Report

Air Quality Updating and Screening Assessment for Perth & Kinross Council

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Executive Summary

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality which culminated in the Environment Act, 1995. The Air Quality Strategy[1] provides a framework for air quality control through air quality management and air quality standards. These and other air quality standards[a] and their objectives have been enacted through the Air Quality Regulations in 1997, 2000 and 2002[2]. The Environment Act 1995 requires Local Authorities to undertake air quality reviews. In areas where an air quality objective is not anticipated to be met, Local Authorities are required to establish Air Quality Management Areas and implement action plans to improve air quality.

The first round of air quality review and assessments has been completed by Perth and Kinross Council. The Council are now required to proceed to the second round of review and assessment in which sources of emissions to air are reassessed to identify whether the situation has changed since the first round, and if so, what impact this may have on predicted exceedences of the air quality objectives.

The second round of review and assessment is to be undertaken in two steps. The first step is an Updating and Screening Assessment, which updates the Stage 1 and 2 review and assessment previously undertaken for all pollutants identified in the Air Quality Regulations. Where a significant risk of exceedence is identified for a pollutant it will be necessary for the local authority to proceed to a Detailed Assessment, equivalent to the previous Stage 3 assessments. Where a local authority does not need to undertake a Detailed Assessment, a progress report is required instead.

This report is an Updating and Screening Assessment for Perth and Kinross Council as outlined in the Government's published guidance.

A First Stage Review and Assessment of September 2002, revised following the updating of the statutory air quality objectives in Scotland in 2000, concluded that levels of benzene, 1,3-butadiene, carbon monoxide and lead were already below the air quality objective levels. A joint first and second stage assessment of sulphur dioxide concluded that levels were already well below the objective levels, and that no significant sources existed within the Council's district, nor in neighbouring districts.

The Second Stage Review and Assessment of NO_2 and PM_{10} concluded that although levels of NO_2 at certain locations in the centre of Perth had been or were close to the objectives, it was unlikely that the objectives would not be achieved in Perth and Kinross. A third stage review and assessment was not therefore undertaken for any pollutants, and no air quality management area has been declared.
The general approach taken to this Updating and Screening Assessment was to:

- Identify the conclusions of the last round of review and assessment for each of the seven pollutants included in the air quality regulations;
- Identify significant sources of emissions to air for the seven pollutants included in the air quality regulations, including major roads and industrial plant;
- Identify new sources not previously considered in the first round of review and assessment;
- Identify any sources for which emissions have changed significantly since the last round of review and assessment;
- Identify and interpret the significance of air quality monitoring data made available since the last round of review and assessment;
- Assess the risk of exceedences of the air quality objectives in locations where relative public exposure may exist using screening models and nomograms; and
- Where necessary, identify locations and pollutants for which further detailed assessment of air quality will be required.

[a] Refers to standards recommended by the Expert Panel on Air Quality Standards. Recommended standards are set purely with regard to scientific and medical evidence on the effects of the particular pollutants on health, at levels at which risks to public health, including vulnerable groups, are very small or regarded as negligible.

This updating and screening assessment has concluded that:

- Nitrogen dioxide predicted concentrations indicate that the annual average objective is likely to be exceeded in 2005 near busy junctions and in street canyons. This has been confirmed from diffusion tube measurements. There are no significant industrial sources of nitrogen dioxide in Perth and Kinross. A detailed assessment is required for nitrogen dioxide.

- The DMRB screening model indicates that the annual mean objective for PM_{10} will be met in 2004 but may be exceeded at relevant locations close to A roads and busy junctions in Perth and Kinross in 2010. The 24 hour mean objective of 50 μgm^{-3} may be exceeded more than 35 times a year in 2004 and 7 times a year in 2010 close to busy road junctions.

It is recommended that a detailed review and assessment is undertaken for nitrogen dioxide and PM_{10} in Perth and Kinross and that monitoring of nitrogen dioxide and PM_{10} is undertaken.

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Acronyms and definitions used in this report

AADTF	Annual Average Daily Traffic Flow
ADMS	an atmospheric dispersion model
AQDD	an EU directive (part of EU law) - Common Position on Air Quality Daughter Directives, commonly referred to as the Air Quality Daughter Directive
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AUN	Automatic Urban Network (DEFRA funded network)
base case	In the context of this report, the emissions or concentrations predicted at the date of the relevant air quality objective (2005 for nitrogen dioxide)
CO	Carbon monoxide
d.f.	degrees of freedom (in statistical analysis of data)
DETR	Department of the Environment Transport and the Regions (now DEFRA)
DEFRA	Department of the Environment, Farming and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EPA	Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards (UK panel)
EU	European Union
GIS	Geographical Information System
kerbside	0 to 1 m from the kerb
Limit Value	An EU definition for an air quality standard of a pollutant listed in the air quality directives
n	number of pairs of data
NAEI	National Atmospheric Emission Inventory
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NRTF	National Road Traffic Forecast
ppb	parts per billion
r	the correlation coefficient (between two variables)
receptor	In the context of this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SD	standard deviation (of a range of data)
SEPA	Scottish Environment Protection Agency
SO_2	Sulphur dioxide
TEA	Triethanolamine
TEMPRO	A piece of software produced by the DEFRA used to forecast traffic flow increases
TEOM	Tapered Element Oscillating Microbalance
TEOM (Grav.)	TEOM Measurements expressed as the equivalent value from a gravimetric monitor
V/V	Volume ratio

Structure of the report

The report is structured as follows:

- **Section 1** summarises the conclusions of air quality review and assessment work to date, the aims of the updating and screening assessment, the approach adopted for the assessment, as well as relevant background information on the Perth and Kinross Council area, and relevant emissions-to-air sources;
- **Section 2** summarises the UK Air Quality Strategy and the function of an updating and screening assessment;
- **Section 3** identifies data used in support of this assessment and highlights significant changes in emissions to air within the Council area since the first round of review and assessment;
- **Sections 4-10** present the review and assessment for each of the seven pollutants included in the Air Quality Regulations;
- **Section 11** presents conclusions and recommendations for further work, where required, for each of the seven pollutants;

1 Introduction to the Updating and Screening Assessment

This section outlines the purpose of this Updating and Screening Assessment for Perth and Kinross Council, and the scope of the assessment.

1.1 PURPOSE OF THE UPDATING AND SCREENING ASSESSMENT

The first round of air quality review and assessments is now complete and all local authorities should have completed all necessary stages. Where the likelihood of exceedences of air quality objectives has been identified in areas of significant public exposure, an air quality management area should have been declared, followed by a further Stage 4 review and assessment, and the formulation of an action plan to eliminate exceedences. Local authorities are now required to proceed to the second round of review and assessment in which sources of emissions to air are reassessed to identify whether the situation has changed since the first round of review and assessment, and if so, what impact this may have on predicted exceedences of the air quality objectives. Such changes might include significant traffic growth on a major road, which had not been foreseen, construction of a new industrial plant with emissions to air, or significant changes in the emissions of an existing plant.

The second round of review and assessment is to be undertaken in two steps. The first step is an Updating and Screening Assessment, which updates the Stage 1 and 2 review and assessments previously undertaken for all pollutants identified in the Air Quality Regulations. Where a significant risk of exceedence is identified for a pollutant it will be necessary for the local authority to proceed to a Detailed Assessment, equivalent to the previous Stage 3 assessments. Where a local authority does not need to undertake a Detailed Assessment, a progress report is required instead.

1.2 OVERVIEW OF APPROACH TAKEN

The general approach taken to this Updating and Screening Assessment was to:

- Identify the conclusions of the last round of review and assessment for each of the seven pollutants included in the air quality regulations;
- Identify significant sources of emissions to air for the seven pollutants included in the air quality regulations, including major roads and industrial plant;
- Identify new sources not previously considered in the first round of review and assessment;
- Identify any sources for which emissions have changed significantly since the last round of review and assessment;
- Identify and interpret the significance of air quality monitoring data made available since the last round of review and assessment;
- Assess the risk of exceedences of the air quality objectives in locations where relative public exposure may exist using screening models and nomograms; and
- Where necessary, identify locations and pollutants for which further detailed assessment of air quality will be required.

1.3 RELEVANT SCOTTISH EXECUTIVE DOCUMENTATION USED

This report takes into account the guidance in LAQM.TG(03)[1], published January 2003.

1.4 POLLUTANTS CONSIDERED IN THIS REPORT

All pollutants included in the Air Quality Regulations[2] for the purposes of Review and Assessment (Table 1.1) have been considered in this report.

Table 1.1 Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 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
Authorities in Scotland and Northern Ireland only[a]	3.25 μg/m^3	running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	running annual mean	31.12.2003
Carbon monoxide			
Authorities in England, Wales and Northern Ireland only[a]	10.0 mg/m^3	maximum daily running 8-hour mean	31.12.2003
Authorities in Scotland only	10.0 mg/m^3	running 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[b]	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)[c]	50 μg/m^3 not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
All authorities	40 μg/m^3	annual mean	31.12.2004
Authorities in Scotland only[d]	50 μg/m^3 not to be exceeded more than 7 times a year	24 hour mean	31.12.2010
	18 μg/m^3	annual mean	31.12.2010
Sulphur dioxide	350 μg/m^3 not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 μg/m^3 not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 μg/m^3 not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

a. In Northern Ireland none of the objectives are currently in regulation. Air Quality (Northern Ireland) Regulations are scheduled for consultation early in 2003.
b. The objectives for nitrogen dioxide are provisional.
c. Measured using the European gravimetric transfer sampler or equivalent.
d. These 2010 Air Quality Objectives for PM_{10} apply in Scotland only, as set out in the Air Quality (Scotland) Amendment Regulations 2002.

2 The UK Air Quality Strategy

The Government prepared the Air Quality Strategy for England, Scotland, Wales and Northern Ireland for consultation in August 1999. It was published in January 2000 (DETR, 2000)[3].

2.1 NATIONAL AIR QUALITY STANDARDS

At the centre of the Air Quality Strategy is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. These standards and associated specific objectives to be achieved between 2003 and 2010 are shown in Table 1.1.

2.1.1 Timescales to achieve the objectives for the pollutants in Air Quality Strategy

In most local authorities in the UK, objectives will be met for most of the pollutants within the timescale of the objectives shown in Table 1.1. It is important to note that the objectives for NO_2 remain provisional. The Government has recognised the problems associated with achieving the standard for ozone and this will not therefore be a statutory requirement. Ozone is a secondary pollutant and transboundary in nature and it is recognised that local authorities themselves can exert little influence on concentrations when they are the result of regional primary emission patterns.

2.2 AIR QUALITY REVIEWS – THE APPROACHES AND EXPECTED OUTCOMES

Technical Guidance has been issued in 'Review and Assessment: Technical Guidance' LAQM.TG (03)[1] to enable air quality to be monitored, modelled, reviewed and assessed in an appropriate and consistent fashion. This updating and screening assessment has considered the procedures set out in this technical guidance.

The primary objective of undertaking a review of air quality is to identify any areas that are unlikely to meet national air quality objectives and ensure that air quality is considered in local authority decision making processes. The complexity and detail required in a review depends on the risk of failing to achieve air quality objectives and it has been proposed therefore that reviews should be carried out in two steps. Both steps of review and assessment may be necessary and every authority is expected to undertake at least a first stage review and assessment of air quality in their authority area. The steps are briefly described in the following table, Table 2.1.

Table 2.1 Brief details of steps in the second Round of the Air Quality Review and Assessment process

Level of Assessment	Objective	Approach
Updating and Screening	To identify those matters that have changed since the last review and assessment, which might lead to a risk of an air quality objective being exceeded	Use a checklist to identify significant changes that require further consideration. Where such changes are identified, then apply simple screening tools to decide whether there is sufficient risk of an exceedence of an objective to justify a Detailed Assessment
Detailed Assessment	To provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure. This should be sufficiently detailed to allow the designation or amendment of any necessary AQMAs	Use quality-assured monitoring and validated modelling methods to determine current and future pollutant concentrations in areas where there is a significant risk of exceeding an air quality objective.
Annual Progress Reports	Local authorities should prepare annual air quality Progress Reports between subsequent rounds of reviews and assessments. The concept is that this will ensure continuity in the LAQM process.	The precise format for the Progress Report has not yet been determined, but will essentially follow the checklist approach that is set out in subsequent chapters of this document. Further details on the Progress Reports will be provided via the Helpdesks by the middle of 2003. It is envisaged that these Progress Reports could be useful for the compilation of annual 'state of the environment' reports that many authorities already prepare .

The current deadline for completion of updating and screening assessments is May 2003, and for detailed assessments April 2004.

2.3 LOCATIONS THAT THE REVIEW AND ASSESSMENT MUST CONCENTRATE ON

For the purpose of review and assessment, the authority should focus their work on locations where members of the public are likely to be exposed over the averaging period of the objective. Table 2.2 summarises the locations where the objectives should and should not apply.

Table 2.2 Typical locations where the objectives should and should not apply

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

Table 2.2 (contd.) Typical locations where the objectives should and should not apply

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

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

3 Information used to support this assessment

This section lists the key information used in this review and assessment.

3.1 CONCLUSIONS FROM THE FIRST ROUND OF REVIEW AND ASSESSMENT OF AIR QUALITY FOR PERTH AND KINROSS COUNCIL

Perth and Kinross Council has completed the following review and assessments of air quality to date:

- Stage 1 (March 1999)[4]
- Stage 1 (revised) and Stage 2 (September 2002)[5]

The reports concluded that a Third Stage review and assessment was not necessary for any pollutants in the strategy, and that Perth and Kinross Council did not need to declare an Air Quality Management Area.

3.2 PROPOSED DEVELOPMENTS WHICH MAY AFFECT AIR QUALITY

3.2.1 Industry

There are no significant industrial developments currently planned in Perth and Kinross

3.2.2 Housing and Redevelopment

Several housing and redevelopment schemes are underway or proposed in Perth and Kinross and these include

Tesco, Crieff Rd, Perth.
Perth Concert Hall
Broxden -Trunk Road Service Area, Park and Ride, and Business Park
Scotland's Garden, Broxden
Almond Valley Development
Oudenarde Village Development
Film studios/ leisure/ housing development, Aberuthven
New Hotel/housing/leisure development, Blackford,
Perth Mart Retail and Leisure Development, Crieff Rd, Perth
Fairies Rd, Perth – 80 house development
Training Facilities, Perth Fire Station

The impact on air quality of the developments has not yet been assessed.

3.2.3 Road

The Perth and Kinross Local Transport Strategy[6] has set targets to encourage the use of alternative transport to cars, particularly in urban areas, and to increase availability of bus services. Road improvement schemes are being prepared by Perth and Kinross Council for the A93 and A827 local routes. The Scottish Executive are being urged to undertake a number of developments on the A90, A9 and A85 trunk roads to ease traffic congestion and improve safety.

3.3 MAPS AND DISTANCES OF RECEPTORS FROM ROADS

Perth and Kinross Council provided electronic OS LandLine™ which was used in the Geographical Information System (GIS) used in assessment. Individual buildings or groups of buildings (receptors) were identified from the electronic OS Landline maps of the areas. The distances of these receptors from the road, and the widths of the roads, were accurately determined from the maps.

3.4 ROAD TRAFFIC DATA

This section summarises the information used in this report; more detailed information is given in Appendix 2. Appendix 2 lists the locations of the traffic flow and speed measurement points, flow and speed data and other relevant traffic statistics.

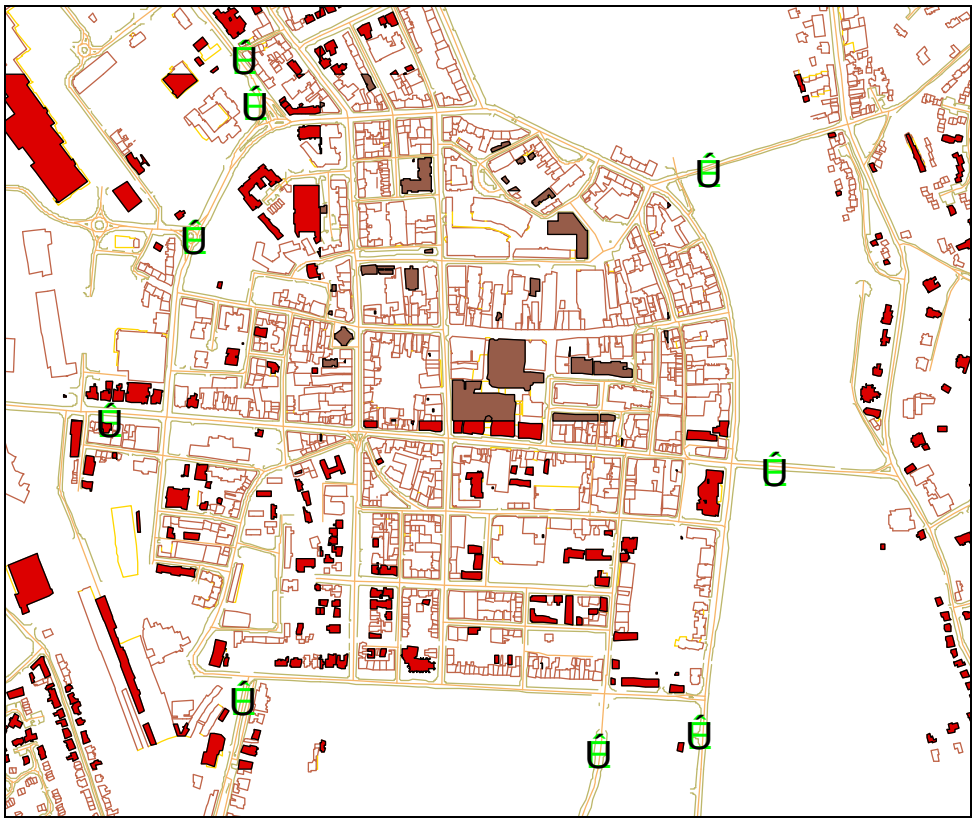
3.4.1 Summary of traffic data provided

Data were collated from a range of sources, including:

- data provided by Perth and Kinross Council for Perth City area (Figure 3.1)
- data held in the National Atmospheric Emissions Inventory (NAEI, 2000) where no other data were available from either Perth and Kinross Council or the Highways Agency.

Where no average speed data were available, estimated speeds were used near receptors and junctions. Speeds slower than the national speed limits have been assigned to sections of roads in areas close to junctions.

Figure 3.1 Traffic Count Points in Perth



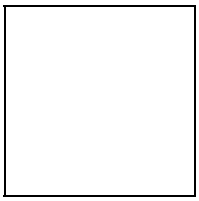


Figure 3.2 Major roads in Perth and Kinross

3.4.2 Fraction of HGVs

Percentages of Cars, LGVs, HGVs and buses were available from the 12-hour manual count data for Perth City. For other road links, the percentage of HGVs was calculated from the data held in the 2000 National Atmospheric Emissions Inventory.

3.4.3 Base year for traffic

The base year for the traffic flows was 2000.

3.4.4 Traffic growth

Traffic growth figures were based on the high side of national growth figures to provide conservative estimates of pollutant concentrations.

3.4.5 Distance from the centre of the road to the kerbside and to the receptors

Road widths and the distances of receptors from the road were taken from the electronic OS Landline™ of the Council area.

3.5 PART A AND B PROCESSES

There are two Part A and 70 Part B Industrial processes in Perth and Kinross. A full list is given in Appendix 3. Emission data for the processes have been supplied by SEPA where appropriate.

3.6 AMBIENT MONITORING

Perth and Kinross Council have undertaken monitoring of the following pollutants in their area:

- Nitrogen dioxide
- Sulphur dioxide
- Carbon monoxide
- Particles (PM_{10})

Full details of the type, locations, and concentrations recorded by the monitors (diffusion tubes and continuous monitors) are given in Appendix 1.

3.6.1 Diffusion tubes

Perth & Kinross Council carry out monitoring of NO_2 by diffusion tubes at a wide range of locations. The tubes are analysed by Dundee City Council Scientific Services.

3.6.2 Continuous monitoring

Concentrations of CO, NO_2, PM_{10} and SO_2 were recorded by a Groundhog continuous monitoring station located at Gowans Terrace Perth (OS grid reference 310946E 725068N) for three one-month periods during 1999-2001.

4 Updating and Screening Assessment for Carbon Monoxide

4.1 THE NATIONAL PERSPECTIVE

The main source of carbon monoxide in the United Kingdom is road transport, which accounted for 67% of total releases in 2000. Annual emissions of carbon monoxide have been falling steadily since the 1970s, 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. Existing policies will be sufficient to reduce maximum daily 8-hour mean concentrations of carbon monoxide below 10 mg m^{-3} by about 2003.

4.2 STANDARD AND OBJECTIVE FOR CARBON MONOXIDE

The Government and the Devolved Administrations have adopted an 8-hour running mean concentration of 11.6 mgm-^{3} as the air quality standard for carbon monoxide. The air quality objective has been set at a slightly tighter level of 10 mg m^{-3} as a running 8-hour mean concentration, to be achieved by the end of 2003, bringing it into line with the second Air Quality Daughter Directive limit value.

4.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR CARBON MONOXIDE

The following conclusions were given for carbon monoxide in the First and Second Stage Review and Assessment for Perth and Kinross:

- National Monitoring data indicate that exceedences of the objective are unlikely to occur in Perth city or the rural areas of Perthshire;
- Local monitoring indicates that levels of carbon monoxide are already well below the objective to be achieved by 2003;
- Current and projected traffic flows are well below those identified as significant by the Technical Guidance (LAQM TG(03)[1]);
- There are no significant current or proposed industrial processes in Perth and Kinross or neighbouring areas, that are likely to cause exceedence of the objective;
- National policy measures are expected to deliver the national air quality objective for carbon monoxide by the end of 2003.

The risk of the air quality objective being exceeded is negligible.

4.4 SCREENING ASSESSMENT OF CARBON MONOXIDE

The Technical Guidance LAQM TG(03) requires assessment of carbon monoxide to consider the following sources, data or locations:

- Monitoring Data
- Very Busy Roads

These are described in the following sections.

4.5 BACKGROUND CONCENTRATIONS FOR CARBON MONOXIDE

The average background carbon monoxide concentration estimated from the UK background maps[7] was 0.13 mgm^{-3} in Perth and Kinross with maximum concentration of 0.21 mgm^{-3} in Perth City.

4.6 SCREENING ASSESSMENT OF MONITORING DATA

Monitoring for carbon monoxide has been undertaken using a Groundhog mobile monitoring station at background locations in Perth City. Data for monitoring periods in 1999, 2000 and 2001 show that maximum 8-hour mean concentrations were less than 3.5 mgm^{-3}.

4.7 SCREENING ASSESSMENT OF VERY BUSY ROADS

The guidance document LAQM TG(03)[1] requires assessment of CO only at 'very busy roads' (Appendix 2 Table A2.1). Traffic flow data were supplied by Perth and Kinross Council and from the NAEI. Based on these data, there are no roads in Perth and Kinross which can be classified as 'very busy' according to the criteria in the guidance.

4.8 CONCLUSIONS FOR CARBON MONOXIDE CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

Carbon monoxide was monitored in Perth City during periods from 1999 to 2001. The maximum running 8-hour mean concentration recorded was less than 3.5 mgm^{-3} which is significantly less than the objective value of 10 mgm^{-3}. There are no roads in Perth and Kinross which can be classified as 'very busy' according to the criteria in the guidance.

Perth and Kinross Council is not required to carry out a Detailed Assessment for carbon monoxide.

5 Updating and Screening Assessment for Benzene

5.1 THE NATIONAL PERSPECTIVE

The main sources of benzene emissions in the UK are petrol-engined vehicles, petrol refining, storage and the distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems. A number of policy measures already in place, or planned for future years, will continue to reduce emissions of benzene. Since January 2000, EU legislation has reduced the maximum benzene content of petrol to 1%, from a previous upper limit of 5%. The European Auto-Oil programme will further reduce emissions for cars and light-duty vehicles, and emissions of benzene from the storage and distribution of petrol are controlled by vapour recovery systems. Forecasts based on national mapping suggest that the policy measures currently in place will achieve the 2003 objective at all urban background and roadside/kerbside locations. Whilst the 2010 objectives are expected to be met at all urban background, and most roadside locations, there is the possibility for some remaining exceedences which will require additional measures at a local level.

5.2 STANDARD AND OBJECTIVE FOR BENZENE

The Government and the Devolved Administrations have adopted a running annual mean concentration of 16.25 μgm^{-3} as the air quality standard for benzene, with an objective for the standard to be achieved by the end of 2003. However, in light of the health advice from EPAQS and the Department of Health's Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (COC) to reduce concentrations of benzene in air to as low a level as possible, additional tighter objectives have also been set. The additional objective is for an annual mean of 5 μgm^{-3} to be achieved by the end of 2010 in England and Wales. In Scotland and Northern Ireland, a running annual mean of 3.25 μgm^{-3} has been adopted as an additional objective, to be achieved by the end of 2010.

5.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR BENZENE

The following conclusions were given for benzene in the First and Second Stage Review and Assessment for Perth and Kinross.

- There are no present or proposed industrial processes in Perth and Kinross, or neighbouring areas, which have the potential, individually or cumulatively, to emit significant quantities of benzene;
- Emissions from vehicles are expected to decrease over the relevant period and national policies are expected to ensure that there will be no exceedences due to petrol stations by 2003;
- Current levels of benzene are estimated to be already below the objective of 16.25 μgm^{-3} in Perth and Kinross;
- National policy measures are expected to deliver the national air quality objective for benzene by the end of 2003.

The objective for benzene will not be exceeded in Perth and Kinross.

5.4 SCREENING ASSESSMENT OF BENZENE

The Technical Guidance LAQM TG(03)[1] requires assessment of benzene to consider the following sources, data or locations:

- Monitoring Data
- Very Busy Roads or Junctions in Built-up Areas
- Industrial Sources
- Petrol Stations
- Major Fuel Storage Depots (Petroleum only)

These are described in the following sections.

5.5 BACKGROUND CONCENTRATIONS FOR BENZENE

The average background benzene concentration in Perth and Kinross, estimated from the UK background maps[7] was 0.05 μgm^{-3}, with maximum concentration of 0.27 μgm^{-3} in Perth City.

5.6 SCREENING ASSESSMENT OF MONITORING DATA

No monitoring of benzene has been undertaken in Perth and Kinross. There is an urban background monitoring station at Edinburgh Medical School. Annual average benzene concentrations measured at this station have been consistently significantly below the objective value of 3.25 μgm^{-3} (Table 5.1).

Table 5.1 Benzene measurements made at Edinburgh Medical School

Year	Benzene µg m^{-3}
1994	2.3
1995	2.4
1996	2.3
1997	1.9
1998	1.8
1999	1.2
2000	1.5
2001	2.3

5.7 SCREENING ASSESSMENT OF VERY BUSY ROADS

The guidance document LAQM TG(03)[1] requires assessment of benzene only at 'very busy roads' (Appendix 2 Table A2.1). Traffic flow data were supplied by Perth and Kinross Council and from the NAEI. Based on these data, there are no roads in Perth and Kinross which can be classified as 'very busy' according to the criteria in the guidance.

5.8 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03) lists the following processes as significant potential sources of benzene:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)
Petroleum processes (73)
Petrochemical processes (2)
Carbonisation processes (12)
Cement/lime manufacture (7)
Gasification processes (5)

Part B
Processes for the storage and unloading of petrol at terminals

None of the Part A or Part B industrial processes in Perth and Kinross (Appendix 3) operate these processes or have the potential to emit benzene.

The Part A refinery process Nynas UK (Appendix 3) in neighbouring Dundee has the potential to emit benzene but is not considered by SEPA to be significant for air quality in Perth and Kinross.

5.9 SCREENING ASSESSMENT OF PETROL STATIONS

There are 27 petrol stations in Perth and Kinross authorised as Part B processes (Appendix 3). Of these, 21 stations have throughput of more than 1 million litres per year (no information is available on the number of stations with a throughput greater than 2 million litres). None of the stations are known to be fitted with Stage 2 vapour recovery systems.

The guidance requires petrol stations to be considered only if they are near a busy road, i.e with more than 30,000 vehicles per day and have a throughput greater than 2 million litres. There are two petrol stations, Inchmichael Garage and Bullion Filling Station, alongside the A90. According to the NAEI 2000 database, the A90 can be classified as a busy road. Based on GIS land line maps supplied by Perth and Kinrosss Council there are no buildings other than those of the petrol station within 10m of the pumps and the council report that there are no places where members of the public might regularly be exposed within 10m of the pumps. A detailed assessment for benzene is not required based on petrol station emissions.

5.10 SCREENING ASSESSMENT OF FUEL STORAGE DEPOTS

There are no major fuel storage depots in Perth and Kinross.

5.11 CONCLUSIONS FOR BENZENE CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

There are no roads in Perth and Kinross which can be classified as ‘very busy’ according to the criteria in the guidance. There are no petrol stations with a throughput greater than 2 million litres and with relevant exposure within 10m of the pumps.

Perth and Kinross Council is not required to carry out a Detailed Assessment for benzene.

6 Updating and Screening Assessment for 1,3-Butadiene

6.1 THE NATIONAL PERSPECTIVE

The main source of 1,3-butadiene in the United Kingdom is emissions from motor vehicle exhausts. 1,3-butadiene is also an important industrial chemical and is handled in bulk at a small number of industrial premises. Maximum running annual mean concentrations of 1,3-butadiene measured at all urban background/centre and roadside locations in the national network are already well below the 2003 objective of 2.25 μgm^{-3}. 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 improvements to fuel quality are expected to further reduce emissions of 1,3-butadiene from vehicle exhausts. These measures are expected to deliver the air quality objective by the end of 2003.

6.2 STANDARD AND OBJECTIVE FOR 1,3-BUTADIENE

The Government and the Devolved Administrations have adopted a maximum running annual mean concentration of 2.25 μgm^{-3} as an air quality standard for 1,3-butadiene. The objective is for the standard to be achieved by the end of 2003.

6.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR 1,3-BUTADIENE

The following conclusions were given for 1,3-butadiene in the First and Second Stage Review and Assessment for Perth and Kinross

- There are no existing or proposed Part A or B processes in Perth and Kinross or neighbouring areas, which have the potential to emit significant amounts of 1,3-butadiene;
- Emissions from vehicles are expected to decrease over the relevant period;
- Current levels of 1,3-butadiene in Perth and Kinross are already below the objective of 2.25 μgm^{-3};
- National policy measures are expected to deliver the national air quality objective for 1,3-butadiene by the end of 2003.

The objective for 1,3-butadiene will not be exceeded in Perth and Kinross

6.4 SCREENING ASSESSMENT OF 1,3-BUTADIENE

The Technical Guidance LAQM TG(03) requires assessment of 1,3-butadiene to consider the following sources, data or locations:

- Monitoring Data
- New Industrial Sources
- Existing Industrial Sources with Significantly Increased Emissions

These are described in the following sections.

6.5 BACKGROUND CONCENTRATIONS FOR 1,3-BUTADIENE

The average background 1,3-butadiene concentration estimated from the UK background maps[7] was 0.03 μgm^{-3} in Perth and Kinross with maximum concentration of 0.11 μgm^{-3} in Perth City.

6.6 SCREENING ASSESSMENT OF MONITORING DATA

No monitoring of 1,3-butadiene has been undertaken in Perth and Kinross. There is an urban background monitoring station at Edinburgh Medical School. Annual average 1,3-butadiene concentrations measured at this station have been consistently significantly below the objective value of 2.25 μgm^{-3} (Table 6.1).

Table 6.1 1,3-butadiene measurements made at Edinburgh Medical School

Year	1,3-bd µg m^{-3}
1994	0.2
1995	0.3
1996	0.2
1997	-
1998	0.2
1999	0.2
2000	0.1
2001	0.2

6.7 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03) lists the following processes as significant potential sources of 1,3-butadiene:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)
Petroleum processes (2)
Petrochemical processes (95)
Organic chemical manufacture (3)

Part B
Rubber processes

None of the Part A or Part B industrial processes in Perth and Kinross (Appendix 3) operate these processes or have the potential to emit 1,3-butadiene.

There are no industrial processes, current or proposed, in neighbouring areas which have the potential to emit 1,3-butadiene.

6.8 CONCLUSIONS FOR 1,3-BUTADIENE CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

Estimated background concentrations and data from national monitoring stations indicate that the objective for 1,3-butadiene is likely to be achieved by the end of 2003. There are no industrial processes, current or proposed, in Perth and Kinross which have the potential to emit 1,3-butadiene.

Perth and Kinross Council is not required to carry out a Detailed Assessment for 1,3-butadiene.

7 Updating and Screening Assessment for Lead

7.1 THE NATIONAL PERSPECTIVE

The agreement reached between the European Parliament and the Environment Council on the Directive on the Quality of Petrol and Diesel Fuels (part of the Auto-Oil Programme) has led to the ban on sales of leaded petrol in the United Kingdom with effect from 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, tank lining and piping.

Detailed assessments of the potential impact of lead emissions from industrial processes have been undertaken by the Government and the Devolved Administrations, based upon both monitoring and sector analysis studies. The former has included a 12-month monitoring survey in the vicinity of 30 key industrial sites in the UK, which has been used to supplement information already provided from the non-automatic monitoring networks. These monitoring data have generally indicated no exceedances of the 2004 or 2008 objectives, although locations in proximity to non-ferrous metal production and foundry processes were deemed to be at risk.

7.2 STANDARD AND OBJECTIVE FOR LEAD

The Government and the Devolved Administrations have adopted an annual mean concentration of 0.5 μgm^{-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 lower air quality objective of 0.25 μgm^{-3} to be achieved by the end of 2008 has also been set.

7.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR LEAD

The following conclusions were given for lead in the First and Second Stage Review and Assessment for Perth and Kinross.

- There are no existing or proposed Part A or B processes in Perth and Kinross, or neighbouring areas, which have the potential to emit significant amounts of lead;
- Levels of lead monitored at Scottish sites were within the UK air quality objective for 2004;
- Estimated current background lead levels in Perth and Kinross are already below the UK air quality objective for 2004;
- National policy measures are expected to deliver the national air quality objective for lead by 2004 and 2008.

The objectives for lead will not be exceeded in Perth and Kinross.

7.4 SCREENING ASSESSMENT OF LEAD

The Technical Guidance LAQM TG(03) requires assessment of lead to consider the following sources, data or locations:

- Monitoring Data outside an AQMA
- New Industrial Sources
- Existing Industrial Sources with Significantly Increased Emissions

These are described in the following sections.

7.5 SCREENING ASSESSMENT OF MONITORING DATA

No monitoring of lead has been undertaken in Perth and Kinross.

7.6 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03) lists the following processes as significant potential sources of benzene:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)
Iron and steel (37)
Non-ferrous metals (23)
Manufacture of organic chemicals (35)

Part B
Non-ferrous metal furnaces
Electrical furnaces
Blast cupolas
Aluminium processes
Zinc Processes
Copper processes
Lead glass manufacture

The only process with the potential to emit lead in Perth and Kinross is the Part A non-ferrous metals at DARA RN Aircraft Workshops (Appendix 3). This plant was not identified as a source of lead in the Second Stage Review and Assessment report. Perth and Kinross Council are not aware of any changes to the output of this plant since that report.

The Part B non-ferrous metals process Dens Metals Ltd (Appendix 3) in neighbouring Dundee has the potential to emit lead but was assessed by SEPA to give rise to an annual mean ground level concentration of less than 0.005 μgm^{-3} which does not exceed the objective for lead.

7.7 CONCLUSIONS FOR LEAD CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

Emissions of lead from industrial processes in Perth and Kinross are not likely to exceed the objectives for lead to be achieved in 2004 and 2008.

Perth and Kinross Council is not required to carry out a Detailed Assessment for lead.

8 Updating and Screening Assessment for Nitrogen Dioxide

8.1 THE NATIONAL PERSPECTIVE

The principal source of NOx emissions is road transport, which accounted for about 49% of total UK emissions in 2000. Major roads carrying large volumes of high-speed traffic (such as motorways and other primary routes) are a predominant source, as are conurbations and city centres with congested traffic. Within most urban areas, the contribution of road transport to local emissions will be much greater than for the national picture.

Meeting the annual mean objective in 2005, and the limit value in 2010, is expected to be considerably more demanding than achieving the 1-hour objective. National studies have indicated that the annual mean objective is likely to be achieved at all urban background locations outside of London by 2005, but that the objective may be exceeded more widely at roadside sites throughout the UK in close proximity to busy road links. Projections for 2010 indicate that the EU limit value may still be exceeded at urban background sites in London, and at roadside locations in other cities.

8.2 STANDARDS AND OBJECTIVES FOR NITROGEN DIOXIDE

The Government and the Devolved Administrations have adopted two Air Quality Objectives for nitrogen dioxide, as an annual mean concentration of 40 μgm^{-3}, and a 1-hour mean concentration of 200 μgm^{-3} not to be exceeded more than 18 times per year. The objectives are to be achieved by the end of 2005.

8.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR NITROGEN DIOXIDE

The following conclusions were given for nitrogen oxides in the First and Second Stage Review and Assessment report for Perth and Kinross:

- Predicted mean background concentrations of oxides of nitrogen are less than 10 μgm^{-3};
- Emissions from industrial processes in Perth and Kinross and neighbouring areas are unlikely to cause exceedence of the objectives;
- Emissions from traffic or other transport sources in Perth and Kinross and neighbouring areas are unlikely to cause exceedence of the objectives;
- Further monitoring data should be compiled at congested junctions and streets and at streets subject to canyon effects in Perth to assess the effect of traffic control measures**;**
- National policy measures are expected to significantly reduce emission from road traffic by 2005.

Local emissions of nitrogen oxides are unlikely to cause exceedence of the objectives in Perth and Kinross.

8.4 SCREENING ASSESSMENT OF NITROGEN DIOXIDE

The Technical Guidance LAQM TG(03)[1] requires assessment of nitrogen dioxide to consider the following sources, data or locations:

- Monitoring data outside an AQMA
- Monitoring data within an AQMA
- Narrow congested streets with residential properties close to the kerb
- Junctions

- Busy streets where people may spend 1-hour or more close to traffic
- Roads with high flow of buses and/or HGVs
- New roads constructed or proposed since first round of review and assessment
- Roads close to the objective during the first round of review and assessment
- Roads with significantly changed traffic flows
- Bus Stations
- New industrial sources
- Industrial sources with substantially increased emissions
- Aircraft

These are evaluated in the following sections.

8.5 BACKGROUND CONCENTRATIONS FOR NITROGEN DIOXIDE

The estimated average background nitrogen dioxide concentration for 2001 was 5.0 μgm^{-3} in Perth and Kinross with a maximum concentration of 18.1 μgm^{-3} in Perth City.

8.6 SCREENING ASSESSMENT OF MONITORING DATA

8.6.1 Diffusion tube monitoring

Nitrogen dioxide is measured in Perth at four sites operated as part of the UK national survey and at additional sites operated by Perth and Kinross Council (Appendix 1 Table A1.1). Figure 8.1 shows the location of monitoring points in Perth centre. Nitrogen dioxide concentrations measured in Perth City decreased between 1995 and 2000 but have increased slightly since then (Figure 8.2).

Figure 8.1 Location of diffusion tube sites in Perth centre

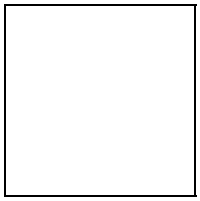
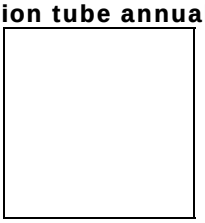


Figure 8.2 Nitrogen dioxide diffusion tube annual average concentrations in Perth



From Guidance LAQM TG(03)[1] the adjustment factors to estimate annual average concentrations in 2005 from 2001 data are 0.892 at roadside sites and 0.908 at background sites. Estimated concentrations for 2005 are shown for monitoring sites in the UK National NO_2 Diffusion Tube Survey are shown in Table 8.1.

Table 8.1 Annual Mean Nitrogen Dioxide Concentrations μgm^{-3}

Site Location	Site No.	Type	NO_2 2001	NO_2 2005
42 Scott St	Perth 1	R	40	35.2
5 Murray Crescent	Perth 3	B	17	15.2
41 Mull Place	Perth 6	B	22	19.6
14 Main St, Bridgend	Perth 14	R	33	29.8

R=Roadside B=Background

Annual average concentrations measured at roadside sites in the centre of Perth in 2002 were close to, or in excess, of 40 μgm^{-3} (Table 8.2).

Table 8.2 Annual Mean Nitrogen Dioxide Concentrations in Perth City centre 2002 μgm^{-3}

Site Location	Site No.	Type	Annual Mean NO_2 μgm^{-3}
42 Scott St	Perth 1	R	**50.9**
17 Speygate	Perth 2	B	26.5
15 Murray Cres,	Perth 3	B	22.7
Tiree Pl,	Perth 4	B	18.7
8 Stormont St	Perth 5	B	26.7
41 Mull Place	Perth 6	B	15.4
257 Rannoch Rd	Perth 7	B	21.9
15 Main St, Bridgend	Perth 14	R	**43.3**
28 York Place	Perth 28	R	**47.8**
37 York Place	Perth 29	R	39.3
104 South St	Perth 30	R	**44.4**
76 Atholl St	Perth 41	R	**55.8**

R=Roadside B=Background

8.6.2 Diffusion tube analysis

The tubes analysed by Dundee Scientific Services were prepared by using 10% or 20% v/v TEA in water methodology. In the UK NO_2 Network Field Intercomparison Exercise 2001 the results of Dundee Scientific Services showed a bias of 23% relative to the reference value as determined by an automatic chemiluminesence method. The period of the intercomparison was 5 September – 31 October 2001.

8.6.3 Bias correction of diffusion tube data

There are no intercomparison data available to enable the bias correction of the diffusion tube data. However, the field intercomparison exercise indicates that tubes analysed by Dundee Scientific Services overestimate NO_2 concentrations.

8.6.4 Automatic Monitoring

Monitoring for nitrogen dioxide has been undertaken using a Groundhog mobile monitoring station at a background location in Perth City. Data for monitoring periods in 1999, 2000 and 2001 show that maximum hourly average concentrations were less than 150 μgm^{-3}.

8.7 SCREENING ASSESSMENT OF ROAD TRAFFIC SOURCES

Traffic flow data were taken from the NAEI 2000 roads database and from manual and automatic Scoot traffic count data taken in 2002 for local roads in Perth City supplied by the Council (Appendix 2). For screening purposes, appropriate receptor distances based on the closest property where public exposure was likely and maximum speeds for the road were used. A traffic growth factor of 1.15 to 2005 was used.

Table 8.3 shows nitrogen dioxide concentrations in 2005 calculated using DMRB for A roads and motorways in Perth and Kinross.

Table 8.3 Estimated nitrogen dioxide concentrations near A roads in Perth and Kinross

Road	East	North	Distance receptor to road centre m	AADT 2005	Average Speed kph	%HDV	NO_2 Annual mean 2005 μgm^{-3}
A85	312500	723000	15	13180	100	6.5	22.8
A85	310000	724700	15	13364	100	3.8	21.7
A85	312400	723700	15	13442	100	6.5	22.9
A85	312100	723900	15	19539	100	3.2	22.5
A85	311250	724200	15	32912	100	4.8	24.8
A9	296500	755600	20	12461	110	11.8	24.0
A9	300000	748500	20	12482	110	13.5	24.5
A9	306600	738950	20	15729	110	10.8	25.1
A9	295000	712400	20	21634	110	16.2	28.3
A9	292800	711000	20	21658	110	18.7	29.3
A9	300500	717550	20	22464	110	14.1	27.6
A9	300000	717100	20	23021	110	18.7	29.6
A9	309000	725650	20	24076	110	10.9	26.5
A9	308250	724000	20	24083	110	9.0	25.6
A9	290000	708800	20	24758	110	12.5	27.2
A90	316500	721900	20	34782	110	13.6	29.0
A90	325000	726600	20	36768	110	14.2	29.6
A90	332700	730400	20	40686	110	12.4	29.1
A912	311500	722000	15	14136	100	6.1	23.0
A912	310000	725750	15	20268	100	5.4	23.8
A93	310460	723000	12	11655	100	5.3	22.1
A93	318200	745300	12	11786	100	4.5	21.8
A93	312300	723400	12	13720	100	6.1	23.4
A94	312300	724000	12	21966	100	6.0	24.9
A989	311700	723100	20	12073	110	7.1	22.2
A989	311325	723790	20	18822	110	3.6	22.4
A989	311800	723900	20	20208	110	2.9	22.2
M90	313700	710000	20	27479	110	9.2	26.1
M90	312400	699100	20	31181	110	8.8	26.3
M90	310900	703700	20	31374	110	11.8	27.8
M90	312200	705300	20	32584	110	9.8	27.0
M90	312500	721000	20	32820	110	11.9	28.0
M90	313360	696500	20	32869	110	2.6	23.1
M90	313270	719340	20	33267	110	8.6	26.4
M90	309000	722300	20	35788	110	9.3	27.1

The DMRB screening model indicates that the 2005 annual mean objective for NO_2 is unlikely to be exceeded at receptors near A road and motorways outside of Perth City.

Table 8.4 shows nitrogen dioxide concentrations for 2005 calculated using DMRB for Roads in Perth City (Figure 8.3). A growth factor of 1.15 to 2005 was used. Receptor distances were estimated using OS landline maps supplied by the council. The DMRB screening model indicates that the 2005 annual mean objective for NO_2 is likely to be exceeded at receptors in road canyons in Perth.

Figure 8.3 Roads in Perth City assessed using DMRB

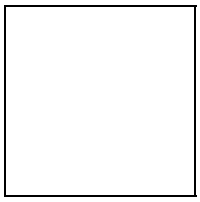


Table 8.4 Estimated nitrogen dioxide concentrations near roads in Perth City

Road	East	North	Distance receptor to road centre m	AADT 2005	Average Speed kph	% HDV	NO_2 Annual mean 2005 μgm^{-3}
Perth Bridge	312063	723860	9.6	17172	40	15.6	26.6
Queen's Bridge	312159	723430	40	17310	40	21.9	24.6
Tay St	312050	723050	10.7	8163	40	35.8	26.3
Princes St	311906	723024	10	9552	40	25.5	40.1*
St Leonards Bank	311393	723100	5.3	7001	40	17.5	22.2
Glasgow Rd	311200	723500	17	19030	40	20.6	29.9
Long Causeway	311323	723763	9.8	17601	40	8.3	25.2
Barrack St	311410	723956	8.7	24219	40	21.3	30.4
Balhousie St	311394	724023	9.3	6470	40	18.9	21.7
Main St	312253	723954	9.0	25437	40	20	33.6
Atholl St	311611	723946	8.8	30289	40	20	53.1*
South St	311584	723482	7.2	17446	40	20	48.5*

*Princes St, Atholl Street and South Street were identified as street canyons and the road traffic component of the annual mean concentration was doubled as detailed in Guidance TG(03)[1] chapter 6.3.

8.7.1 Busy Junctions

Annual average NO_2 concentrations near busy road junctions in Perth City have been estimated for 2005 using DMRB (Table 8.5). No busy junctions were identified outside of Perth City with relevant exposure within 20m.

Table 8.5 Estimated nitrogen dioxide concentrations near busy junctions in Perth City

Junction	East	North	Average Speed kph	% HDV	NO_2 Annual mean 2005 μgm^{-3}
Queens Bridge/Tay St	312091	723439	40	20	32.9
Main Street/Perth Bridge	31259	723925	40	20	43.1
Atholl Street /Barrrack Street	311427	723924	40	20	43.1
South Street/ King St	311553	723484	40	20	35.8

The DMRB screening model indicates that the 2005 annual mean objective for NO_2 is likely to be exceeded at receptors near busy road junctions on Perth.

8.8 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03)[1] lists the following processes as significant potential sources of nitrogen dioxide:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)
Iron and steel (19)
Petroleum processes (16)
Combustion processes (34)
Cement/lime manufacture (9)
Carbonisation (6)
Gasification (4)
Inorganic chemicals (4)

Part B
Glass manufacture

The only Part A process in Perth and Kinross which is a potential source of nitrogen dioxide is Hydrochafer. This plant was not identified as a source of nitrogen dioxide in the Second Stage Review and Assessment report. Perth and Kinross Council are not aware of any changes to the output of this plant since the report. No Part B processes in Perth and Kinross are potential sources of nitrogen dioxide. The Part A process Dundee Energy Recycling in neighbouring Dundee authority was identified by SEPA as a source of nitrogen dioxide but ground level concentrations modelled in 1999 were low (maximum hourly average 23 μgm^{-3}) and this plant is not thought to be a significant source of nitrogen dioxide.

8.9 SCREENING ASSESSMENT OF OTHER TRANSPORT SOURCES

8.9.1 Bus Stations

The main bus station in Perth is in Leonard Street and has approximately 200 bus movements per day which is significantly less than the flow of 1000 given in the Guidance as the level requiring further investigation.

8.9.2 Airports

There are no airports in Perth and Kinross or neighbouring authorities that have a throughput of 5 million passengers per year and/or 500,000 tonnes of freight.

8.10 CONCLUSIONS FOR NITROGEN DIOXIDE CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

Nitrogen dioxide predicted concentrations indicate that the annual average objective is likely to be exceeded in 2005 near busy junctions and in street canyons. This has been confirmed from the diffusion tube measurements. There are no significant industrial sources of nitrogen dioxide in Perth and Kinross.

Perth and Kinross Council is required to carry out a Detailed Assessment for nitrogen dioxide.

9 Updating and Screening Assessment for Sulphur Dioxide

9.1 THE NATIONAL PERSPECTIVE

The main source of sulphur dioxide in the United Kingdom is power stations, which accounted for more than 71% of emissions in 2000. There are also significant emissions from other industrial combustion sources. Domestic sources now only account for 4% of emissions, but can be locally much more significant. Road transport currently accounts for less than 1% of emissions.

Local exceedences of the objectives (principally the 15-minute mean objective) may occur in the vicinity of small combustion plant (less than 20 MW) which burn coal or oil, in areas where solid fuels are the predominant form of domestic heating, and in the vicinity of major ports.

9.2 STANDARD AND OBJECTIVE FOR SULPHUR DIOXIDE

The Government and the Devolved Administrations have adopted a 15-minute mean of 266 μgm^{-3} as an air quality 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.
Additional objectives have also been set which are equivalent to the EU limit values specified in the First Air Quality Daughter Directive. These are for a 1-hour mean objective of 350 μgm^{-3}, to be exceeded no more than 24 times per year, and a 24-hour objective of 125 μgm^{-3}, to be exceeded no more than 3 times per year, to be achieved by the end of 2004.

9.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR SULPHUR DIOXIDE

The following conclusions were given for SO_2 in the First and Second Stage Review and Assessment report for Perth and Kinross:

- Current and historical monitoring data for this area confirms that measured levels of sulphur dioxide from all sources are very low in Perth and Kinross;
- There are no current or proposed significant industrial sources of sulphur dioxide at relevant locations in Perth and Kinross;
- Emissions from small combustion plant are not considered to have any significant effect either individually or cumulatively and in conjunction with ambient background concentrations of sulphur dioxide on air quality at relevant locations in Perth and Kinross;
- Densities of coal fire burning households has not been confirmed but monitoring data confirms that emissions from domestic coal fire burning are unlikely to significantly prejudice air quality objectives at relevant locations in Perth and Kinross.

The risk of exceeding air quality objectives for sulphur dioxide is considered negligible.

9.4 SCREENING ASSESSMENT OF SULPHUR DIOXIDE

The Technical Guidance LAQM TG(03) requires assessment of sulphur dioxide to consider the following sources, data or locations:

- Monitoring data within an AQMA
- New industrial sources
- Industrial sources with substantially increased emissions
- Areas of domestic coal burning

- Small boilers (>5MW (thermal)) burning coal or oil
- Shipping
- Railway Locomotives

These are evaluated in the following sections.

9.5 BACKGROUND CONCENTRATIONS FOR SULPHUR DIOXIDE

The estimated average background sulphur dioxide concentration for 2001 was 0.9 μgm^{-3} with maximum concentration of 18.5 μgm^{-3} in Perth City.

9.6 SCREENING ASSESSMENT OF MONITORING DATA

Monitoring for sulphur dioxide has been undertaken using a Groundhog mobile monitoring station at a background location in Perth City. Data for monitoring periods in 1999, 2000 and 2001 show that maximum 1-hour average concentrations were:

1999 69 μgm^{-3}.
2000 20 μgm^{-3}.
2001 26 μgm^{-3}

9.7 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03)[1] lists the following processes as significant potential sources of sulphur dioxide:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)
Iron and steel (9)
Petroleum processes (15)
Combustion processes (45)
Cement/lime manufacture (3)
Carbonisation (10)
Non-ferrous metals (7)
Ceramic Production (9)

Part B
Combustion plant 20-50 mwth
Furnaces 20-50 mwth
Copper processes
Refractory goods
Glass manufacture
Roadstone coating

The only Part A process in Perth and Kinross which is a potential source of sulphur dioxide is the DARA RN Aircraft Workshops. This plant was not identified as a source of sulphur dioxide in the Second Stage Review and Assessment report and Perth and Kinross Council are not aware of any changes to the output of this plant since the report. The only Part B processes in Perth and Kinross that are potential sources of sulphur dioxide are the roadstone coating plants at Shierglass and Collace quarries. Data are not available on SO_2 emissions from these processes but they are not considered significant sources. The Part A processes Dundee Energy Recycling and Michelin tyres in neighbouring Dundee authority were identified by SEPA as sources of sulphur dioxide. Ground level concentrations modelled in 1999 at Dundee Energy were low (maximum hourly average 20 μgm^{-3}) and this plant is not thought to be a significant source of sulphur dioxide. The Michelin tyre plant mainly operates with natural gas but occasionally uses heavy fuel oil which emits sulphur dioxide. Emissions are not likely to cause an exceedence of the objectives unless there is a greatly increased use of fuel oil.

9.7.1 Small Boilers

Of the small boiler processes identified for Perth and Kinross (Table 9.1), only one is greater than 5MW. The calculated SO_2 emission in tonnes per year was compared with the maximum emission threshold (equivalent to 20% of the 15-minute 2005 objective) as determined using the Industrial Emissions Screening Toolkit. The emissions were significantly below the threshold and no exceedence of the objective is likely.

Table 9.1 Estimated nitrogen dioxide concentrations from small boilers

Operator	Location	Fuel Type	Size (MW)	Stack Height (m)	Stack Diameter (m)	SO_2 Tonnes/year	Release Threshold Tonnes /year
Aberfeldy Distillery	Aberfeldy, Perthshire PH15 2EB	Heavy fuel oil	7	20	0.54	20.5	60.1
Edradour Distillery	Pitlochry Perthshire PH16 5JP	Gas Oil	1.0	6	0.255	2.9	-
Glenturret Distillery	The Hosh Crieff Perthshire PH7 4HA	Heavy Fuel Oil	2.8	20	0.35	8.3	-

9.8 DOMESTIC COAL BURNING

There are no data for domestic coal burning available but solid fuel use continues to decline throughout the area. It is unlikely that there are any areas with 50 houses using these fuels in a 500 m square.

9.9 SCREENING ASSSESSMENT OF OTHER TRANSPORT SOURCES

9.9.1 Shipping

There are approximately two hundred shipping movements per year from Perth Harbour. This is significantly less than the 5000 movements requiring a detailed assessment to be undertaken and shipping is not considered a significant source of sulphur dioxide.

9.9.2 Railways

According to information supplied by Perth and Kinross Council there are no areas where railway engines are run for more than 15 minutes continuously and where members of the public might be exposed.

9.10 CONCLUSIONS FOR SULPHUR DIOXIDE CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

There are no significant industrial or domestic sources of sulphur dioxide in Perth and Kinross.

Perth and Kinross Council is not required to carry out a Detailed Assessment for sulphur dioxide.

10 Updating and Screening Assessment for PM_{10}

10.1 THE NATIONAL PERSPECTIVE

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

The Government established the Airborne Particles Expert Group (APEG) to advise on sources of PM_{10} in the UK and current and future ambient concentrations. Their conclusions were published in January 1999 (APEG, 1999). APEG concluded that a significant proportion of the current annual average PM_{10} is due to the secondary formation of particulate sulphates and nitrates, resulting from the oxidation of sulphur and nitrogen oxides. These are regional scale pollutants and the annual concentrations do not vary greatly over a scale of tens of kilometres. There are also natural or semi-natural sources such as wind-blown dust and sea salt particles. The impact of local urban sources is superimposed on this regional background. Such local sources are generally responsible for winter episodes of hourly mean concentrations of PM_{10} above 100 $\mu g\ m^{-3}$ associated with poor dispersion. However, it is clear that many of the sources of PM_{10} are outside the control of individual local authorities and the estimation of future concentrations of PM_{10} are in part dependent on predictions of the secondary particle component.

10.2 STANDARD AND OBJECTIVE FOR PM_{10}

The Government and the Devolved Administrations have adopted two Air Quality Objectives for fine particles (PM_{10}), which are equivalent to the EU Stage 1 limit values in the first Air Quality Daughter Directive. The objectives are 40 μgm^{-3} as the annual mean, and 50 μgm^{-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. In addition there are objectives of 50 μgm^{-3} as the fixed 24-hour mean to be exceeded on no more than 7 days per year, and 18 μgm^{-3} as the annual mean to be achieved by the end of 2010 which applies to Scottish Authorities only. The objectives are based upon measurements carried out using the European gravimetric transfer reference sampler or equivalent.

10.3 CONCLUSIONS OF THE FIRST ROUND OF REVIEW AND ASSESSMENT FOR PM_{10}

The following conclusions were given for PM_{10} in the First and Second Stage Review and Assessment report for Perth and Kinross:

- Predicted annual mean background concentrations of PM_{10} are below 25 μgm^{-3};
- Local monitoring data for PM_{10} shows concentrations currently below the 24 hour objective of 50 μgm^{-3} with no exceedences of the objective recorded to date;
- PM_{10} emissions from domestic solid fuel burning are unlikely to cause exceedence of the objectives;
- Emissions from industrial processes in Perth and Kinross, and neighbouring areas, are unlikely to cause exceedence of the objectives;
- Emissions from industrial processes in neighbouring areas are unlikely to cause exceedence of the objectives in Perth and Kinross;
- Emissions from traffic or other transport sources are unlikely to cause exceedence of the objectives in Perth and Kinross;

- Emissions from uncharacterised activities are unlikely to cause exceedence of the objectives in Perth and Kinross.

Local emissions of PM_{10} are unlikely to cause exceedence of the objectives in Perth and Kinross.

10.4 SCREENING ASSESSMENT OF PM_{10}

The Technical Guidance LAQM TG(03)[1] requires assessment of PM_{10} to consider the following sources, data or locations:

- Monitoring data outside an AQMA
- Monitoring data within an AQMA
- Busy roads and junctions in Scotland
- Junctions
- Roads with high flow of buses and/or HGVs
- New roads constructed or proposed since first round of review and assessment
- Roads close to the objective during the first round of review and assessment
- Roads with significantly changed traffic flows
- New industrial sources
- Industrial sources with substantially increased emissions
- Areas with domestic solid fuel burning
- Quarries, landfill sites, opencast coal, handling of dusty cargoes at ports etc
- Aircraft

These are evaluated in the following sections.

10.5 BACKGROUND CONCENTRATIONS FOR PM_{10}

The estimated average background PM_{10} concentration for 2001 was 12.7 μgm^{-3} in Perth and Kinross with maximum concentration of 15.8 μgm^{-3} in Perth City.

10.6 SCREENING ASSESSMENT OF MONITORING DATA

Monitoring for PM_{10} has been undertaken using a Groundhog mobile monitoring station at a background location in Perth City. Data for monitoring periods in 1999, 2000 and 2001 show that maximum daily average concentrations measured using the TEOM analyser were less than 50 μgm^{-3}. When corrected to the gravimetric equivalent there was only one daily average greater than 50 μgm^{-3} (Appendix 1).

10.7 SCREENING ASSESSMENT OF ROAD TRAFFIC SOURCES

Traffic flow data were taken from the NAEI 2000 roads database and from manual and from automatic Scoot traffic count data taken in 2002 for local roads in Perth City supplied by the Council (Appendix 2 Tables A2.2 and A2.3). For screening purposes, appropriate receptor distances based on the closest property where public exposure was likely and maximum speeds for the road were used. Traffic growth factors of 1.12 to 2004 and 1.2 to 2010 were used.

Table 10.1 shows PM_{10} concentrations in 2004 and 2010 calculated using DMRB for A roads and motorways in Perth and Kinross.

Table 10.1 Estimated PM_{10} concentrations near A roads in Perth and Kinross

Road	East	North	Distance receptor to road centre m	AADT	Speed kph	%HDV	PM_{10} annual mean μgm^{-3}	
							2004	2010
A85	312500	723000	15	13180	100	6.5	17.9	15.8
A85	310000	724700	15	13364	100	3.8	17.6	15.6
A85	312400	723700	15	13442	100	6.5	18.0	15.8
A85	312100	723900	15	19539	100	3.2	18.1	16.0
A85	311250	724200	15	32912	100	4.8	19.3	16.6
A9	296500	755600	20	12461	110	11.8	18.5	16.1
A9	300000	748500	20	12482	110	13.5	18.7	16.2
A9	306600	738950	20	15729	110	10.8	19.2	16.5
A9	295000	712400	20	21634	110	16.2	20.7	17.3
A9	292800	711000	20	21658	110	18.7	21.1	17.4
A9	300500	717550	20	22464	110	14.1	20.4	17.1
A9	300000	717100	20	23021	110	18.7	21.3	17.5
A9	309000	725650	20	24076	110	10.9	20.0	17.0
A9	308250	724000	20	24083	110	9.0	19.7	16.8
A9	290000	708800	20	24758	110	12.5	20.4	17.1
A90	316500	721900	20	34782	110	13.6	21.4	17.7
A90	325000	726600	20	36768	110	14.2	21.6	17.9
A90	332700	730400	20	40686	110	12.4	21.5	17.8
A912	311500	722000	15	14136	100	6.1	18.1	15.9
A912	310000	725750	15	20268	100	5.4	18.6	16.2
A93	310460	723000	12	11655	100	5.3	17.7	15.7
A93	318200	745300	12	11786	100	4.5	17.6	15.6
A93	312300	723400	12	13720	100	6.1	18.3	16.0
A94	312300	724000	12	21966	100	6.0	19.2	16.5
A989	311700	723100	20	12073	110	7.1	17.9	15.8
A989	311325	723790	20	18822	110	3.6	18.4	16.2
A989	311800	723900	20	20208	110	2.9	18.4	16.2
M90	313700	710000	20	27479	110	9.2	20.0	17.0
M90	312400	699100	20	31181	110	8.8	20.2	17.1
M90	310900	703700	20	31374	110	11.8	20.8	17.4
M90	312200	705300	20	32584	110	9.8	20.5	17.3
M90	312500	721000	20	32820	110	11.9	20.9	17.5
M90	313360	696500	20	32869	110	2.6	19.0	16.7
M90	313270	719340	20	33267	110	8.6	20.3	17.2
M90	309000	722300	20	35788	110	9.3	20.6	17.4

Traffic data for local roads in Perth City were supplied by the Council. Tables 10.2 and 10.3 show PM_{10} concentrations for 2004 and 2010 calculated using DMRB. Receptor distances were estimated using landline maps supplied by the council.

Table 10.2 Estimated PM_{10} concentrations 2004 near roads in Perth City

	Distance receptor to road centre m	AADT 2004	Average Speed kph	% HDV	PM_{10} Annual mean μgm^{-3} 2004	No of Exceedences of 50 μgm^{-3}
Perth Bridge	9.6	17172	40	15.6	19.7	3
Queen's Bridge	40	17310	40	21.9	18.7	2
Tay St	10.7	8163	40	35.8	21.2	5
Princes St	10	9552	40	25.5	20.6	4
St Leonards	5.3	7001	40	17.5	17.4	1
Glasgow Rd	17	19030	40	20.6	21.8	6
Long Causeway	9.8	17601	40	8.3	18.4	2
Barrack St	8.7	24219	40	21.3	21.6	6
Balhousie St	9.3	6470	40	18.9	21.1	1
Main St	9.0	25437	40	20	24.4	11
Atholl St	8.8	30289	40	20	25.1	13
South St	7.2	17446	40	20	23.4	9

Table 10.3 Estimated PM_{10} concentrations 2010 near roads in Perth City

	Distance receptor to road centre m	AADT 2010	Average Speed kph	% HDV	PM_{10} Annual mean μgm^{-3} 2010	No of Exceedences of 50 μgm^{-3}
Perth Bridge	9.6	17918	40	15.6	17.4	1
Queen's Bridge	40	18062	40	21.9	15.8	0
Tay St	10.7	8518	40	35.8	17.1	1
Princes St	10	9967	40	25.5	16.8	1
St Leonards	5.3	7306	40	17.5	15.7	0
Glasgow Rd	17	19858	40	20.6	17.4	1
Long Causeway	9.8	18366	40	8.3	16.4	0
Barrack St	8.7	25272	40	21.3	18.9	2
Balhousie St	9.3	6751	40	18.9	15.6	0
Main St	9.0	26543	40	20	18.7	2
Atholl St	8.8	31606	40	20	19.1	2
South St	7.2	18204	40	20	18.2	2

10.7.1 Busy Junctions

Annual average PM_{10} concentrations at receptors near busy road junctions in Perth City have been estimated for 2004 and 2010 using DMRB. No busy junctions were identified outside of Perth City with relevant exposure within 20m. Tables 10.4 and 10.5 show the PM10 concentrations near busy junctions in Perth estimated for 2004 and 2010.

Table 10.4 Estimated PM_{10} concentrations for 2004 near busy road junctions in Perth City

Junction	East	North	Average Speed kph	% HDV	PM_{10} Annual mean μgm^{-3} 2004	No of Exceedences of 50 μgm^{-3}
Queens Bridge/Tay St	312091	723439	40	20	21.5	8
Main Street/Perth Bridge	31259	723925	40	20	29.8	25
Atholl Street /Barrrack Street	311427	723924	40	20	30.3	**37**
South Street/ King St	311553	723484	40	20	25.5	15

Table 10.5 Estimated PM_{10} concentrations for 2010 near busy junctions in Perth City

Junction	East	North	Average Speed kph	% HDV	PM_{10} Annual mean μgm^{-3} 2010	No of Exceedences of 50 μgm^{-3}
Queens Bridge/Tay St	312091	723439	40	20	**19.2**	3
Main Street/Perth Bridge	31259	723925	40	20	**21.6**	6
Atholl Street /Barrrack Street	311427	723924	40	20	**22.2**	7
South Street/ King St	311553	723484	40	20	**19.7**	3

The DMRB screening model indicates that the annual mean objective of 50 μgm^{-3} for PM_{10} will be met in 2004. The annual mean objective of 18 μgm^{-3} may be exceeded at relevant locations close to A roads, busy roads and junctions in Perth and Kinross in 2010. The 24 hour mean objective of 50 μgm^{-3} may be exceeded more than 35 times a year in 2004 and 7 times a year in 2010 close to busy road junctions in Perth.

10.8 SCREENING ASSESSMENT OF INDUSTRIAL SOURCES

The Guidance LAQM TG(03)[1] lists the following processes as significant potential sources of PM_{10}:

Part A (percentage of total emissions from all UK plant in this sector to the UK total in brackets)

Iron and steel (61)
Petroleum processes (4)
Combustion processes (13)
Cement/lime manufacture (7)
Carbonisation (2)
Gasification (4)
Non-ferrous metals (4)
Fertilizer production

Part B
Combustion plant 20-50 mwth
Furnaces 20-50 mwth
Coal and coke processes
Quarry Process
Roadstone coating
Rubber processes
China and clay processes
Coating powder
Coil coating

The only Part A process in Perth and Kinross which is a potential source of PM_{10} is the DARA RN Aircraft Workshops. This plant was not identified as a source of PM_{10} in the Second Stage Review and Assessment report. Perth and Kinross Council are not aware of any changes to the output of this plant since the report.

Of the Part B processes listed in Appendix 3, 10 are potential sources of PM_{10}. According to information supplied by SEPA 6 of these processes are considered significant and regularly monitored for particulate emissions. Table 10.6 shows the calculated PM_{10} emission in tonnes per year compared with the maximum emission thresholds as determined using the Industrial Emissions Screening Toolkit. All of the calculated concentrations were significantly below the thresholds for 2004 and 2010. Further investigation is not required for these sources.

Table 10.6 Estimated PM_{10} emissions from Part B processes

Process	Company	Stack Diam m	Stack Ht m	Temp °C	PM_{10} Background μgm^{-3}		Calculated PM_{10} Emissions Tonnes/Year	Maximum Emission Threshold Tonnes/year	
					2004	2010		2004	2010
Roadstone Coating	Shierglass Quarry	0.89	15	28	12.1	11.6	0.85	8.4	5.5
Crusher Plant		0.9	18	9	12.1	11.6	0.27	12.6	8.3
Roadstone Coating	Collace Quarry	1.42	18	44	13.5	12.8	8.60	15.5	8.8
Crusher Plant	Friarton Quarry	0.92	10.3	27	14.5	13.6	0.35	3.2	1.63
Roadstone Coating		0.92	19.6	78	14.5	13.6	0.19	13.4	6.9
Cremator 1	Perth Crematorium	0.5	18.5	374	12.9	12.2	0.16	12.8	10.7
Cremator 2		0.5	18.5	317	12.9	12.2	0.27	12.8	10.7
Incinerator	SACVS	0.5	9.2	328	14.6	13.7	0.15	2.6	1.9
Kilnstack	Errol Brickworks	0.98	11.5	107	13.7	13	0.03	5.5	4.3

The Part A processes Dundee Energy Recycling and Michelin tyres in neighbouring Dundee authority were identified by SEPA as sources of PM_{10}. Ground level concentrations modelled in 1999 at Dundee Energy were low (maximum hourly average 2 μgm^{-3}), and this plant is not thought to be a significant source of PM_{10}. The Michelin tyre plant mainly operates with natural gas but occasionally uses heavy fuel oil which emits PM_{10} but emissions are not likely to cause an exceedence of the objectives.

10.9 SCREENING ASSESSMENT OF FUGITIVE AND UNCONTROLLED SOURCES

10.9.1 Quarries and landfill sites

There are no recorded quarries or landfill sites with relevant locations for public exposure within 200m. Collace and Friarton quarries have relevant locations within 200-1000m but there have been no complaints of dust nuisance and the background concentrations are less than 16 μgm^{-3} at these locations.

10.9.2 Domestic solid fuel burning

There are no data for domestic coal burning available but solid fuel use continues to decline throughout the area. It is unlikely that there are any areas with 50 houses using these fuels in a 500 m square.

10.10 SCREENING ASSESSMENT OF OTHER TRANSPORT SOURCES

10.10.1 Airports

There are no airports in Perth and Kinross or neighbouring authorities that have a throughput of 5 million passengers per year and/or 500,000 tonnes of freight.

10.11 CONCLUSIONS FOR PM_{10} CONCENTRATIONS IN PERTH AND KINROSS COUNCIL AREA

The DMRB screening model indicates that the annual mean objective of 50 μgm^{-3} for PM_{10} will be met in 2004. The annual mean objective of 18 μgm^{-3} may be exceeded at relevant locations close to A roads, busy roads and junctions in Perth and Kinross in 2010. The 24 hour mean objective of 50 μgm^{-3} may be exceeded more than 35 times a year in 2004 and 7 times a year in 2010 close to busy road junctions in Perth.

Perth and Kinross Council is required to carry out a Detailed Assessment for PM_{10}.

11 Conclusions

11.1 CARBON MONOXIDE

Carbon monoxide was monitored in Perth City during periods from 1999 to 2001. The maximum running 8-hour concentration recorded was less than 3 mgm^{-3} which is significantly less than the objective value of 10 mgm^{-3}. There are no roads in Perth and Kinross which can be classified as 'very busy' according to the criteria in the guidance. A Detailed Assessment is not required for carbon monoxide in Perth and Kinross.

11.2 BENZENE

There are no roads in Perth and Kinross which can be classified as 'very busy' according to the criteria in the guidance. There are no petrol stations with a throughput greater than 2 million litres and with relevant exposure within 10m of the pumps. A detailed assessment is, therefore, not required for benzene in Perth and Kinross.

11.3 1,3-BUTADIENE

Estimated background concentrations and data from national monitoring stations indicate that the objective for 1,3-butadiene is likely to be achieved by the end of 2003. There are no industrial processes, current or proposed, in Perth and Kinross which have the potential to emit 1,3-butadiene. A Detailed Assessment is not required for 1,3-butadiene in Perth and Kinross.

11.4 LEAD

Emissions of lead from industrial processes in Perth and Kinross are not likely to exceed the objectives for lead to be achieved in 2004 and 2008. A detailed assessment is not required for lead in Perth and Kinross.

11.5 NITROGEN DIOXIDE

Nitrogen dioxide diffusion tube measurements, and estimates of concentration from DMRB, indicate that the annual average objective is likely to be exceeded in 2005 near busy junctions and in street canyons. There are no significant industrial sources of nitrogen dioxide in Perth and Kinross. A Detailed Assessment is required for nitrogen dioxide.

11.6 SULPHUR DIOXIDE

There are no significant industrial or domestic sources of sulphur dioxide in Perth and Kinross.
A Detailed Assessment is not required for sulphur dioxide.

11.7 PM_{10}

The DMRB screening model indicates that the annual mean objective of 50 μgm^{-3} for PM_{10} will be met in 2004. The annual mean objective of 18 μgm^{-3} may be exceeded at relevant locations close to A roads, busy roads and junctions in Perth and Kinross in 2010. The 24 hour mean objective of 50 μgm^{-3} may be exceeded more than 35 times a year in 2004 and 7 times a year in 2010 close to busy road junctions in Perth.

A Detailed Assessment is required for PM_{10}.

11.8 SUMMARY AND RECOMMENDATIONS

The annual average nitrogen dioxide objective is likely to be exceeded in 2005 near busy junctions and in street canyons in Perth.

The annual mean objective of 18 μgm^{-3} may be exceeded at relevant locations close to A roads, busy roads and junctions in Perth and Kinross in 2010. The 24 hour mean objective of 50 μgm^{-3} may be exceeded more than 35 times a year in 2004 and 7 times a year in 2010 close to busy road junctions in Perth.

It is recommended that a detailed review and assessment is undertaken for nitrogen dioxide and PM_{10} in Perth and Kinross and that monitoring of nitrogen dioxide and PM_{10} is undertaken.

12 References

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Appendices

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Appendix 1
Detailed Monitoring data

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Table A1.1 Diffusion Tube Monitoring Site Details in Perth and Kinross

Site Number	Address	East	North	Type
Perth 1	42 Scott St, Perth, PH1 5PH	311700	723500	R
Perth 2	17 Speygate, Perth, PH2 8PJ	312000	723400	B
Perth 3	15 Murray Cres, Perth, PH2 0HU	310500	722800	B
Perth 5	8 Stormont St, Perth, PH1 5NW	311600	723900	B
Perth 6	41 Mull Place, Perth, PH1 3DP	310500	725700	B
Perth 7	257 Rannoch Rd, Perth PH1 2DW	308900	724400	B
Perth 14	15 Main St, Bridgend, Perth, PH2 7HD	312200	723900	R
Perth 28	28 York Place Perth PH2 8EH	311100	723400	R
Perth 29	37 York Place Perth PH2 8EH	311200	723500	R
Perth 30	104 South St, Perth, PH2 8PA	311700	723400	R
Perth 41	76 Atholl St, Perth, PH1 5NL	311400	723900	R

Table A1.2 Annual average NO_2 concentrations - UK national survey sites in Perth

	PERTH 1	PERTH 3	PERTH 5*	PERTH 6	Perth 14
1994	43	24	33	23	
1995	42	23	27	18	
1996	40	23	23	15	
1997	46	15	22	16	
1998	39	15	23	12	
1999	38	15	21	11	
2000	35	16	20	12	
2001	40	17	22*	16	33
2002	51	23	27	15	43

*Intermediate site withdrawn from national survey and replaced by Perth 14 roadside site

Table A1.3 Monthly average NO_2 concentrations at sites in Perth 2002

Site Location	Site No	Site Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
42 Scott St	Perth 1	R	57	41	51	55	47	44			48	52	51	63
17 Speygate	Perth 2	B	22	27	29	29	21	24	21	21	30	29	35	30
15 Murray Cres	Perth 3	B	31	20	20	21	17	17	16	18	23	25	31	33
Tiree Pl	Perth 4	B	29	19	23	18	13	16	14	15	21			
8 Stormont St	Perth 5	B	40		30	26	23	24	22	19	25	24	36	25
41 Mull Place	Perth 6	B	25	16	15			10	10	9	15	14	21	19
257 Rannoch Rd	Perth 7	R	27	19	21	21	16		15	16	22	23	29	32
15 Main St, Bridgend	Perth 14	R	40	44	38	50	46	36	38	38	47	47	46	49
28 York Place	Perth 28	R	57	40	51	49	46	42	42	44	52	46	54	50
37 York Place	Perth 29	R	44	38	39	42	35	33	30	34	41	44	45	46
104 South St	Perth 30	R		45	46	46	41	42	38	42	46	47	53	42
76 Atholl St	Perth 41	R	56		73	59	54	44	45	47	57	55	58	66

Table A1.4 Daily average PM_{10} concentrations - Automatic Monitoring Data Monitoring Station Located in Gowans Terrace Perth City (derived from time series plots)

1999	TEOM	Grav	2000	TEOM	Grav	2001	TEOM	Grav
	PM_{10} μgm^{-3}			PM_{10} μgm^{-3}			PM_{10} μgm^{-3}	
22-Dec			02-May	15	20	09-Jan	20	26
23-Dec			03-May	15	20	10-Jan	26	34
24-Dec	12	16	04-May	12	16	11-Jan	16	21
25-Dec	6	8	05-May	16	21	12-Jan	18	23
26-Dec	17	22	06-May	12	16	13-Jan	25	33
27-Dec	12	16	07-May	18	23	14-Jan	27	35
28-Dec	9	12	08-May	19	25	15-Jan	48	62
29-Dec	10	13	09-May	25	33	16-Jan	35	46
30-Dec	13	17	10-May	19	25	17-Jan	27	35
31-Dec	18	23	11-May	22	29	18-Jan	26	34
01-Jan	18	23	12-May	26	34	19-Jan	27	35
02-Jan	16	21	13-May	27	35	20-Jan	24	31
03-Jan	10	13	14-May	35	46	21-Jan	15	20
04-Jan	9	12	15-May	23	30	22-Jan	9	12
05-Jan	10	13	16-May	11	14	23-Jan	13	17
06-Jan	14	18	17-May	7	9	24-Jan	12	16
07-Jan	8	10	18-May	7	9	25-Jan	13	17
08-Jan	10	13	19-May	6	8	26-Jan	11	14
09-Jan	12	16	20-May	10	13	27-Jan	10	13
10-Jan	9	12	21-May	9	12	28-Jan	19	25
11-Jan	14	18	22-May	9	12	29-Jan	21	27
12-Jan			23-May	10	13	30-Jan	16	21
13-Jan	11	14	24-May	9	12	31-Jan	15	20
14-Jan	10	13	25-May	8	10	01-Feb	19	25
15-Jan	9	12	26-May	10	13	02-Feb	19	25
16-Jan	9	12	27-May	6	8	03-Feb	7	9
17-Jan	5	7	28-May	6	8	04-Feb	6	8
18-Jan	6	8	29-May	6	8	05-Feb	9	12
19-Jan	11	14	30-May	8	10	06-Feb	9	12
20-Jan			31-May	8	10	07-Feb	11	14
21-Jan			01-Jun	10	13	08-Feb	15	20
			02-Jun	9	12			
			03-Jun	12	16			
			04-Jun	10	13			
			05-Jun	13	17			
			06-Jun	11	14			

Appendix 2
Detailed Traffic Flow Data

CONTENTS

Table A2.1 Road classifications in LAQM TG(03)[1]

Very busy roads	Single carriageway roads with daily average traffic flows which exceed 80,000 vehicles per day. Dual carriageway (2 or 3-lane) roads with daily average traffic flows which exceed 120,000 vehicles per day. Motorways with daily average traffic flows which exceed 140,000 vehicles per day.
Busy Roads	Roads with more than 30000 vehicles per day.

n

Figure A2.1 Major roads in Perth and Kinross

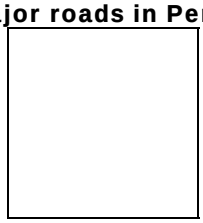

Table A2.2 Traffic Flow Data from the NAEI Data Warehouse

Explanation of the data fields:	
Rd_no	Number of the road
x	Grid reference Easting
y	Grid reference Northing
Rd_cls	Road classification
AADFYear	Year that the count was made
All_vehicles	AADF Total
CAR	AADF Cars
BUS	AADF Buses
LGV	AADF Light Goods Vehicles
HGV	AADF HGVs
Moto	AADF Motorcycles
MB	Built-up motorway
MN	Non built-up motorway
PB	Built-up primary road

Table A2.2 Traffic Flow Data from the NAEI Data Warehouse (continued)

Rd_no	x	y	Rd_class	AADFYear	All_vehicles	CAR	BUS	LGV	HGVr	Moto
A90	332700	730400	TN	2000	35379	26757	175	3971	3971	139
A90	325000	726600	TN	2000	31972	24735	218	3438	3438	62
M90	309000	722300	MN	2000	31120	25987	167	2791	2791	24
A90	316500	721900	TN	2000	30245	23312	130	2812	2812	6
M90	313270	719340	MN	2000	28928	23247	170	3120	3120	63
A85	311250	724200	PB	2000	28619	24123	481	3026	3026	82
M90	313360	696500	MN	2000	28582	23981	153	2528	2528	93
M90	312500	721000	MN	2000	28539	21265	46	3715	3715	40
M90	312200	705300	MN	2000	28334	22303	206	3204	3204	43
M90	310900	703700	MN	2000	27282	20748	99	3238	3238	59
M90	312400	699100	MN	2000	27114	23158	147	2075	2075	14
M90	313700	710000	MN	2000	23895	19185	200	2405	2405	96
A9	290000	708800	TN	2000	21529	16561	218	2186	2186	72
A9	308250	724000	TN	2000	20942	17089	149	1921	1921	31
A9	309000	725650	TN	2000	20936	16102	134	2407	2407	100
A9	300000	717100	TN	2000	20018	13861	150	2343	2343	20
A9	300500	717550	TB	2000	19534	14589	184	2180	2180	57
A94	312300	724000	PB	2000	19101	15784	255	2145	2145	49
A9	292800	711000	TN	2000	18833	13059	150	2191	2191	41
A9	295000	712400	TN	2000	18812	13246	85	2148	2148	77
A912	310000	725750	PB	2000	17624	14134	269	2372	2372	157
A989	311800	723900	PB	2000	17572	15438	194	1596	1596	31
A85	312100	723900	PB	2000	16990	14303	286	1993	1993	159
A989	311325	723790	PB	2000	16367	14135	227	1518	1518	99
A9	306600	738950	TN	2000	13677	10815	172	1279	1279	65
A912	311500	722000	PB	2000	12292	10080	185	1394	1394	76
A93	312300	723400	PB	2000	11930	10092	145	802	802	92
A85	312400	723700	PB	2000	11689	9706	87	1223	1223	16
A85	310000	724700	PB	2000	11621	10060	129	1095	1095	30
A85	312500	723000	PB	2000	11461	9324	111	1312	1312	81

Rd_no	x	y	Rd_class	AADFYear	All_vehicles	CAR	BUS	LGV	HGVr	Moto
A9	300000	748500	TN	2000	10854	7971	161	1379	1379	23
A9	296500	755600	TN	2000	10836	8640	42	1023	1023	3
A989	311700	723100	PB	2000	10498	8449	195	1289	1289	20
A93	318200	745300	PB	2000	10249	8570	151	1192	1192	24
A93	310460	723000	PB	2000	10135	8689	199	881	881	26
A912	314700	716900	PN	2000	8653	7063	75	1121	1121	70
A9	272000	770400	TN	2000	8042	6415	94	575	575	79
A93	317700	745000	PB	2000	7797	6446	218	845	845	38
A91	315000	706800	PN	2000	7153	5632	100	808	808	43
M90	314400	706340	MN	2000	7153	5632	100	808	808	43
A989	312000	723100	PB	2000	7106	5376	62	1085	1085	24
A94	322300	740100	PB	2000	6963	5528	24	866	866	13
A977	310000	702800	PN	2000	6388	4685	43	884	884	23
A9	293000	757700	TN	2000	6358	4584	36	627	627	11
A85	288000	722900	TN	2000	5899	4866	55	745	745	20
A977	301900	698500	PN	2000	5656	4165	19	617	617	91
A923	321000	740900	PN	2000	5630	4521	69	707	707	62
A977	302400	699600	PN	2000	5468	3881	26	714	714	7
A94	328600	744800	PB	2000	5449	4054	41	738	738	42
A922	311700	704000	PB	2000	5381	4440	112	649	649	16
A989	312050	723720	PB	2000	5289	4607	12	482	482	5
A94	320000	737000	PN	2000	5145	3873	62	695	695	12
A923	320000	741900	PN	2000	4792	3937	68	561	561	27
A912	311900	720300	PN	2000	4711	3984	121	411	411	64
A923	325700	736600	PN	2000	4708	3985	48	464	464	7
A822	286200	718600	PN	2000	4604	3754	59	654	654	26
A913	320100	717000	PN	2000	4425	3536	39	614	614	36
A94	324900	742300	PN	2000	4418	3325	19	552	552	21
A924	295000	757500	PN	2000	4354	3662	94	419	419	52
A93	317200	741500	PN	2000	4178	3473	28	435	435	52
A93	313200	730700	PN	2000	4078	3513	30	349	349	50
A85	304800	725200	TN	2000	4051	3438	31	381	381	1

Rd_no	x	y	Rd_class	AADFYear	All_vehicles	CAR	BUS	LGV	HGVr	Moto
A94	330810	745500	PN	2000	4000	3224	54	479	479	28
A923	302700	742300	PB	2000	3949	3356	91	357	357	20
A91	311600	704600	PB	2000	3860	3094	39	507	507	33
A822	283700	709300	PN	2000	3850	3254	13	426	426	16
A924	293100	758700	PB	2000	3820	3354	84	294	294	5
A823	292100	711000	PN	2000	3694	3179	37	362	362	3
A977	300000	697400	PN	2000	3673	2802	3	251	251	1
A824	295000	713100	PB	2000	3577	2801	34	558	558	10
A911	317800	702500	PN	2000	3052	2545	31	353	353	27
A911	315400	704100	PN	2000	2880	2423	18	306	306	52
A827	295000	752600	PN	2000	2808	2183	53	412	412	7
A911	319400	701500	PN	2000	2721	2214	22	410	410	6
A827	290000	752300	PN	2000	2621	2034	38	365	365	21
A824	292700	712000	PN	2000	2567	2144	47	295	295	9
A91	309700	704000	PN	2000	2485	2080	7	266	266	25
A926	322800	746500	PN	2000	2446	1946	61	335	335	41
A824	293555	712000	PN	2000	2296	1811	19	328	328	3
A926	325500	747800	PN	2000	2213	1745	4	312	312	30
A912	316600	711200	PN	2000	2008	1655	11	234	234	8
A924	294200	758665	PB	2000	1929	1682	38	168	168	0
A93	316300	750000	PN	2000	1754	1398	17	236	236	25
A85	270000	724200	TN	2000	1581	1302	32	154	154	20
A827	282200	748300	PN	2000	1553	1281	18	203	203	1
A823	294800	705300	PN	2000	1537	1179	15	204	204	111
A823	290200	713200	PN	2000	1524	1252	23	164	164	30
A984	310000	740550	PN	2000	1464	1127	37	182	182	12
A823	302000	697800	PN	2000	1434	1194	9	177	177	27
A823	301700	699400	PN	2000	1336	1125	23	121	121	34
A926	326400	748050	PN	2000	1309	971	75	199	199	8
A822	289400	734500	PN	2000	1251	1043	3	105	105	79
A822	290000	726800	PN	2000	961	737	9	171	171	15
A984	307200	740500	PN	2000	875	653	14	131	131	20

Rd_no	x	y	Rd_class	AADFYear	All_vehicles	CAR	BUS	LGV	HGVr	Moto
A826	290600	742600	PN	2000	852	697	12	100	100	15
A827	262900	736600	PN	2000	835	712	11	85	85	12
A984	318600	740100	PN	2000	804	685	0	62	62	7
A93	312850	774300	PN	2000	800	702	10	51	51	3
A93	313700	757200	PN	2000	779	612	11	98	98	12
A822	296700	739700	PN	2000	739	578	8	92	92	51
A924	310000	755350	PN	2000	655	516	8	104	104	1
A923	306400	745800	PN	2000	616	469	11	116	116	0
A85	280800	722700	TN	2000	608	475	19	43	43	7
A924	300000	762990	PN	2000	554	482	2	54	54	2

Table A2.3 Traffic Flow Data supplied for roads in Perth City by Perth and Kinross Council 2002

Road Link	East	North	Daily Flow 12 hour	AADT 2002	CAR	LGV	OGV 1*	OGV 2	BUS
Perth Bridge between Charlotte St and Main Street	312063	723860	12985	14933	11234	1288	221	1	241
Queen's Bridge between Tay St and A85	312159	723430	13089	15052	10738	1398	596	209	148
Shore Rd between A989 and Harbour Rd	311906	723023	6172	7098	4546	836	444	315	31
Edinburgh Rd between A989 & South Inch View	311051	723069	7223	8306	5754	962	299	88	120
St Leonards Bank between A989 and Abbot St	311200	723506	5294	6088	4505	548	132	0	109
Glasgow Rd between Earls Dyke & Whitefriars Cres	311549	723100	14390	16549	11930	1279	448	124	609
Long Causeway between Caledonian Rd and St Catherines Rd	311323	723763	13309	15305	12292	702	189	78	
Barrack St between Atholl St and Low St	311410	723956	18313	21060	15099	1928	771	96	419
Balhousie St between Barossa Place and Hay Street	311394	724023	4893	5627	4114	530	72	1	176

*other goods vehicles

Figure 3.1 Traffic Count Points in Perth

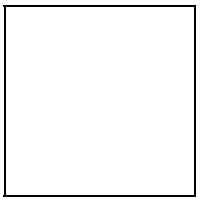

Table A2.4 DMRB Screening for nitrogen dioxide

	East	North	road centre m	AADT 2002	AADT 2005	Average Speed kph	% HDV	NO_2 Annual mean background 2005 μgm^{-3}	Road Transport Contribution 2005 μgm^{-3}	NO_2 Annual mean 2005 μgm^{-3}
Perth Bridge	312063	723860	9.6	14932	17172	40	15.6	16.1	10.5	26.6
Queen's Bridge	312159	723430	40	15052	17310	40	21.9	16.1	8.5	24.6
Tay St	312050	723050	10.7	7098	8163	40	35.8	16.1	10.2	26.3
Princes St	311906	723024	10	8306	9552	40	25.5	16.1	12	28.1
St Leonards	311393	723100	5.3	6088	7001	40	17.5	16.1	6.1	22.2
Glasgow Rd	311200	723500	17	16548	19030	40	20.6	16.1	13.8	29.9
Long Causeway	311323	723763	9.8	15305	17601	40	8.3	16.1	9.1	25.2
Barrack St	311410	723956	8.7	21060	24219	40	21.3	16.1	14.3	30.4
Balhousie St	311394	724023	9.3	5626	6470	40	18.9	16.1	5.6	21.7
Main Street	312318	723450	9	22120	25437	40	20	16.1	17.5	33.6
South Street	311611	723946	7.2	15170	17446	40	20	16.1	16.2	48.5
King Street	311554	723467	8.3	3724	4283	40	20	16.1	5.3	21.4
Atholl Street	311611	723946	8.8	26339	30289	40	20	16.1	18.5	53.1
Queens Bridge/Tay St	312090	723438	40,11	22150	25473	40	20	16.1	16.8	32.9
Main Street/Perth Bridge	312259	723927	11,9.6	39662	45611	40	20	16.1	27	43.1
Atholl Street /Barrrack Street	311423	723940	9.4, 16	47399	54509	40	20	16.1	27	43.1
South Street/ King St	311552	7233484	7.4,15	18294	21038	40	20	16.1	19.7	35.8

Table A2.5 DMRB Screening for PM_{10} 2004

Road	East	North	Receptor to road centre m	AADT 2002	AADT 2004	Average Speed kph	% HDV	PM_{10} background μgm^{-3}	PM_{10} from roads μgm^{-3}	PM_{10} total μgm^{-3}	Exceedences of 50 μgm^{-3} Daily Mean
Perth Bridge	312063	723860	9.6	14932	17172	40	15.6	14.9	4.8	19.7	3
Queen's Bridge	312159	723430	40	15052	17310	40	21.9	14.9	3.8	18.7	2
Tay St	312050	723050	10.7	7098	8163	40	35.8	14.9	6.3	21.2	5
Princes St	311906	723024	10	8306	9552	40	25.5	14.9	5.7	20.6	4
St Leonards	311393	723100	5.3	6088	7001	40	17.5	14.9	2.5	17.4	1
Glasgow Rd	311200	723500	17	16548	19030	40	20.6	14.9	6.9	21.8	6
Long Causeway	311323	723763	9.8	15305	17601	40	8.3	14.9	3.5	18.4	2
Barrack St	311410	723956	8.7	21060	24219	40	21.3	14.9	6.7	21.6	6
Balhousie St	311394	724023	9.3	5626	6470	40	18.9	14.9	2.1	21.1	1
Main Street	312318	723450	9	22120	25437	40	20	14.9	9.5	24.4	11
Atholl Street	311611	723946	8.8	26339	30289	40	20	14.9	10.2	25.1	13
South Street	311611	723946	7.2	15170	17446	40	20	14.9	8.5	23.4	9
Queens Bridge/Tay St	312090	723438	40,11	22150	25473	40	20	14.9	8.3	21.5	8
Main Street/Perth Bridge	312259	723927	11,9.6	39662	45611	40	20	14.9	14.3	29.8	25
Atholl Street /Barrrack St	311423	723940	9.4, 16	47399	54509	40	20	14.9	17.5	30.3	37
South Street/ King St	311552	723484	7.4,15	18294	21038	40	20	14.9	11.6	25.5	15

Table A2.6 DMRB Screening for PM_{10} 2010

Road	East	North	Receptor to road centre m	AADT 2002	AADT 2010	Average Speed kph	% HDV	PM_{10} background μgm^{-3}	PM_{10} from roads μgm^{-3}	PM_{10} total μgm^{-3}	Exceedences of 50 μgm^{-3} Daily Mean
Perth Bridge	312063	723860	9.6	14932	17918	40	15.6	13.9	3.5	17.4	1
Queen's Bridge	312159	723430	40	15052	18062	40	21.9	13.9	1.9	15.8	0
Tay St	312050	723050	10.7	7098	8518	40	35.8	13.9	3.2	17.1	1
Princes St	311906	723024	10	8306	9967	40	25.5	13.9	2.9	16.8	1
St Leonards	311393	723100	5.3	6088	7306	40	17.5	13.9	1.8	15.7	0
Glasgow Rd	311200	723500	17	16548	19858	40	20.6	13.9	3.5	17.4	1
Long Causeway	311323	723763	9.8	15305	18366	40	8.3	13.9	2.5	16.4	0
Barrack St	311410	723956	8.7	21060	25272	40	21.3	13.9	5	18.9	2
Balhousie St	311394	724023	9.3	5626	6751	40	18.9	13.9	1.7	15.6	0
Main Street	312318	723450	9	22120	26543	40	20	13.9	4.8	18.7	2
Atholl Street	311611	723946	8.8	26339	31606	40	20	13.9	5.2	19.1	2
South Street	311611	723946	7.2	15170	18204	40	20	13.9	4.3	18.2	2
King Street	311554	723467	8.3	3724	4469	40	20	13.9	1.2	15.1	
Queens Bridge/Tay St	312090	723438	40,11	22150	26580	40	20	13.9	5.3	19.2	3
Main Street/Perth Bridge	312259	723927	11,9.6	39662	47594	40	20	13.9	7.7	21.6	6
Atholl St /Barrrack St	311423	723940	9.4, 16	47399	56879	40	20	13.9	8.3	22.2	7
South Street/ King St	311552	723484	7.4,15	18294	21953	40	20	13.9	5.8	19.7	3

Appendix 3
Emissions Data

CONTENTS

Table A3.1 Part A Processes in Perth and Kinross

SEPA Ref	Company	Site Address	Process Description
IPC/E/72	Hydrochafer	Shore Road, Friarton, Perth	Inorganic
IPC/E/20013	DARA	RN Aircraft Workshops, Almondbank, Perth	Non-ferrous metals, cadmium recovery

Table A3.2 Part B Processes in Perth and Kinross

SEPA Ref	Company	Site Address	Process Description
APC/E/544	CPL Calport	Calport Store, Shore Road, Perth	Animal/Vegetable
APC/E/545	CPL Calport	Norsk Store, Friarton Road, Perth	Animal/Vegetable
APC/E/530	Kirk, Donald Ltd.	Strathtay Road, No 288, Perth	Car Spraying
APC/E/531	J.M. Accident Repair Centre	Friarton Bridge Park, Friarton Road, Perth PH8 2LN	Car Spraying
APC/E/532	Frews Cars Ltd.	Riggs Road, Perth	Car Spraying
APC/E/534	Camerons (Perth) Ltd.	166 Dunkeld Road, Perth	Car Spraying
APC/E/535	Elder & Paton	Arran Road, North Muirton, Perth	Car Spraying
APC/E/536	Dickson Motors Ltd.	172-174 Dunkeld Road, Perth	Car Spraying
APC/E/537	Croles Coachworks	Jessie Street, Blairgowrie	Car Spraying
APC/E/538	Mutch Mechanical Serv.	Shore Road, Perth	Car Spraying
APC/E/540	Dougan Allan	The Station, Auchterarder	Car Spraying
APC/E/513	Errol Brick Co Ltd	Inchcoonans Road, Errol, Perthshire	Ceramics
APC/E/522	CPL Calport	CPL Calport, The Harbour, Perth	Coal Storage
APC/E/20116	MacGregor Equipment Ltd	Main Street, Aberuthven	Crushing Process (Mobile)
APC/E/20483	Grosvenor Grain & Feed Co Ltd	The Harbour, Perth	Fishmeal storage
APC/E/539	Smith Anderson & Co	Erichtside Works, Haugh Road, Blairgowrie	Flexible Packaging Casting
APC/E/20086	Transco	Cleish Transco Site near Drum Kinross	Gas Odorisation
APC/E/20431	Transco	Pitcairngreen	Gas odourant injection
APC/E/525	Perth & Kinross	Perth Crematorium, Crieff Road, Perth	Incinerator
APC/E/526	SAC Veterinary Service	Cleeve Gardens, Oakbank Road, Perth	Incinerator
APC/E/514	Ready Mixed Concrete	Shore Road, Perth	Mineral
APC/E/515	Bardon Aggregates	Gowrie Plant, Stanley, Perthshire	Mineral
APC/E/516	Pioneer Concrete (UK)	Friarton Road, Perth	Mineral
APC/E/517	Tarmac Heavy Build.	Friarton Quarry, Gleneagles Road, Perth	Mineral
APC/E/518	MI Great Britain Ltd.	Foss Mine/Quarry Tummel Bridge by Aberfeldy, Perthshire	Mineral
APC/E/519	APW Plant Ltd.	Aberfeldy Industrial Estate, Dunkeld Street, Aberfeldy, Perthshire	Mineral
APC/E/520	Thistle Aggregates	Shierglas Quarry by Pitlochry, Perthshire	Mineral
APC/E/521	Tayside Contracts	Collace Quarry, Kinrossie by Perth	Mineral
APC/E/20467	I & H Brown Ltd	Perth	Mobile Crusher
APC/E/20196	Asda Stores	Dunkeld Road, Perth (under determ)**	PVR*
APC/E/20153	BP Express Shopping	Bullion Filling Station, Invergowrie	PVR
APC/E/20120	Auchterarder Motors Ltd	223 High Street, Auchterarder (under determination)	PVR

SEPA Ref	Company	Site Address	Process Description
APC/E/20126	Kenneth Melville (Errol) Ltd	Inchmichael Garage (under determ)	PVR
APC/E/20135	Petrol Plus (Angus) Ltd	New Scone Filling Station (under determ)	PVR
APC/E/20140	Lamb & Gardiner Ltd	Union Street, Coupar Angus	PVR
APC/E/20145	Alexander Reid	Guildtown Garage, Perth	PVR
APC/E/20164	BP Express Shopping Ltd	Kingsway West Filling Station, Dundee (under determ)	PVR
APC/E/20190	Ballinluig Services	Ballinluig (under determ)	PVR
APC/E/20204	Tesco Stores Ltd	Crieff Road, Perth (under determ)	PVR
APC/E/20219	King & Sons	Dunkeld Street, Aberfeldy (under determ)	PVR
APC/E/20217	Save Service Stations	204-206 Glasgow Road, Perth (under determ)	PVR
APC/E/20221	South Inch Filling Station	Edinburgh Rd, Perth	PVR
APC/E/20240	Perth Services	The Triangle, Inveralmond, Perth	PVR
APC/E/20242	Crieff Garage	75 East High St, Crieff	PVR
APC/E/20243	Pitlochry Service Station	Perth Rd, Pitlochry	PVR
APC/E/20293	Safeway Stores Plc	Perth	PVR
APC/E/20294	Perth St Service Station	Blairgowrie	PVR
APC/E/20302	The Brig Motor Co	Main St , Bridge of Earn	PVR
APC/E/20319	Strathtay Service Station	Edinburgh Rd, Perth	PVR
APC/E/20426	Almondbank Service Station	Crieff Rd, Perth	PVR
APC/E/20502	Blair Atholl Garage	Blair Atholl	PVR
APC/E/20503	Lix Toll Garage	Killin	PVR
APC/E/20506	Birnam Autopoint	Perth Rd, Birnam	PVR
APC/E/20520	Balbeggie Service Station	Main St, Balbeggie	PVR
APC/E/0120014	Burrel St Filling Station	Burrell St, Crieff	PVR
APC/E/0120021	Tesco Stores Ltd	Crieff Rd, Perth	PVR
PPC/E/ 30001	Esso Petrol Station	Broxden, Perth	PVR
APC/E/20192	Glenalmond Timber Co Ltd	Methven	Timber
APC/E/489	Mozolowski & Murray Ltd	Bridgend Ind. Estate, Kinross	Timber Machining
APC/E/511	Millbridge Motors	Millbridge, No 2 Kinross	Waste Oil Burner
APC/E/546	Gordon Motors	West End Garage, Comrie Road, Crieff	Waste Oil Burner
APC/E/549	Lamb & Gardiner	Union Street, Coupar Angus	Waste Oil Burner
APC/E/550	Elder & Paton	Arran Road, Perth	Waste Oil Burner
APC/E/554	Nicol, Robert & Son	Burnside Garage, Dunning, Perthshire	Waste Oil Burner
APC/E/557	Reid, Mr J S	Comrie Garage, Drummond Street, Comrie	Waste Oil Burner
APC/E/200029	Taylor, Stewart	Glenfarg Garage, Main Street, Glenfarg, Perthshire	Waste Oil Burner
APC/E/20055	Hydro Electric plc.	Inveralmond Depot Central Workshop, Inveralmond Road, Perth	Waste Oil Burner
APC/E/20103	Crichton, Robert B	Lochty Garage Services Unit, 3 Lochty Industrial Estate, Almondbank, Perth	Waste Oil Burner
APC/E/20111	Kennedy, D.A	Inchcape Place, North Muirton Industrial Estate, Perth	Waste Oil Burner
APC/E/20409	Alan Samson Motors,	Terminus St, Blairgowrie	Waste Oil Burner

* Petrol Vapour Recovery
** under determ= Under Determination by SEPA

Table A3.3 Significant Part A Processes in Dundee

SEPA Ref	Company	Site Address	Process Description
IPC/E/20018	Dundee Energy Recycling Ltd	Claymore Street Dundee	Incineration
IPC/E/82	Michelin Tyre plc	Baldovie Road Dundee	Combustion
IPC/E/83	Nynas (Uk) AB Ltd	East Camperdown Street Dundee	Oil Refinery

Table A3.4 Significant Part B Processes in Dundee

SEPA Ref	Company	Site Address	Process Description
APC/E/331	Dens Metal (Dundee) Ltd	Dens Road Dundee	Non-ferrous metals
APC/E/339	British Fuels Ltd	Piper Street Dundee	Mineral

Appendix 4

Descriptions of selected models and tools

CONTENTS

Simple screening models1[a]

1. Design Manual for Roads and Bridges (DMRB)[8] - This screening method was formulated by the former Department of Transport. The method gives a preliminary indication of air quality near roads, and is more suited to rural motorways and trunk roads than city centre traffic conditions. It is a simple procedure based on tables and nomograms; originally published in August 1994, a revision has been produced in 1999, which is more applicable to urban road situations. The DMRB method requires information on vehicle flow, HGV mix, vehicle speed and receptor-road distances. It contains a useful database of vehicular emission factors for future years.

In the revision of the DMRB method the following pollutants can be estimated:

- the maximum 8-hour mean CO concentration;
- the 98th percentile and the maximum of hourly mean NO_2 concentrations;
- the annual average benzene and annual average 1,3 butadiene concentration;
- the annual mean and the fourth highest daily mean PM_{10} concentrations.

The method adopts the annual mean concentration as the base statistic. Background pollutant levels are included explicitly in the calculations by adding an amount to the annual mean traffic contribution using the Air Quality Archive (paragraph 6.09) or default values. Surrogate statistics are used to convert annual means to National Air Quality Strategy statistics. Details of the road layout cannot be specified.

2. DI Stack Height Calculations - This screening procedure, based on nomograms, estimates a chimney height which should ensure that ground level concentrations of a pollutant do not exceed a specified standard or guideline for that pollutant for more than about 5 minutes, under weather conditions which are likely to occur 98% of the time. Therefore, the method does not take into account worst-case meteorology. Strictly speaking, this screening method is applicable only to the smaller processes which come under local authority control i.e. Part B processes and non-combustion sources. The method can be used to check whether a process has a stack of adequate height. The results should be treated with caution in cases of extreme weather condition's, complex topography or complicated configuration of buildings. Heights determined using the method should be regarded as a guide, rather than an accurate definition of the discharge chimney height.

3. Guidance for Estimating the Air Quality Impact of Stationary Sources (GSS)[9]; this guide provides precalculated dispersion results for stack emissions expressed as nomograms, was published by the Environment Agency (EA) in 1998. The nomograms are based on a large number of computations using ADMS. They cover 10 stack heights, 4 categories of surface roughness, 3 averaging times and 3 climate types. The predicted pollutant concentrations are comparable with the prescribed air quality objectives. The model is limited to a range of stack heights and exit velocities, and cannot treat building wake effects or non-buoyant source releases.

[a] The information on simple screening models has been taken from LAQM.TG(03)[1] Review and Assessment: *Selection and use of dispersion models.*