessed by the Quality Manager at GMSS.

The Quality Manager also carries out internal audits.

AQC and Calibration

Nitrogen dioxide tubes

Calibration
The instrument is calibrated twice daily, using a series of calibration standards to ensure a satisfactory linear response is obtained. A standard check is analysed after every fifty samples to ensure that the calibration is still valid.
Quality Control
A quality control check is run after every ten samples and is assessed against warning and action limits defined in the method. Quality control solutions are prepared from standards supplied by a different vendor to that of the calibration standards.
Any AQC exceeding the action limit or two consecutive warning limits is internally assessed and is reported to the client as an AQC failure.
Blank
The travelling blank is analysed at the same time as the samples, any blank exceeding the currently prescribed maximum is investigated and reported to the client.

Benzene tubes

Calibration
The instrument is calibrated once per sample run (35 samples), using a series of calibration standards to ensure a satisfactory linear response is obtained.
Quality Control
A quality control check is run after every five samples and is assessed against warning and action limits defined in the method. Quality control solutions are prepared from standards supplied by a different vendor to that of the calibration standards.
Any AQC exceeding the action limit or two consecutive warning limits is internally assessed and is reported to the client as an AQC failure.

Blank
A blank is run once per sample run but after comparison with other techniques it has not been found necessary to send out travelling blanks with each set of samples.

Reviews (AQC)
The quality policy demands annual reviews of AQC data, the limits may be revised after such a review.

Quality Control limits (as at 7/12/99)

	Nitrogen dioxide	Benzene
Warning	96–104% at the 0.5μg/ml level	91–109% at the 250mg level
Action	93-106% at the 0.5μg/ml level	86.5-113.5% at the 250mg level
Blank	0.11μg/ml	n/a

Additional points not covered above.

Nitrogen dioxide

Nitrogen Oxide tubes are prepared using 10% TEA in water to which a small quantity of surfactant is added. A field intercomparison exercise (organised by AEA Technology) in which tubes prepared by GMSS are exposed alongside a continuous Nox meter has produced acceptable results.

The limits applied by AEA are a basis of +/-25% and a standard deviation of 3ppb.

Benzene

These are supplied with a mesh inlet but do not contain a membrane.

The tubes for benzene sampling are packed with Chromosorb 106.

The uptake rate for these tubes is:-

0.54 ml/min (or 1.72 ng/ppm/min)
data taken form MDHS 80 – Volatile organic compounds in air.

Wasp Results for NO_2 tubes date 14.08.02

Lab result	Assigned Value
0.50	0.45
% Bias	11:11
Z Score	0.855
Performance Classification	Good

Wasp Results for Benzene tubes

Number of Outlets	0
Performance Index	174
Running Performance Index (RPI)	190
Performance Category	2

Results of 2001 Intercomparison Exercise

% bias in period 1	5.0
% bias in period 2	26.5
Precision in period 1	6.31
Precision in period 2	8.94

Results were within $\pm$ 25% of the reference value and therefore deemed satisfactory.

APPENDIX (3)

Screening Assessment for Domestic Solid Fuel Burning and Exceedence of the PM_{10} Objectives

Step 1

Identify the area with the highest density of solid fuel burning houses.

Step 2

Calculate the effective number of coal burning houses **[Ceff]** in the 500m x 500m grid:

[Ceff] = **[C]** + (0.36*[**A**]) + (0.56*[**S**]) + (0.79*[**W**]), where:

Ceff is the effective number of coal-burning households;
[C] is the number of coal burning households;
[A] is the number of anthracite burning households;
[S] is the number of smokeless-fuel-burning households; and
[W] is the number of wood-burning households

In the case of Longtown, **[Ceff]** = 33 + (0.36*33) + (0.56*4) + (0.79) = 47

Step 3

The density of effective coal-burning houses **[Deff]** per 500m x 500m area is then given by the following equation:

[Deff] = [Ceff]/(1-L)

Where **L** = proportion of open space (in this case 70%) equal to 0.7

[Deff] = 47/(1-0.7) = 157 houses per 500 x 500 m area

Step 4

Estimate the 2004 and 2010 background concentrations from the internet maps $[^{B}_{2004}]$ and $[^{B}_{2010}]$. In this case $[^{B}_{2004}]$ = 13.5μg/m^3 gravimetric, and $[^{B}_{2010}]$ is 12.8μg/m^3 gravimetric.

Step 5

Using the figures below the threshold density of effective coal-burning houses in 2004, with an annual mean background of 13.5μg/m^3 is more than 350. The actual density of effective coal-burning houses **[Deff]** is 157, which is below the threshold number. It is very unlikely that the 2004 objectives will be exceeded, and the authority need proceed no further.

Step 6

The threshold number of effective coal-burning houses in 2010 with an annual mean background of 13.5μg/m^3 is 130. The actual number of effective coal-burning houses **[Deff]** is 157 which is above the threshold number. There is therefore a potential that the provisional 2010 annual mean objective will be exceeded.

Figure 8.8: Estimated density of coal-burning households in a 500 x 500 m area which may give rise to an exceedence of the 24-hour mean PM_{10} objective in 2004.

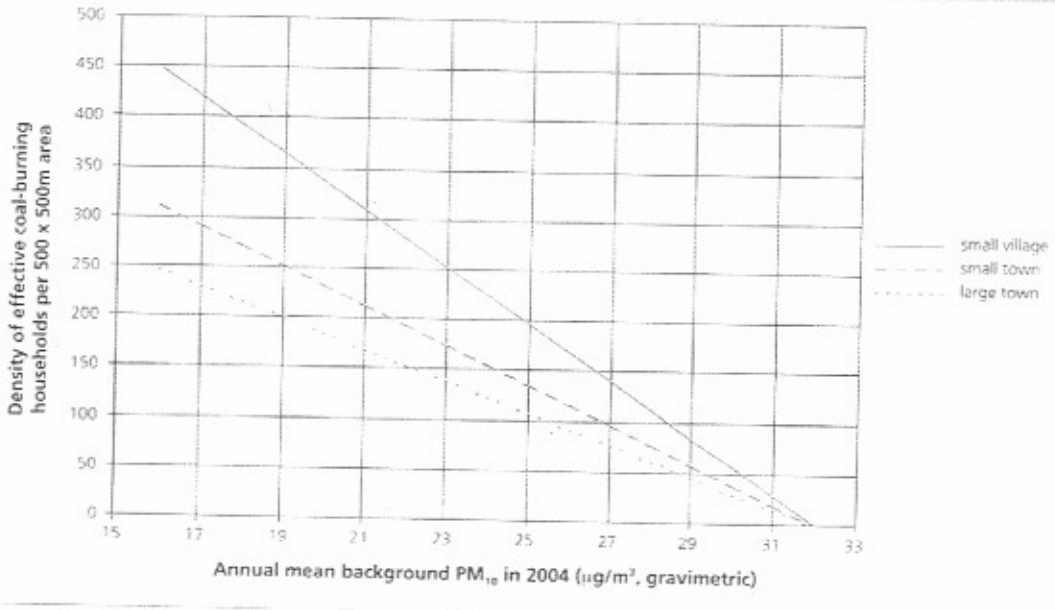
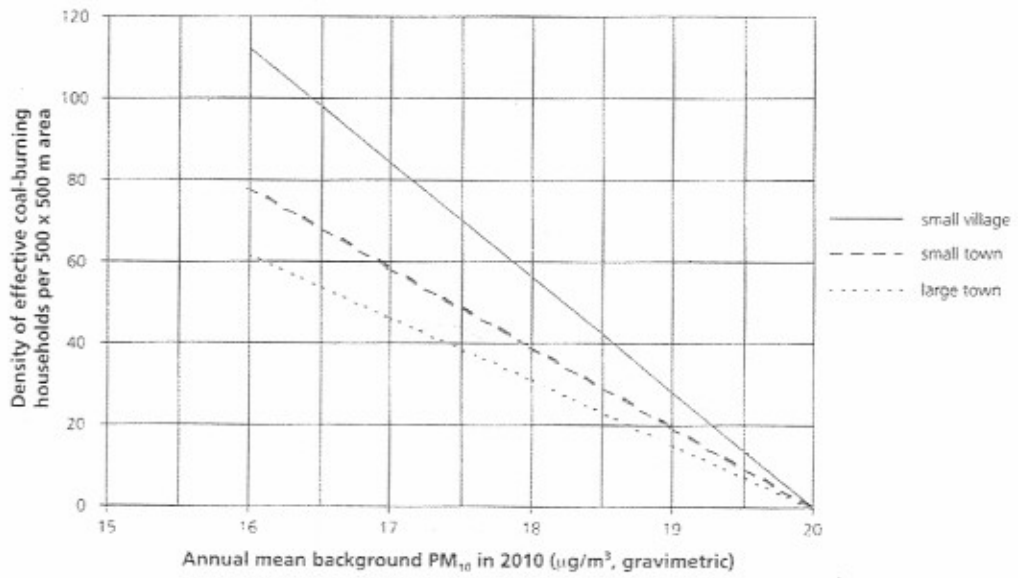


Figure 8.9: Estimated density of coal-burning households in a 500 x 500 m area which may which may give rise to an exceedence of the 2010 annual mean PM_{10} objective.



APPENDIX (4) (a)

Significant Processes Lists

Part A processes likely to require Review and Assessment analysis

The numbers below indicate how significant the process is likely to be for each pollutant as a % of the total part A emission in 2000. A blank cell indicates that the process can be ignored. 0 indicates and emission is likely but small in comparison to other sources.

Processes are in order of general significance:

Process ID	IPC Process Name	CO	Nox	PM	SO2	Lead	Benzene	1,3-Butadiene
2.1	**IRON AND STEEL**	57	19	61	9	37		
1.4	**PETROLEUM PROCESSES**	0	16	4	15	0	73	2
4.1	**PETROCHEMICAL PROCESSES**	0	0		0		2	95
1.3	**COMBUSTION PROCESSES**	1	34	13	45	2	0	0
2.2	**NON-FERROUS METALS**	17	1	4	7	23		
4.2	**MANUFACTURE AND USE OF ORGANIC CHEMICALS**	0	0	0	0	35	0	3
1.2	**CARBONISATION AND ASSOCIATED PROCESSES**	2	6	2	10	2	12	
3.1	**CEMENT/ LIME MANUFACTURE AND ASSOCIATED PROCESSES**	1	9	7	3	1	7	0
4.4	**PROCESSES INVOLVING HALOGENS**	19	1	0	0		0	
3.6	**CERAMIC PRODUCTION**	1	0	4	9			
1.1	**GASIFICATION AND ASSOCIATED PROCESSES**	0	4		0		5	
4.5	**INORGANIC CHEMICAL PROCESSES**	1	4		0	1		
6.3	**TAR AND BITUMEN PROCESSES**	0	0	3	1		1	
4.6	**CHEMICAL FERTILISER PRODUCTION**	0	1	2				
3.3	**OTHER MINERAL FIBRES**	0	1	1	0	0		
5.1	**INCINERATION**	0	2	0	0	0		
6.1	**PAPER AND PULP MANUFACTURING PROCESSES**	0	0	0	0			
4.3	**ACID PROCESSES**	0	0	0	0		0	
3.5	**GLASS MANUFACTURE AND PRODUCTION**		0			0		
5.2	**RECOVERY PROCESSES**	0	0	0	0	0	0	
6.9	**TREATMENT/PROCESSING OF ANIMAL OR VEGETABLE MATTER**	0		0				

Process ID	IPC Process Name	CO	Nox	PM	SO2	Lead	Benzene	1,3-Butadiene
5.3	**PRODUCTION OF FUEL FROM WASTE**	0	0					
6.5	**COATING PROCESSES AND PRINTING**		0	0				
3.2	**PROCESSES INVOLVING ASBESTOS**			0				
6.2	**DI-ISOCYANATE PROCESSES**			0			0	
4.7	**PESTICIDE PRODUCTION**			0				
2.3	**SMELTING PROCESSES**	0		0	0	0		
3.4	**OTHER MINERAL PROCESSES**			0				
4.8	**PHARMACEUTICAL PRODUCTION**							
4.9	**STORAGE OF CHEMICALS IN BULK**						0	
6.4	**PROCESSES INVOLVING URANIUM**							
6.6	**MANUFACTURE OF DYESTUFFS/PRINTING INK/COATING MATS**			0	0			
6.7	**TIMBER PROCESSES**							
6.8	**PROCESSES INVOLVING RUBBER**							0
7.0	**SEWAGE TREATMENT WORKS**							

Part B/A2 processes likely to require Review and Assessment analysis

The following table gives an indication (x) of those processes most likely to release significant quantities of the specified substances to air.

Process	PG Note(s)	Carbon Monoxide	Benzene	1,3-Butadiene*	Sulphur dioxide **	Nitrogen Oxides	Lead	PM_{10}
Waste Oil Combustion								
Combustion Plant 20-50 mwth					X			X
WDF Combustion <3 mwth								
Reheat furnaces 20-50 mwth					X			X
Processes for the storage, loading & unloading of petrol at terminals			X					
Unloading of petrol into storage at service stations								
Furnaces for extraction of non-ferrous metals from scrap							X	
Galvanising								
Electrical and Rotary Furnaces							X	
Foundry Processes								

Process	PG Note(s)	Carbon Monoxide	Benzene	1,3-Butadiene*	Sulphur dioxide **	Nitrogen Oxides	Lead	PM_{10}
Hot land cold blast cupolas					X		X	
Aluminium & aluminium alloy processes					X		X	
Zinc & zinc alloy processes					X		X	
Copper & copper alloy processes					x		X	
Metal decontamination								
Blending, packing, loading and use of bulk cement								
Manufacture of heavy clay goods and refractory goods					X			
Glass (excluding lead glass) manufacturing processes					X	x		
Lead glass manufacturing processes					x		X	
Coal, coke, coal product and petroleum coke processes								X
Exfoliation of vermiculite and expansion of perlite								
Quarry processes								X
Plaster processes								
Lime processes								
Roadstone coating					X			x
China and ball clay processes involving the spray drying of ceramics								X
Processes for the surface treatment of metals								
Incineration processes								
Crematoria								
Processes for the manufacture of particleboard & fibreboard								
Textile & fabric coating processes (where nitrogen containing solvents are used)								
Manufacture of coating powder								X
Coil coating (where nitrogen containing solvents are used)								X
Heat set web offset printworks								
Rubber processes				X				x
Powder coating processes								
Metal and other thermal spraying process								

* Only if 1,3-butadiene is used as part of the process.
** Only if process burns coal or heavy fuel oil.

APPENDIX 4 (b)

List of Part B Processes Within Authority

Asda Carlisle Petrol Filling Station EPA/001

Full Name: The Manager
Job Title: EPA/001
Company: Asda Carlisle Petrol Filling Station
Chandler Way
Parkhouse
Kingstown Industrial Estate
CARLISLE
Cumbria
CA3 0JQ
Home: £122.00
Other: Vapour Recovery

Brunton Park Service Station EPA/055

Full Name: Mr M Taylor
Job Title: EPA/055
Company: Brunton Park Service Station
Warwick Road
CARLISLE
Cumbria
CA1 2RZ
Home: £122.00
Other: Vapour Recovery

Carleton Filling Station EPA/064

Full Name: W M Collin
Job Title: EPA/064
Company: Carleton Filling Station
London Road
CARLISLE
Cumbria
CA4 0AA
Home: £122.00
Other: Vapour Recovery

Corby Hill Garage EPA/063

Full Name: Mr Michael Collin
Job Title: EPA/063
Company: Corby Hill Garage
Corby Hill
CARLISLE
Cumbria
CA4 8PL
Home: £122.00
Other: Vapour Recovery

Currock Service Station EPA/054

Full Name: The Manager
Job Title: EPA/054
Company: Currock Service Station
Currock Road
CARLISLE
Cumbria
CA2 4AS
Home: £122.00
Other: Vapour Recovery

Golden Fleece Filling Station, EPA/065

Full Name: Mr M Exelby
Job Title: EPA/065
Company: Golden Fleece Filling Station
Exelby Services Ltd
Londondary garage
Northallerton
DL7 9NE
Bus: Vapour Recovery
Home: £122.00

Hardwick Circus Petrol Filling

Full Name: Hardwick Circus Petrol Filling Station
Job Title: EPA/068
Company: Hardwick Circus
CARLISLE
Cumbria
Home: £122.00
Other: Vapour Recoveruy
Invoice to: The Secretary
Shell UK Products Limited
Retail
PO Box 403
Staines
TW18 3ZB

Harraby Green Serv. Stat. EPA/006

Full Name: Harraby Green Service Station
Job Title: EPA/006
Company: London Road
CARLISLE
Cumbria
CA1 2PR
Home: £122.00
Other: Vapour Recovery

James Street Service Station EPA/053

Full Name: Mr M Bell
Job Title: EPA/053
Company: James Street Service Station
James Street
CARLISLE
Cumbria
CA2 5AH
Home: £122.00
Other: Vapour Recovery

Kingstown Filling Station EPA/062

Full Name: Mr Michael Collin
Job Title: EPA/062
Company: Kingstown Filling Station
Kingstown Road
CARLISLE
Cumbria
CA3 0BN
Home: £122.00
Other: Vapour Recovery

Morrisons Petrol Service Station EPA/010

Full Name: The Manager
Job Title: APA/010
Company: Morrisons Petrol Service Station
Kingstown Road
CARLISLE
Cumbria
CA3 0BJ
Home: £122.00
Other: Vapour Recovery

Moss Filling Station EPA/061

Full Name: Moss Filling Station
Job Title: EPA/061
Company: Todhills
CARLISLE
CA6 4HA
Other: £122.00

Newby West Filling Station EPA/032

Full Name: Mr N Edgar
Job Title: EPA/032
Company: Newby West Filling Station
Wigton Road
CARLISLE
Cumbria
CA2 6QU
Home: £122.00
Other: Vapour Recovery
Invoice to: Mr Michael Collin
Hills of Corby Hill
Corby Hill Garage
CARLISLE
CA4 8PL

Shell Carlisle North EPA/069

Full Name: Mr James Flynn, SIte Cost Administrator
Job Title: EPA/069
Company: Shell Carlisle North
A74, North Bound
Todhills
CARLISLE
CA6 4HA
Home: £122.00
Other: Vapour Recovery
Invoice to: Mr James Flynn
Site Cost Administrator
Shell UK Retail
PO Box 403
Staines
TW18 3ZB
Tel: 01784 897700

Solway Main Service Station EPA/056

Full Name: Mr R Etheridge
Job Title: EPA/056
Company: Solway Main Service Station
Church Street
CARLISLE
Cumbria
CA2 5TJ
Home: £122.00
Other: Vapour Recovery

Tesco Filling Station EPA/058

Full Name: The Manager
Job Title: EPA/058
Company: Tesco Filling Station
Warwick Road
CARLISLE
Cumbria
CA1 2SB
Home: £122.00
Other: Vapour Recovery
Invoice to: Rory Hennessy
Tesco Stores Limited
PO Box 400, Cirrus Building
Shire Park,
WELWYN GARDEN CITY
AL7 1AB

Tuddenhams (Longtown) Ltd EPA/009

Full Name: Mr A Tuddenham
Job Title: EPA/009
Company: Tuddenhams (Longtown) Ltd
Bridge Street Garage
Longtown
Nr CARLISLE
Cumbria
CA6 5UD
Home: £122.00
Other: Vapour Recovery

Whiteclosegate Filling Station EPA/060

Full Name: The Manager
Job Title: EPA/045
Company: Whiteclosegate Filling Station
Brampton Old Road
CARLISLE
Cumbria
CA3 0JN
Home: £122.00
Other: Vapour Recovery

APPENDIX (5)

Maps of Estimated Ambient Air Pollution


Estimated annual mean background Benzene concentration, 2010 (ugm-3)
Below 0.3
0.3 - 0.5
0.5 - 0.8
0.8 - 1.1
1.1 - 1.3
Above 1.3
No Data

APPENDIX (6)

6.1 Air Quality Monitoring Unit

Site type

Roadside (a defined category in the national automatic monitoring network; between 1-5m of a busy road)

Site selection

Data from the city's network of diffusion tubes indicated that the highest levels of nitrogen dioxide in the city were along the southern extent of Scotland Road; a road carrying about 34,000 vehicles per day in 1999 at its busiest point. This road is fronted by Victorian terraces within 10m of the road's edge and has shops and bus stops along it. The intention was to obtain readings alongside the busiest road to measure the "worst case" for air pollution in the urban area.

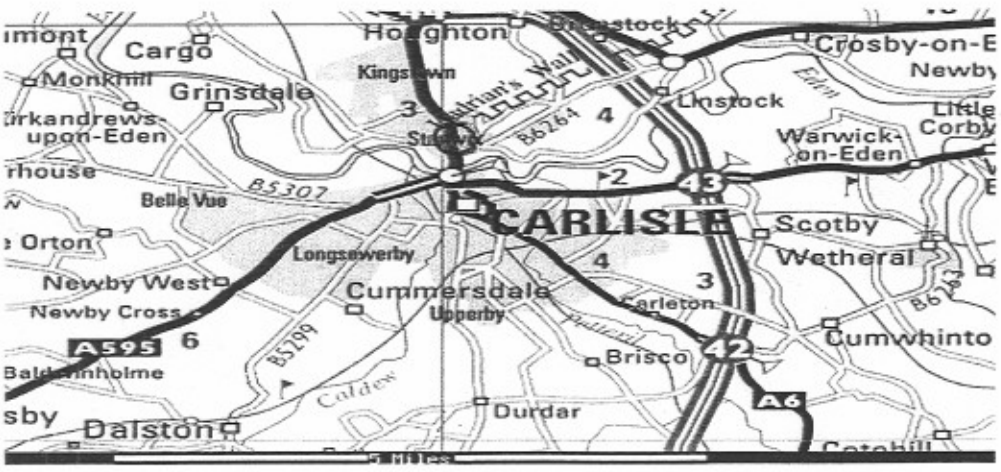
Measurement methods

Nitrogen dioxide analyser: Chemiluminescent analyser with single channel detector by Monitor Labs, 6 Inverness Drive East, Colorado, USA. Measurements of NO_{x1} NO_2 and NO in ppb and ug/m^3 logged every 15 mins. As used by UK AUN sites. Further details from www.monitorlabs.com

Fine particulates: Tapered Element Oscillating Microbalance (TEOM) by Rupprecht & Patashnick Co. Inc., 25 Corporate Circle, Albany, N.Y., USA. Measures PM_{10} every 15 mins. As used by UK AUN sites. Further details from www.rpco.com.

Location of unit

Grid reference: NY4002-5570 (location circled on map below)



Quality Assurance/ Quality Control

Oxides of nitrogen analyser: Automatic calibration daily at 0100 hrs, with calibration data logged and used subsequently to correct and scale data. Periodic manual calibrations. "Zero" gas and "Span" gas to BS8327. Data screened daily at Enview PC, once polled from Envidas logger. Data ratified every 3 months.

TEOM analyser: No calibration necessary. Filter changed once loading reaches 95%

Complete unit: Full service every 6 months by ETI service engineers, including replacement of all filters, efficiency check, calibration etc.

References

Routine reference to TG1(00) "monitoring air quality", DETR.

Data capture

Data capture 01/01/02 to 31/12/02: -

NO_2 97.7%

PM_{10} 98.8%

APPENDIX (7)

Approach To Correcting Measured Pm_{10} Concentrations To 2004

Monitoring data for 2002 is available for the calendar year. The data has been measured using a TEOM analyser. The annual mean concentration **[CT_{2002}]** is 19.7μg/m^3 and is corrected as follows: -

Step 1: Adjust the TEOM data to estimate gravimetric values by multiplying by 1.3
[CG_{2002}] = [CT_{2002}] x 1.3, 19.7 x 1.3 which is equal to 25.6μg/m^{-3} gravimetric.

Step 2: Derive the local secondary PM_{10} concentration from the internet maps for 2001 **[$Csec_{2001}$]**.
[$Csec_{2001}$] = 4.3μg/m^3

Step 3: Estimate the local secondary PM_{10} concentration in 2002 **[$Csec_{2002}$]** using the correction factors, i.e. **[$Csec_{2002}$] = [$Csec_{2001}$]** x 0.977 = 4.2011

Step 4: Estimate the local primary PM_{10} concentration in 2002 **[$Cprim_{2002}$]** by subtracting the 2002 secondary concentration and the PM_{10} coarse concentration (assumed to be 10.5μg/m^3 gravimetric) from the measured PM_{10} concentration, i.e. **[$Cprim_{2002}$] = [CG_{2002}] - [$Csec_{2002}$]** − 10.5 = 10.9

Step 5: Adjust the local primary PM_{10} concentration in 2002 to the future interest e.g. 2004 **[$Cprim_{2004}$]** using the correction factors in Box 8.7, i.e. **[$Cprim_{2004}$] = [$Cprim_{2002}$]** x (0.930/0.977) = 10.37

Step 6: Calculate the secondary PM_{10} in the same future year **[$Csec_{2004}$]**, using the correction factors, i.e. **[$Csec_{2004}$] = [$Csec_{2001}$]** x 0.932 = 4

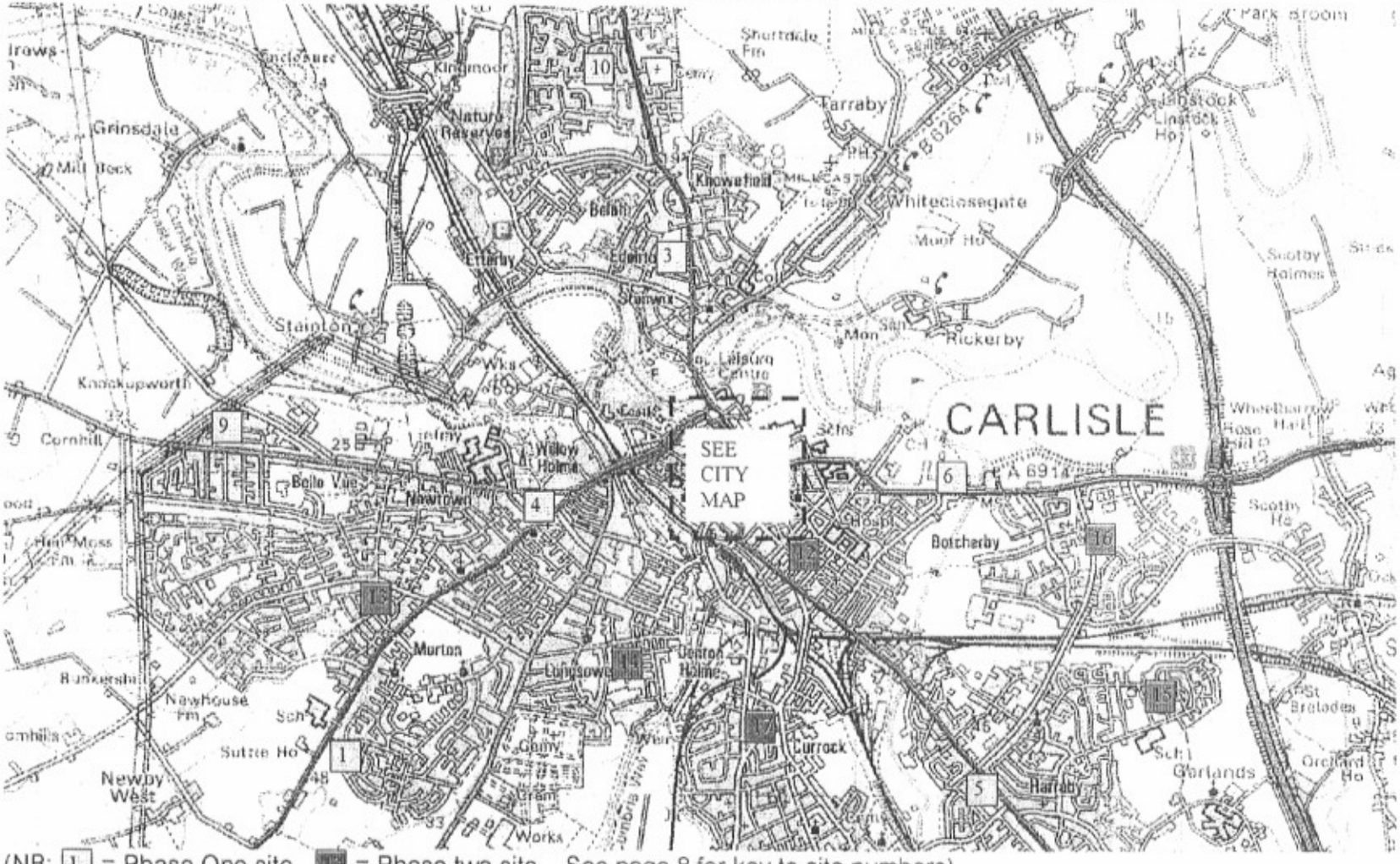
Step 7: Calculate the total estimated PM_{10} concentration in 2004 by adding the components together, i.e. **[CG_{2004}] = [$Cprim_{2004}$] + [$Csec_{2004}$]** + 10.5μg/m^3 gravimetric **= 24.87μg/m^{-3}**

Correction factors to estimate secondary PM_{10} and primary combustion PM_{10} concentrations in future years from 2001 mapped data.

Year	Correction factor to be applied	
	Secondary PM_{10}	Primary combustion PM_{10}
1996	1.571	1.367
1997	1.340	1.289
1998	1.062	1.207
1999	0.972	1.158
2000	0.891	1.025
2001	1.000	1.000
2002	0.977	0.977
2003	0.955	0.954
2004	0.932	0.930
2005	0.909	0.907
2006	0.886	0.890
2007	0.864	0.870
2008	0.841	0.850
2009	0.818	0.832
2010	0.795	0.815

APPENDIX (9a)

7.3.1 LOCATIONS OF NO_2 DIFFUSION TUBE SITES IN CARLISLE CITY – EXCLUDING CITY CENTRE



(NB: 1 = Phase One site, ■ = Phase two site. See page 8 for key to site numbers)

APPENDIX (9b)

7.3.2 MAP OF NO_2 DIFFUSION TUBE SITES - CARLISLE CITY CENTRE