1.0 Executive Summary

1.1 This is a report of Stages 1 and 2 of the formal Review and Assessment of air quality in West Lothian, as required to be undertaken by all Local Authorities under Part IV of the Environment Act 1995 and associated guidance. An interim Stage 1 Report was published in December 1998. The Air Quality (Scotland) Regulations 2000 lay down Standards for seven priority pollutants, and set Objectives against each Standard to be met by specified dates. The procedures for Local Air Quality Management are phased, such that the detail and extent of the Review and Assessment are consistent with the risks of the Objectives not being achieved.

1.2 The Stage 1 is a screening process, designed to identify significant sources of the individual pollutants according to a Department of the Environment Transport and the Regions (DETR) methodology. Stage 2 should then focus-in on potential 'hotspots' where Objectives are potentially likely to be exceeded, and a Stage 3 Review and Assessment, if required, entails the use of predictive dispersion modelling techniques. This report therefore covers Stages 1 and 2 for each pollutant, and has identified their principal sources, and compared existing monitoring data and modelled estimations with the Objectives.

1.3 Chapters 3 to 9 address each of the seven pollutants in turn, namely benzene, 1,3-Butadiene, carbon monoxide, lead, nitrogen dioxide, fine particles and sulphur dioxide, as recommended in DETR Guidance. For each pollutant, the national perspective is discussed, the local sources are identified, comparison with the Objectives are made where monitoring data are available.

1.4 The conclusions drawn from this process are that the picture for West Lothian closely reflects the national situation, with issues consistent with those in most urban areas. There is at this stage a clear indication that all pollutants are likely to comply with the objectives by the dates prescribed in the Regulations. It is therefore concluded that a Stage 3 review and assessment will not be necessary.

2.0 Introduction

This Report represents the Stages 1 and 2 Review and Assessment of Air Quality in West Lothian, as required by the Environment Act 1995. There are Chapters on each of the seven priority pollutants identified by the Department of the Environment, Transport and the Regions (DETR), each with a summary and conclusion as to whether there is a need to progress to a more detailed Stage 3 review.

2.1 Legislation

Part IV of the Environment Act 1995 introduced new responsibilities for Local Authorities relating to Local Air Quality Management. The approach to be adopted was set out in a Government policy paper in January 1995[1], 'Air Quality: Meeting the Challenge, and following a lengthy consultation period, the National Air Quality Strategy ('the strategy') was published in April 1997[2] and a revised version in April 2000[3]. The Strategy lays down Air Quality Standards and Objectives to be achieved for prescribed air pollutants by a certain target date and Local Authorities have to undertake a formal Review and Assessment of air quality within their areas of jurisdiction to determine the likelihood of compliance with the Objectives by the end of that target year. If any pollutant concentrations are predicted to exceed the relevant Objective, this would lead to the designation of an Air Quality Management Area, within and around which an Action Plan to address the elevated pollutant levels must be prepared.

The system for Local Air Quality Management (LAQM) was formalised when the Air Quality (Scotland) Regulations (the Regulations[12]) were laid in April 2000, placing the Objectives onto a statutory footing. The Regulations were supported by both general and technical guidance to Local Authorities[4-11]. The key to the Review and Assessment procedure is a phased approach, such that the complexity and detail should be consistent with the risk of the Objectives not being achieved. After a Stage 1 screening process, in areas where there is deemed to be a potential risk of elevated pollution levels, a second Stage entails estimations of ground level pollutant concentrations and identification of potential local 'hotspots'.

Where it is predicted by this process that the statutory Objectives may not be met by the date specified in the Regulations, a more detailed and accurate third Stage assessment will be required. The guidance on Review and Assessments indicates that Stage 1 may be a simple desk-top screening exercise, whilst Stage 2 and 3 procedures will need to employ such techniques as air quality monitoring, compilation of an emissions inventory and predictive dispersion modelling.

An interim Stage 1 Report for West Lothian was completed in December 1998, but this combined Stage 1 and 2 report incorporates a more detailed review of the pollutants.

2.2 Aims and Objectives

The aims of this Stage 1 and 2 air quality review are:-

i) to identify the principal sources of pollutant emissions in the District according to a methodology laid down in guidance for Local Authorities;

ii) to compare existing air quality monitoring data to national Objectives for the

target year and to apply preliminary predictive statistics to determine the likely compliance with those Objectives;

iii) to identify any further monitoring, modelling or other action which might be needed to complete a Stage 3 Review and Assessment;

The objective of the review is to collate sufficient information on individual air pollutant sources and ambient concentrations to determine the need to progress to a further Review and Assessment, in accordance with the requirements of the National Air Quality Strategy.

2.3 Glossary of Terms

2.3.1 Pollutants

CO	Carbon monoxide
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen (= NO + NO_2)
PM_{10}	Particulate matter, (the mass fraction of particles collected by a sampler with a 50% inlet cut-off at aerodynamic diameter 10 µm).
SO_2	Sulphur dioxide

2.3.2 Units of Measurement

ppb	Parts per billion by volume
ppm	Parts per million by volume
µm	micrometre, one-millionth of a metre (one-thousandth of a millimetre)
µg/m^3	micrograms (one-millionth of a gram) per cubic metre of air
MT	megatonnes (one million tonnes)

2.3.3 Abbreviations

AADT	Annual average daily traffic flow
AAWT	Annual average weekday traffic flow
DETR	The Department of the Environment, Transport and the Regions
LAQM	Local Air Quality Management

2.3.4 Other Terms

'non-occupational'	External locations where the general public are likely to spend time, but not in any place of work.

2.4 The National Air Quality Strategy

2.4.1 Overview

The major elements of the Environment Act 1995 relating to the National Air Quality Strategy are as follows:-

Table 2.1 - Environment Act 1995, Chapter IV, s 80-88

Part IV Air Quality	Summary
Section 80	Obliges the Secretary of State (SoS) to publish a National Air Quality Strategy as soon as possible.
Section 81	Obliges the Environment Agency to take account of the Strategy.
Section 82	Requires Local Authorities to review air quality and to assess whether the air quality standards and objectives are being achieved. Areas where standards fall short must be identified.
Section 83	Requires a Local Authority, for any area where air quality standards are not being met, to issue an order designating it as an air quality management area (AQMA).
Section 84	Imposes duties on Local Authorities with respect to AQMAs. The Local Authority must carry out further assessments and draw up an action plan specifying the measures to be carried out and the timescale to bring air quality in the area back within limits.
Section 85	Gives reserve powers to cause assessments to be made in any area and to give instructions to a Local Authority to take specific actions. Authorities have a specific duty to comply with these instructions.
Section 86	Provides for the role of County Councils to make recommendations to a district on the carrying out of an air quality assessment and the preparation of an action plan.
Section 87	Provides the SoS with wide ranging powers to make regulations concerning air quality. These include standards and objectives, the conferring of powers and duties, the prohibition and restriction of certain activities or vehicles, the obtaining of information, the levying of fines and penalties, the hearing of appeals and other criteria. The regulations must be approved by affirmative resolution of both Houses of Parliament.
Section 88	Provides powers to make guidance to which Local Authorities must have regard.

DETR Guidance

The local air quality management guidance series comprises eight separate publications [4-11], four general and four technical guidance notes, together with an introductory Circular[13]. The notes constitute guidance under section 88 of the Act, to which Local Authorities must have regard when carrying out such functions.

General Guidance[4-11]

i) *Framework for review and assessment of air quality*. LAQM.G1(00)

ii) *Developing local air quality strategies and action plans: the principal considerations*. LAQM.G2(00)

iii) *Air quality and transport.* LAQM.G3(00)

iv) *Air quality and land use planning*. LAQM.G4(00)

Technical Guidance

i) *Review and assessment monitoring air quality*. LAQM.TG1(00)

ii) *Review and assessment estimating emissions.* LAQM.TG2(00)

iii) Review and assessment s*election and use of dispersion models*. LAQM.TG3(00)

iv) *Review and assessment: pollutant specific guidance*. LAQM.TG4(00)

2.4.2 Standards and Objectives

The air quality *standards* in the Strategy were set purely with regard to scientific and medical evidence of the effects of a particular pollutant on health. As such, they represent minimum or no significant risk levels. They were not based on an assessment of costs and benefits or issues of technical feasibility.

The air quality *objectives* in the strategy, however, represent the Government's present judgement of achievable air quality by the dates specified in the Regulations[12] on the evidence of costs and benefits and technical feasibility. The Strategy[3] used the recommendations of the Expert Panel on Air Quality Standards (EPAQS), where they existed, as the standards on which the setting of objectives was based. Where EPAQS had not made a recommendation, the relevant information from the World Health Organisation was used, where available.

The Objectives as laid down in the Air Quality (Scotland) Regulations 2000 are as follows:-

Table 2.2 - Objectives : Air Quality (Scotland) Regulations 2000

Pollutant	Maximum Concentration	Date to be Achieved By
Benzene	16.25 micrograms per cubic metre or less, when expressed as a running annual mean	31 December 2003
1,3-Butadiene	2.25 micrograms per cubic metre or less, when expressed as a running annual mean	31 December 2003
Carbon Monoxide	11.6 milligrams per cubic metre or less, when expressed as an 8 hour mean	31 December 2003
Lead	0.5 micrograms per cubic metre or less, when expressed as an annual mean	31 December 2004
Lead	0.25 micrograms per cubic metre or less, when expressed as an annual mean	31 December 2008
Nitrogen Dioxide	200 micrograms per cubic metre or less, when expressed as an hourly mean, not to be exceeded more than 18 times a year	31 December 2005
Nitrogen Dioxide	40 micrograms per cubic metre or less, when expressed as an annual mean	31 December 2005
PM_{10}	50 micrograms per cubic metre or less, when expressed as a 24 hour mean, not to be exceeded more than 35 times a year	31 December 2004
PM_{10}	40 micrograms per cubic metre or less, when expressed as an annual mean	31 December 2004
Sulphur Dioxide	350 micrograms per cubic metre or less, when expressed as an hourly mean, not to be exceeded more than 24 times a year.	31 December 2004
Sulphur Dioxide	125 micrograms per cubic metre or less, when expressed as a 24 hour mean, not to be exceeded more than 3 times a year	31 December 2004
Sulphur Dioxide	266 micrograms per cubic metre or less, when expressed as a 15 minute mean, not to be exceeded more than 35 times a year	31 December 2005

For interpretation of the terms used see the Air Quality (Scotland) Regulations 2000

2.4.3 First Stage Review and Assessment Procedures

The information required to be collated for the First Stage review and assessment is detailed in the DETR Guidance, 'Framework for Review and Assessment of Air Quality[4], sections 3.05 - 3.09. Local Authorities are required to collate the following:

i) details of any significant transport related sources of pollution, including any existing or proposed roads, with existing or predicted

levels of traffic flow or congestion that could generate significant quantities of a pollutant of concern (see technical guidance);

ii) details of industrial sources regulated under Part 1 of [14] (or under[15]), together with the name, address and geographical location (ie Ordnance Survey co-ordinates), and whether the process is controlled under Part 'A' or 'B' of the Act;

iii) details of any significant sources of a pollutant of concern outside the local authority's area, which could lead to a risk of a failure to achieve air quality objectives on time (see technical guidance);

iv) details of any other existing or proposed significant sources of a pollutant of concern (see technical guidance);

v) a description of the sources of information the authority used to compile the report;

vi) details of any surveys or investigations undertaken to compile the report.

The authority should include a map of its area. For simplicity, it might also show geographical information in map form.

For all the above, the authority should then identify those existing or proposed processes or activities which:

- could, either singly or together, emit significant quantities of the pollutant(s) of concern; and are expected to be in existence and/or operation by the end of the relevant period; and to which – the public could be exposed to the pollutants in relevant locations (see paras 2.11 and 2.12)[4].

If any of these conditions do not apply for a pollutant of concern within the authority's area, then the risk of failing to achieve the air quality objective for that pollutant by the due date is likely to be negligible the authority will not need to move to the second stage for that pollutant. However, if the authority identifies processes or activities which satisfy all these conditions for any of the pollutants of concern, it should proceed to a second stage review and assessment for that pollutant. In addition, if any uncharacterised process or activity is situated within, or adjacent to, an authority's area in a relevant location (see paras 2.10 and 2.11)[4] and could be a "significant" source of a pollutant of concern, the authority should proceed to a second stage review and assessment in the vicinity of the uncharacterised source.

The first stage report should conclude by listing the pollutants and the locations (if any) that the local authority concludes require further examination.

2.4.4 Second Stage Review and Assessment Procedures

The aim of the second stage is to provide a further screening of a pollutant concentration within the authority's area. It is not intended to predict levels of current or future air quality across the whole of the authority's area with absolute accuracy. Nor does it require an authority to estimate every area of exceedence for each pollutant of concern. Authorities should instead select a number of relevant locations (see paras 2.11-2.12)[4] where the first stage showed that the highest concentrations of each air pollutant are likely to occur. The authority should review and assess whether there is a significant risk of an air quality objective not being achieved by the relevant deadline. They should also include any areas highlighted in the first stage review and assessment as containing uncharacteristic pollutant sources which could be a significant source of a pollutant of concern in a relevant location.

The local authority should estimate ground level concentrations of the relevant pollutants at a combination of roadside and/or industrial and/or urban background locations. The estimated concentrations in these locations will enable authorities to predict the potential* pollution concentrations at the end of the relevant period for each pollutant. Full details of relevant methodologies are given in the technical guidance.

The position and number of areas selected for second stage assessment will be a matter of judgement for individual authorities, but authorities should note that at this stage the approach is intended to be a precautionary one. If an air quality objective is currently being achieved in areas where the highest pollution concentrations are likely, and there is no significant risk that the objective will not continue to be achieved, it can be confident that an AQMA will not be necessary. If, however, this process indicates that, in any appropriate area, an air quality objective is not being achieved, might be exceeded in future, a local authority should proceed to the third stage.

Information requirements of a second stage review and assessment.

The report of a second stage review and assessment should being by listing the pollutants that require further examination based on the first stage review and assessment. For each pollutant of concern considered in the second stage review and assessment, the following information should then be provided:

i) details of any automatic or non-automatic monitoring activities undertaken, including:

- the pollutant species measured;
- the pollutant concentrations and averaging times;
- the monitoring period;
- an estimation of the accuracy and precision of the resulting measurements including any evidence of positive or negative bias;
- the monitoring technique used (including reference to British or European standards where appropriate);
- whether a gas or particulate sampling system has been used;
  site details and description, including Ordnance Survey co-

ordinates;
- quality control and assurance procedures undertaken, including, where appropriate, site maintenance, and calibration, service and maintenance of analysers;
- calibration gas trace ability or certification, where appropriate;
- a description of any data processing techniques employed, including validation, screening or review of data; and
- reference to the technical guidance, or other published material.

ii) details of any modelling activities including:

- model outputs including, where appropriate, predicted pollutant concentrations for current and future air quality;
- details of, or reference to, model input data including, where appropriate, assumed meteorology, pollutant emissions, traffic flows and speeds, dimensions of roads, street geometry and industrial operating conditions. Details of surrounding buildings and exposure should also be taken into account;
- the name and description of models used;
- information on estimated uncertainty in model outputs;
- details of or reference to validation of models; and
- reference to the technical guidance, or other published methods.

iii) details of the review and assessment methodology including:

- references to the technical guidance, or other published methods;
- estimated background concentrations used in the assessment, together with a reference to the source of the information or full details of the estimation method;
- full details of how indicator pollutants have been calculated;
- full details of how surrogate statistics for estimating the appropriate averaging time for a pollutant concentration have been used, full details of calculation methods.

For presentational simplicity, the authority should consider presenting geographically based information.

An authority will need to conduct a third stage review and assessment for any pollutant of concern for which the second stage review and assessment has indicated that there is a significant risk of an air quality objective not being achieved. The report of the second stage should therefore conclude by listing those pollutants and those locations, if any, which the local authority has concluded require further examination.

2.4.5 Meteorology

Weather data for West Lothian is collected using a Windtracker system that is based at the County Buildings, Linlithgow. A variety of parameters are collated including atmospheric pressure, temperature, wind speed and direction and rainfall (see figures below for 1999). The most common

occurrences for each of the parameters are given in Figures 2.1 to 2.4 and Table 2.3.

The data suggests that the climate of West Lothian is dry and temperate, with light winds, although the direction can be variable. Fifty-nine percent of the wind direction measurements were from between SW and W, although ENE and E wind direction were also significant. Winds from ENE/E tend to be seasonal and usually occur in spring and autumn.

Figure 2.1 - Wind Rose : West Lothian Council 1999

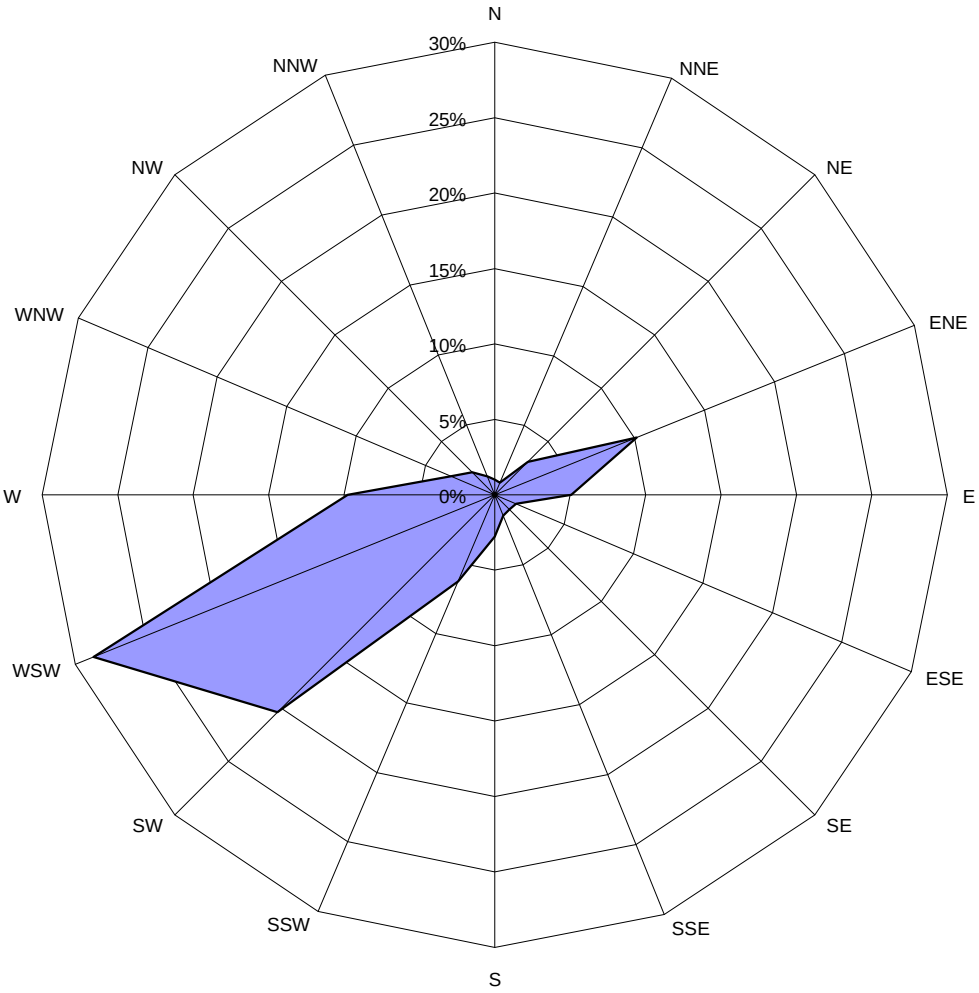


Table 2.3 - Wind Rose Data : West Lothian Council 1999

		Count	% Dirn
0	N	531	1%
1	NNE	461	1%
2	NE	1635	3%
3	ENE	5380	10%
4	E	2682	5%
5	ESA	816	2%
6	SE	738	1%
7	SSE	796	2%
8	S	1467	3%
9	SSW	3299	6%
10	SW	10812	20%
11	WSW	15210	29%
12	W	5174	10%
13	WNW	1676	3%
14	NW	1120	2%
15	NNW	693	1%
16	N	531	1%

Figure 2.2

West Lothian Council
Air Temperature 1999

Class Interval 1.5°C

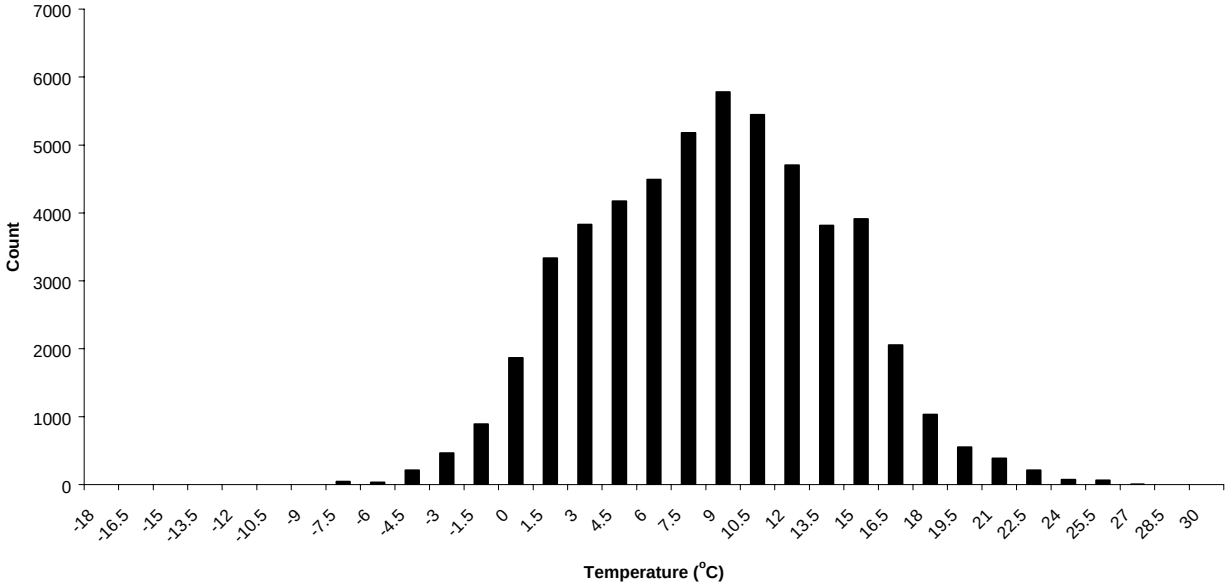


Figure 2.3

West Lothian Council
Daily Rainfall (mm) 1999

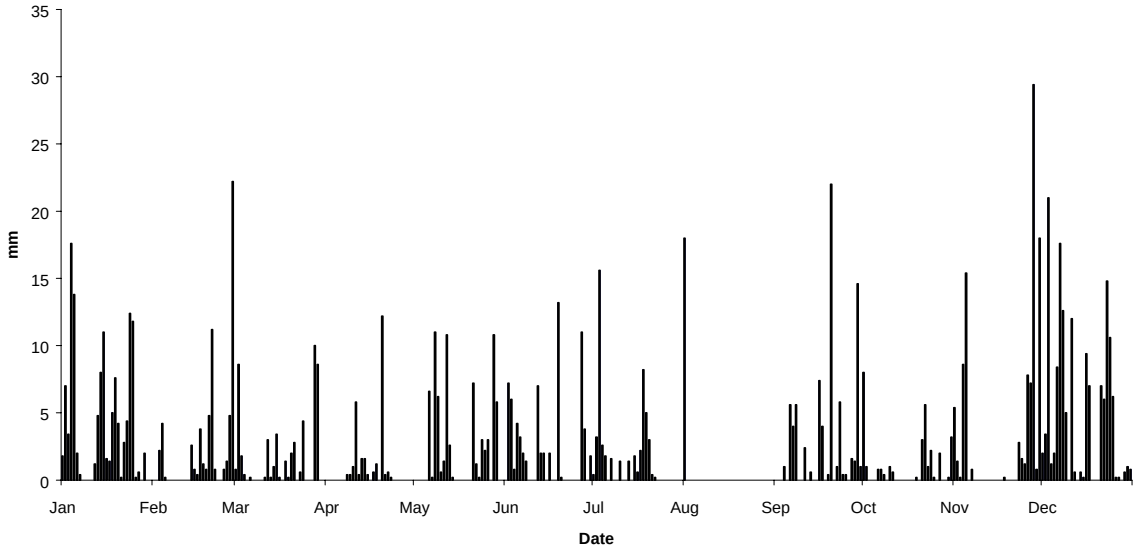
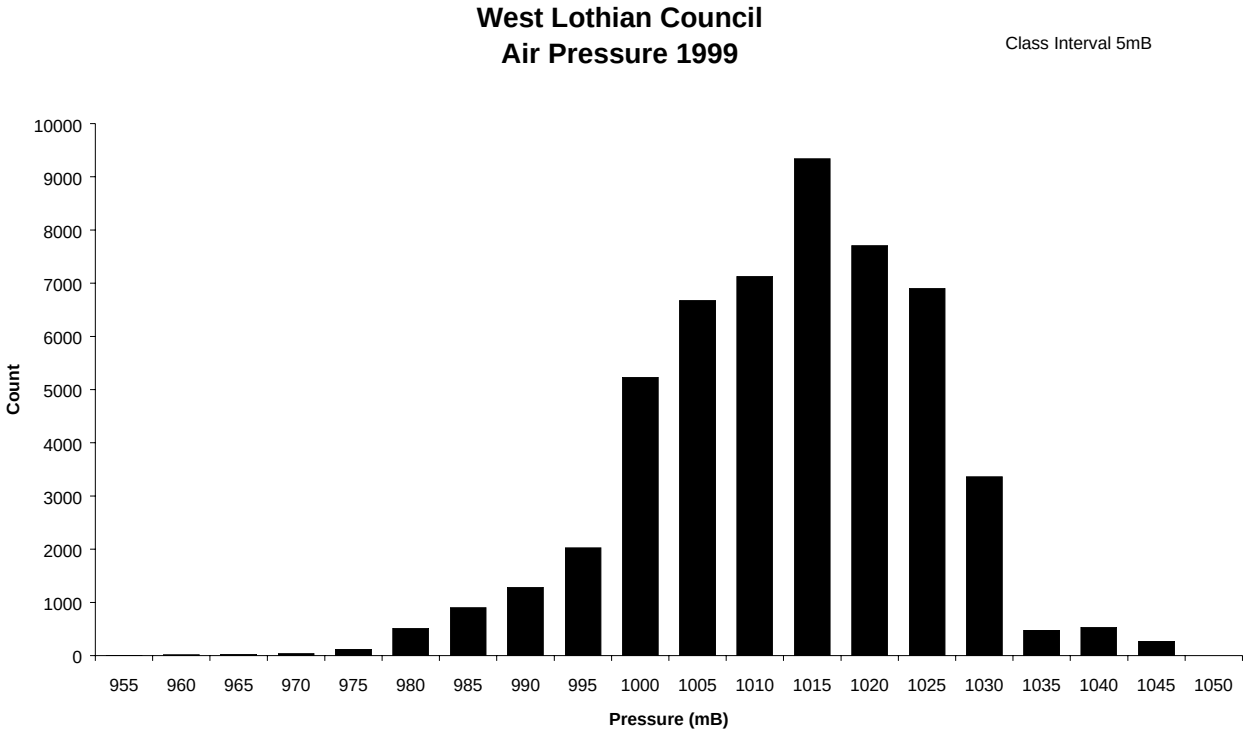


Figure 2.4



2.4.6 Part A and B Processes

There are 4 Part A and 26 Part B processes which operate in West Lothian. The Part A Processes cover micro-electronic production, which tend to emit NO_x and SO_2, and lead works which emit lead and particles.

The Part B processes are much more wide ranging and include paint spraying, chemical, timber, metal processes and fish food manufacture.

See the map and list in Appendix 1 to view table of processes and their locations within the district. The list and map do not include 16 Part B processes covering service stations (petrol vapour recovery), although a list of these is included at Appendix 1.

2.4.7 Traffic

The Council's Highways Service provided information from 8 automatic traffic-counting sites. These are listed below:-

A899, A89 (Newbridge), A89 (Boghall), A801, A71 (Linhouse), A71 (West Calder), B7015 (between East and Mid Calder), A803 (Linlithgow). Traffic information regarding the M8 and M9 motorways was provided by The Scottish Executive Road Network Management Division.

Data is available from sites A899, A89 (Newbridge), A801, B7015, A71 (West Calder) and A71 (Linhouse water) as hourly and daily totals, which were averaged over the whole year for years 1997 – 1999.

Information is available for traffic flows M8 for 1997 and 1999 single year information is available for sites A89 (Boghall) and 6-month period of information for A803 (Linlithgow). The traffic counter at the High Street, Linlithgow is located at the same part of the road as the air quality monitoring unit but has only 6 months data available. A map showing these roads is located in Appendix 2 with an example of the type of information provided by Highways for the sites at A803, A899, A89, A71 and A801 attached.

Table 2.4 - Annual Average Daily Traffic - 1999

Road	Annual Average Daily Traffic
M8	approx 50,000
M9 (Linlithgow)	approx 30,000
A899	36,016
A89 (Newbridge)	18,549
A89 (Boghall)	11,589
A801	11,482
A71 (Linhouse)	13,160
A71 (West Calder)	6,617
A803 (Linlithgow)	17,773

Figure 2.5

Annual Average 24 Hour Daily Figures and Annual Average Daily Traffic Flow 01/01/97 to 31/12/97

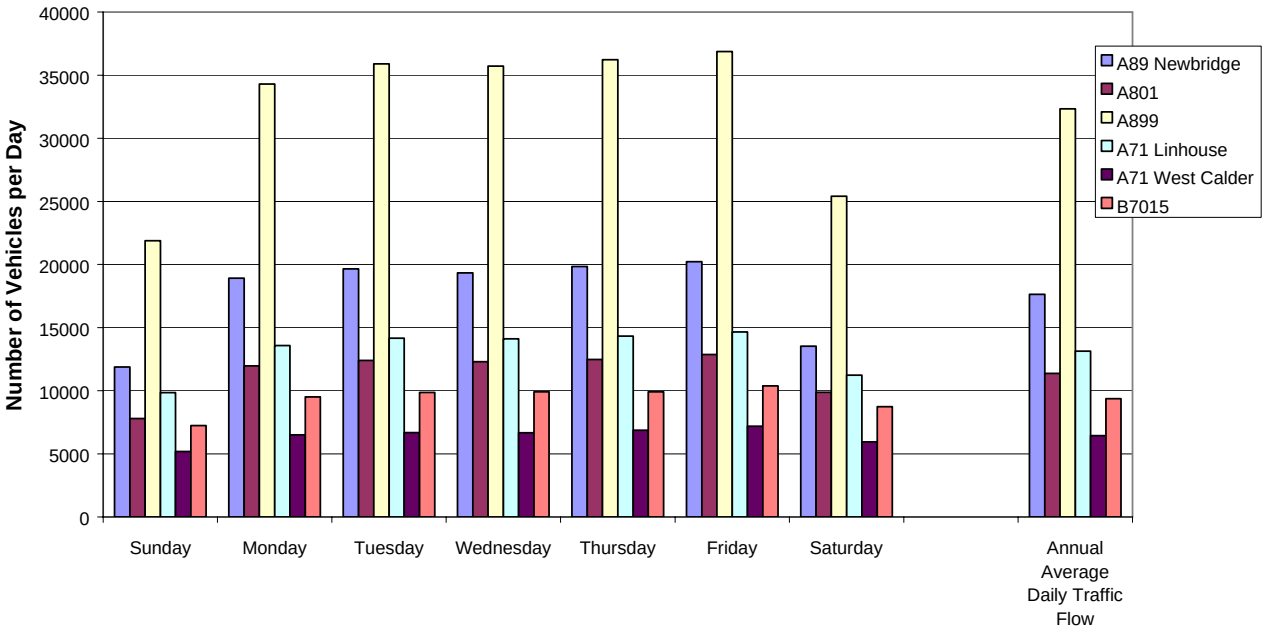


Figure 2.6

Annual Average 24 Hour Daily Figures and Annual Average Daily Traffic Flow 01/01/98 to 31/12/98

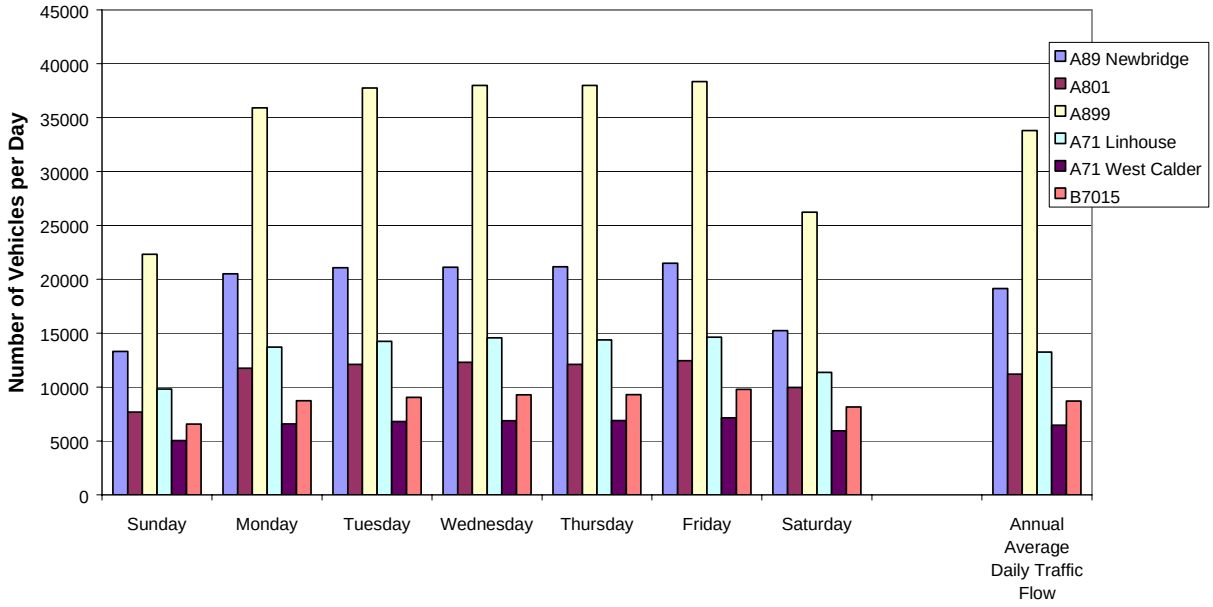


Figure 2.7

Annual Average 24 Hour Daily Figures and Annual Average Daily Traffic Flow 01/01/99 to 31/12/99

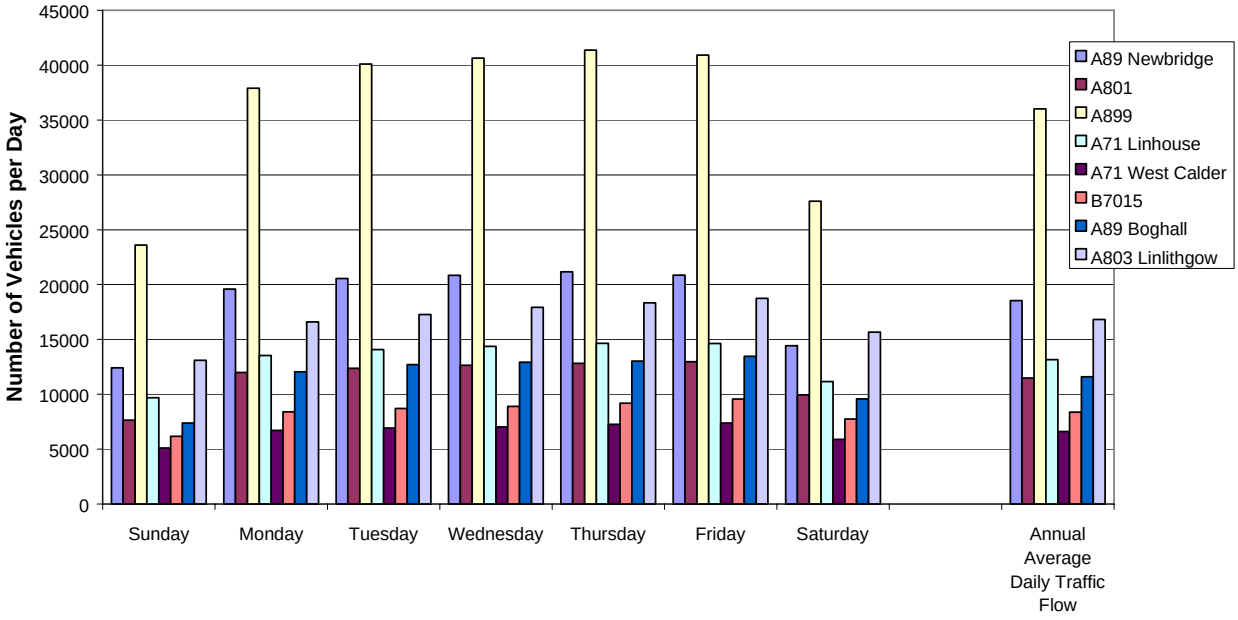
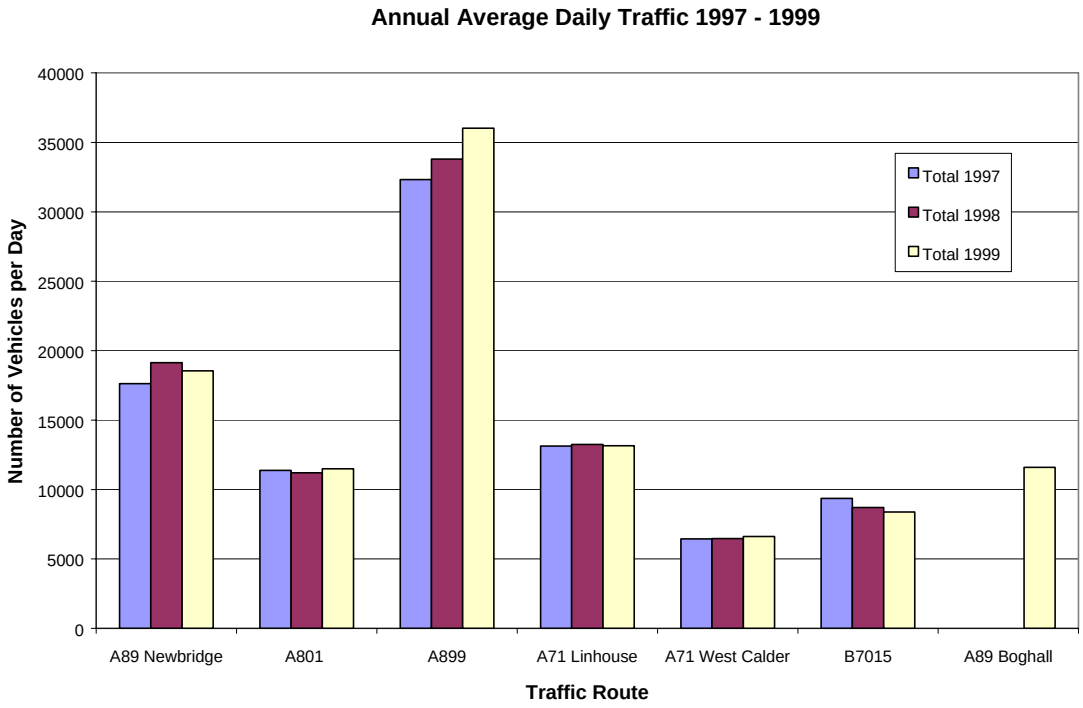


Figure 2.8



Air Quality Forum

2.4.8 Air Quality Forum

During the preparation of the interim Stage 1 Review and Assessment several valuable contacts from external agencies and other council service units were established.

It was therefore decided to set up a working group where the participants would comprise of individuals able to provide the information required in the preparation of the combined stage 1 and 2 Review and Assessment Air Quality in West Lothian.

The first meeting of the working group thereafter called the Air Quality Forum was held on the 12 November 1998, when it was decided to meet twice yearly. Since then there have been five meetings. In addition there have been many further meetings of individual participants as the information requested became available.

The main participants in the Air Quality Forum are:

Bob Hume, West Lothian Council, Highways
Tom Bryceland, West Lothian Council, Highways
John Sheldon, West Lothian Council, Strategic Planning and Transportation (Environment)
Malcolm Inkster, West Lothian Council, Strategic Planning and Transportation (Local Plan)

Alastair Stuart, West Lothian Council, Strategic Planning and Transportation (Transport Plan)
Claire Braithwaite, West Lothian Council, Strategic Planning and Transportation (Local Agenda 21)
Richard Hartland, West Lothian Council, Development and Building Control
Gordon Jackson, Scottish Environmental Protection Agency
Davie Holloway, Scottish Environmental Protection Agency
Mark Eggilling, Scottish Environmental protection Agency
Crawford Morgan, Environmental Health and Trading Standards
Albert Valentine, Environmental Health and Trading Standards
John Nelson, Environmental Health and Trading Standards
Christina Wells, Environmental Health and Trading Standards

A considerable amount of useful and helpful information has been gathered which can only contribute to an improvement in Local Air Quality.

A separate West Lothian Council/SEPA Liaison Group also meets quarterly, where air quality is also regularly on the agenda.

3.0 First Stage Review and Assessment of Benzene

3.1 Introduction

Benzene is a chemical consisting of six atoms each of carbon and hydrogen, arranged in a ring structure. At normal ambient temperatures it is a liquid but it readily evaporates and small amounts are detectable in the atmosphere.

There are no well defined natural sources of benzene and all the benzene observed at ground level in the Northern Hemisphere is likely to have resulted from human activities in particular the use of petrol and oil.

In the UK the main atmospheric source of benzene is the combustion and distribution of petrol, of which it is a minor constituent, currently comprising about 2% by volume in the UK, on average. Diesel is a relatively small source. Exhaust fumes contain some unburned benzene, but they also contain benzene formed from the combustion of other aromatic components of petrol. Motor vehicles are the most important single source of benzene on a national basis, accounting in 1996 for 64% of the total UK annual emissions of 41 ktonnes.

Benzene is naturally broken down through chemical reactions in the atmosphere but these reactions take several days. Thus, in common with inhabitants of industrial and industrialising nations people living in the United Kingdom are exposed to benzene in the air they breathe.

Benzene is known to be a human carcinogen. The effect of long-term exposure which is of most concern is leukaemia.

It has not been possible to demonstrate a level at which there is zero risk of exposure to benzene and policies to control benzene concentrations in the ambient air therefore adopt a risk management approach, aiming at attaining levels where the risk to health is very small.

3.2 Standard and Objective for Benzene

The Air quality (Scotland) Regulations 2000 established air quality standards and objectives as follows:-

- **Standard annual running mean of 16.25 micrograms (5 ppb) per cubic metre**
- **Objective maximum annual running mean of 16.25 (5 ppb) micrograms per cubic metre to be achieved by end of 2003**
- **To convert concentrations of benzene between ppb and µg/m^3 use the following factor: 3.25 *ppb = µg/m^3**

The focus of an authority's review and assessment for benzene should be non-occupational near ground level outdoor locations with elevated benzene concentrations in areas where a person might reasonably be expected to be exposed over a year (eg in the vicinity of housing, schools or hospitals etc).

3.3 The National Perspective

Existing national policies are expected to deliver the prescribed air quality objective for benzene by the end of 2003. Roadside levels of benzene next to even the most busy or congested road are expected to be well below the objective by the year 2003. Only those authorities with major industrial processes which either handle, store or emit benzene, which have the potential, in conjunction with other sources to result in elevated levels of benzene in relevant locations are expected to need to undertake a second or third stage review and assessment. It is expected for benzene that most local authorities will not need to progress past the first stage.

3.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of benzene. Clearly these sources need to be in existence and/or operation in 2003. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, paragraph 1.17)[11] need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- Details of existing and/or proposed Part A authorised processes in the authority's area;
- Details of existing and/or proposed Part B authorised processes in the authority's area;
- Details of any significant sources of benzene in neighbouring areas which could impact within the authority's area.

The Government and the devolved administrations are currently finalising an investigation into ambient levels of benzene in the vicinity of petrol stations. Whilst there may be current exceedences of the objective in the vicinity of some large petrol stations in London (where background concentrations are higher), the expected reduction in emissions will ensure that there will be no exceedences due to petrol stations by 2003. Authorities should therefore assume that petrol stations do not give rise to significant emissions.

3.5 Background Benzene Concentrations

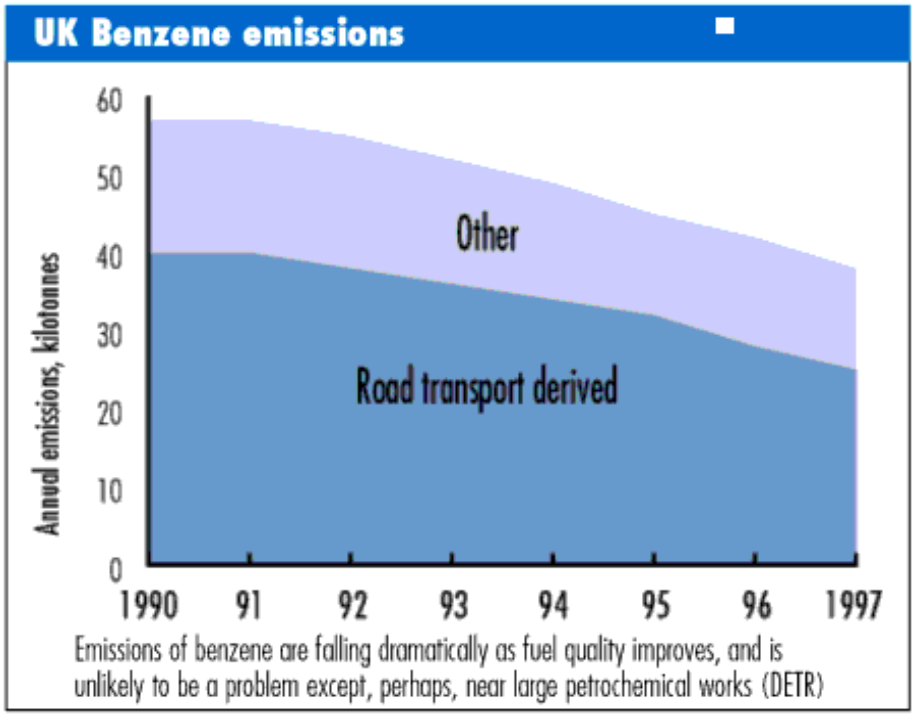
National maps are available which indicate estimated background benzene concentrations across the UK. The estimated background concentrations of benzene for the West Lothian area are <1.625 $\mu g/m^{-3}$.

3.6 Benzene Monitoring in the UK

In 1996 the Government operated 12 sites across the UK measuring speciated hydrocarbons every hour. All of these sites, some of which are urban, kerbside and rural, complied with the National Air Quality Standard of 16.25 $\mu g/m^3$ running annual mean.

Figure 3.1 shows the trend in Annual Emissions of Benzene in the UK 1990 to 1999.

Figure 3.1 - UK Benzene Emissions



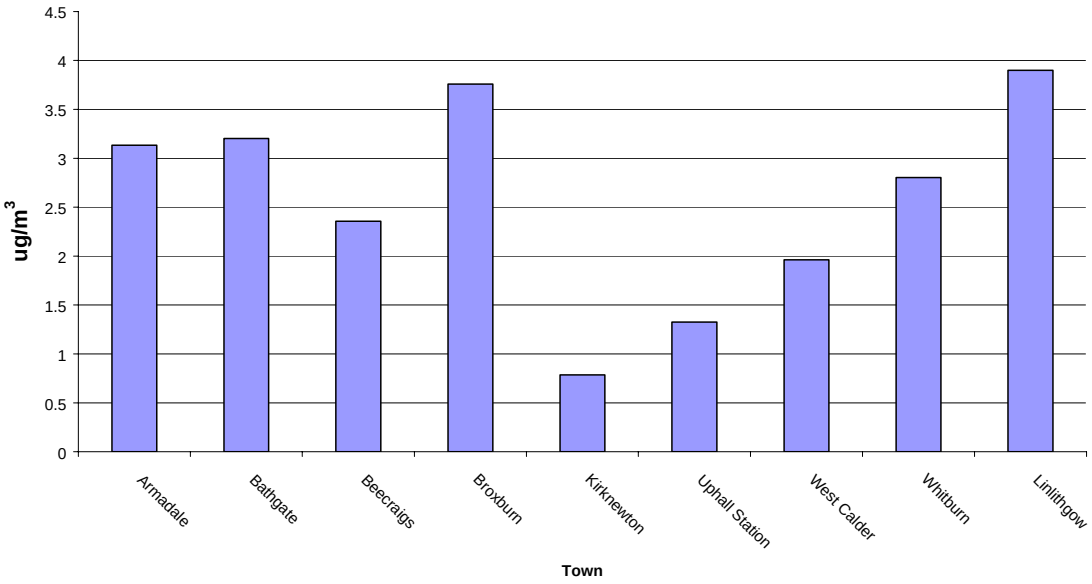
3.7 Benzene Monitoring in West Lothian

For the year 1998, West Lothian Council carried out a twelve-month benzene survey, using diffusion tubes. Nine sites were identified, one was at Kirknewton and was used as a rural background location. The other eight sites were at a series of locations where benzene levels were expected to be at their highest; for example, in areas where there are one or more of the following - heavy traffic flow, slow moving or queuing vehicles, petrol stations, enclosed street canyons, which restrict natural dispersion. The survey ran January - December 1998. See maps in Appendix 3 for precise monitoring locations. The monthly monitoring results are given in Table 3.1 and the annual average results in Figure 3.2.

Table 3.1 - Benzene Monitoring in West Lothian 1998 (µg/m^3)

	Armadale	Bathgate	Beecraigs	Broxburn	Kirknewton	Uphall Station	West Calder	Whitburn	Linlithgow
Jan-98	9.52	6.18	13.65	0.00	1.40	1.50	2.05	5.23	5.79
Feb-98	2.44	2.11	1.53	2.54	0.75	1.24	3.02	2.86	6.89
Mar-98	2.89	3.71	0.75	4.58	0.72	1.72	2.05	4.13	4.26
Apr-98	1.92	5.53	0.55	4.81	1.01	0.98	1.40	2.67	3.45
May-98	1.50	2.50	0.42	4.26	0.33	0.62	1.30	2.63	3.22
Jun-98	1.89	2.24	0.49	3.32	0.26	0.55	1.30	1.98	3.02
Jul-98	2.02	1.24	<0.227	3.67	0.26	0.46	0.68	1.59	3.71
Aug-98	1.69	1.59	0.72	3.06	0.42	1.66	1.01	1.92	5.33
Sep-98	3.84	3.25	1.17	4.49	0.36	1.04	1.50	0.00	3.19
Oct-98	2.02	2.57	0.33	3.80	0.46	0.88	1.27	2.60	2.57
Nov-98	3.77	3.77	0.88	5.72	0.55	1.89	4.84	3.71	1.59
Dec-98	4.13	3.74	5.46	4.88	2.93	3.38	3.12	4.32	3.80
Average	**3.13**	**3.20**	**2.36**	**3.76**	**0.79**	**1.32**	**1.96**	**2.80**	**3.90**
Limit	**16.25**	**16.25**	**16.25**	**16.25**	**16.25**	**16.25**	**16.25**	**16.25**	**16.25**

Figure 3.2 - Annual Average of Benzene 1998 (µg/m^3)



All of the sites were below the 16.25 µg/m^3 objective.

3.8 Benzene Monitoring in Neighbouring Local Authorities

Benzene has not been monitored by North Lanarkshire or South Lanarkshire Councils. Falkirk Council have used ATD tubes at 16 locations, including roadside, urban centre and urban background sites. The levels recorded were all well below the standard of 16.25 µg/m^3.

Therefore West Lothian monitoring results are consistent with neighbouring local authorities.

3.9 Part A and Part B Authorised Processes

The review of authorised processes identified no Part A or Part B processes which could be a potential significant sources of benzene.

These processes are authorised by the Scottish Environment Protection Agency and the consultation exercise with the agency identified that no processes would emit benzene. Therefore there are no Part A processes within West Lothian which are a significant source of benzene.

There are no Part B processes within West Lothian which are likely to give rise to significant quantities of benzene.

3.10 Future Developments and Neighbouring Sources

There are no known planned developments within West Lothian which will be a significant source of benzene.

There are no sources within neighbouring local authority areas which could impact significantly on air quality within West Lothian.

3.11 Conclusions for Benzene

1) There is no significant industrial source of benzene located either within West Lothian or neighbouring areas which is likely to adversely affect air quality within West Lothian.

2) Monitoring has indicated that roadside levels of benzene within West Lothian are likely to comply with the standard.

3) There is no need to proceed to a second stage review for benzene.

4.0 First Stage Review and Assessment of 1,3-Butadiene

4.1 Introduction

1,3-Butadiene is a chemical compound which comprises a molecule containing four carbon and six hydrogen atoms. At normal ambient temperatures it is a gas, and trace amounts can be found in the atmosphere that we breathe.

1,3-Butadiene is derived, solely from human activity mainly from the combustion of petrol and other materials. Although neither petrol nor diesel fuel contains 1,3-Butadiene it is formed in the combustion process from olefins in the fuel.

1,3-Butadiene is also an important industrial chemical, and is handled in bulk in a small number of industrial locations in the UK. Other than in the vicinity of such locations, the dominant source of 1,3-Butadiene in the UK atmosphere is the motor vehicle. The UK national inventory for 1,3-Butadiene showed that, in 1995, 67% of national annual emissions arose from petrol vehicles and 13% arose from industrial processes.

1,3-Butadiene is removed from the atmosphere in a few hours by chemical reactions. This prevents it being dispersed far from its source.

1,3-Butadiene is a genotoxic carcinogen and, in theory, it is not possible to determine an absolute safe level for human exposure. It has also been shown that occupational exposure to 1,3-Butadiene results in a slightly higher than expected risk of cancers of the lymphoid system and bone marrow, lymphomas and leukaemias.

As it has not been possible to demonstrate a level at which there is zero risk from exposure to 1,3-Butadiene policies to control its concentration in the ambient air adopt a risk management approach, aiming to attain levels where the risk to health is very small.

4.2 Standard and Objective for 1,3-Butadiene

The Air Quality (Scotland) Regulations 2000 established air quality standards and objectives as follows:-

- **Standard maximum annual running mean of 2.25 micrograms per cubic metre (1 ppb)**

- **Objective maximum annual running mean of 2.25 micrograms per cubic metre (1 ppb) to be achieved by the end of 2003**

The focus of an authority's review and assessment for 1,3-Butadiene should be non-occupational near ground level outdoor locations with elevated 1,3-Buatadiene concentration where a person might reasonably be expected to be exposed over a year (eg in the vicinity of housing, schools or hospitals).

4.3 The National Perspective

Existing national policies are expected to deliver the prescribed air quality objective for 1,3-Butadiene by the end of 2003. Roadside levels of 1,3-Butadiene, next to even the most busy or congested roads are expected to be well below the air quality

objective. Only those authorities with major industrial processes, which either handle, store or emit 1,3-Butadiene and which have the potential in conjunction with other sources, to result in elevated levels in relevant locations, are expected to need to undertake a second or third stage review and assessment.

4.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of 1,3 Butadiene. Clearly these sources need to be in existence and/or operation in 2003. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, paragraph 1.17)[11] need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- Details of existing and/or proposed Part A authorised processes in the authority's area;
- Details of existing and/or proposed Part B authorised processes in the authority's area;
- Details of any significant sources of 1,3 Butadiene in neighbouring areas which could impact within the authority's area.

It should be noted that emissions from road traffic are unlikely to be significant, and should not generally need to be considered by the authority.

4.5 1,3-Butadiene Monitoring in the UK

In contrast to better-known pollutant gases, there is relatively little information on levels of 1,3-Butadiene in the ambient air of the UK. The Government has now established a network of 12 sites continuously monitoring 1,3-Butadiene. In 1996 there were no recorded exceedences at any site.

4.6 1,3-Butadiene Monitoring in West Lothian and Neighbouring Local Authorities

No monitoring has been done in North Lanarkshire or South Lanarkshire Councils. Falkirk Council monitor the pollutant at 16 locations using ATD tubes. The levels recorded were all below the method detection limit of 0.5 ppb (1.125 µg/m^3).

Some diffusion tube monitoring of 1,3-Butadiene has been carried out in West Lothian. An eight-month survey was carried out during 1998 at the same sites as the Benzene monitoring (see Table 4.1). The results show no exceedence of the method detection limit of 0.5 ppb (1.125 µg/m^3). See Appendix 3 to view precise monitoring locations

Table 4.1 - 1,3-Butadiene Monthly Averages (May-December 1998) µg/m^3

All < 1.125

Date	Armadale	Bathgate	Beecraigs	Broxburn	Kirknewton	Uphall Station	West Calder	Whitburn	Linlithgow
May-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Jun-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Jul-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aug-98	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sep-98	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Oct-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Nov-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.3
Dec-98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

4.7 Part A and Part B Authorised Processes

The review of authorised processes identified no Part A processes which could be a potential significant source of 1,3-Butadiene. See Appendix 1 for map of Part A and B process locations.

These processes are authorised by the Scottish Environment Protection Agency and the consultation exercise with the agency identified that no processes would emit 1,3-Butadiene to air.

There are therefore no Part A processes within West Lothian which are a significant source of 1,3-Butadiene.

There are no Part B processes within West Lothian which are likely to give rise to significant quantities of 1,3-Butadiene.

4.8 Future Developments and Neighbouring Sources

There are no known planned developments within West Lothian which will be a significant source of 1,3-Butadiene.

There are no sources within neighbouring local authorities which could impact significantly on air quality within West Lothian.

4.9 Conclusions for 1,3-Butadiene

- There is no significant industrial sources of 1,3-Butadiene located either within West Lothian or neighbouring areas which is likely to adversely affect air quality in West Lothian.
- There is no need to proceed to a second stage review and assessment for 1,3-Butadiene.

5.0 First Stage Review and Assessment of Carbon Monoxide

5.1 Introduction

Carbon monoxide (CO) is produced by the incomplete combustion of organic material or materials that are essentially just carbon such as coke.

In the indoor environment, individuals are exposed to carbon monoxide from sources such as domestic fuel burning heaters and gas cooking appliances. Cigarette smoke can be a significant source.

The main source of outdoor exposure to carbon monoxide is general pollution of the atmosphere by vehicle exhaust gases. Proportionately higher levels of carbon monoxide are contained in exhaust gases when the engine is cold or badly tuned, or while the engine is idling or moving slowly. Thus it might be expected that levels of the gas in the ambient air would be highest close to busy roads in towns where traffic flow is reduced as in rush hours.

Carbon monoxide emitted by motor vehicles in urban areas is normally rapidly dispersed away from roads and then is destroyed by photochemical reaction over a period of months.

Unlike many toxic gases, carbon monoxide is both colourless and odourless and life-threatening concentrations can be breathed without giving any warning to the individual. Exposure to high levels results in unconsciousness with further exposure causing death.

Health effects are caused by carbon monoxide interfering with the transport of oxygen by the red blood cells by the formation of carboxyhaemoglobin and also by blocking essential biochemical reactions in cells.

Varying levels of brain damage can result from carbon monoxide poisoning.

5.2 Standard and Objective for Carbon Monoxide

The Air Quality (Scotland) Regulations 2000 established air quality standards and objectives as follows:- (Please note that the software system presently used for the real-time monitoring station is set up to give measurement reading in ppm. The graphs that follow are all in ppm as opposed to $\mu g/m^3$ as is now used in the Regulations. Hence the reason for using both sets of values).

- **Standard 8-hour running average of 11.6 milligrams (10 ppm) per cubic metre**

- **Objective maximum 8-hour running average of 11.6 milligrams (10 ppm) per cubic metre to be achieved by end of 2003**

The focus of an authority's review and assessment for CO should be the following non-occupational, near ground level outdoor locations; background locations; roadside locations; and other areas of elevated CO concentrations where a person might reasonably be expected to be exposed over an 8 hour period (eg in the vicinity of housing, schools or hospitals etc).

5.3 National Perspective

The main source of carbon monoxide in the UK is road transport which accounted for 71% of the total emissions of 4.6 mtonnes in 1996.

Road transport sources will constitute a larger proportion of the total in most cities and maximum concentrations are expected near busy, especially congested roads. Of road transport emissions, the predominant source is petrol vehicles. Emissions of carbon monoxide from diesel vehicles are relatively small.

Emissions of carbon monoxide in the UK have increased significantly from 6.5 million tonnes in 1970 to 7.38 million tonnes in 1990.

However, since 1990 emissions have been decreasing and in 1996 were 4.6 million tonnes. These reductions have been the result of national policies to reduce carbon monoxide emissions from vehicles. These include the introduction of three way catalysts and a reduction of the carbon monoxide limit in exhaust gases.

Fig 5.1 below shows Annual and Estimated emissions of CO in urban areas for the period 1995- 2025.

Figure 5.1 - Carbon Monoxide Pollution in Urban Areas

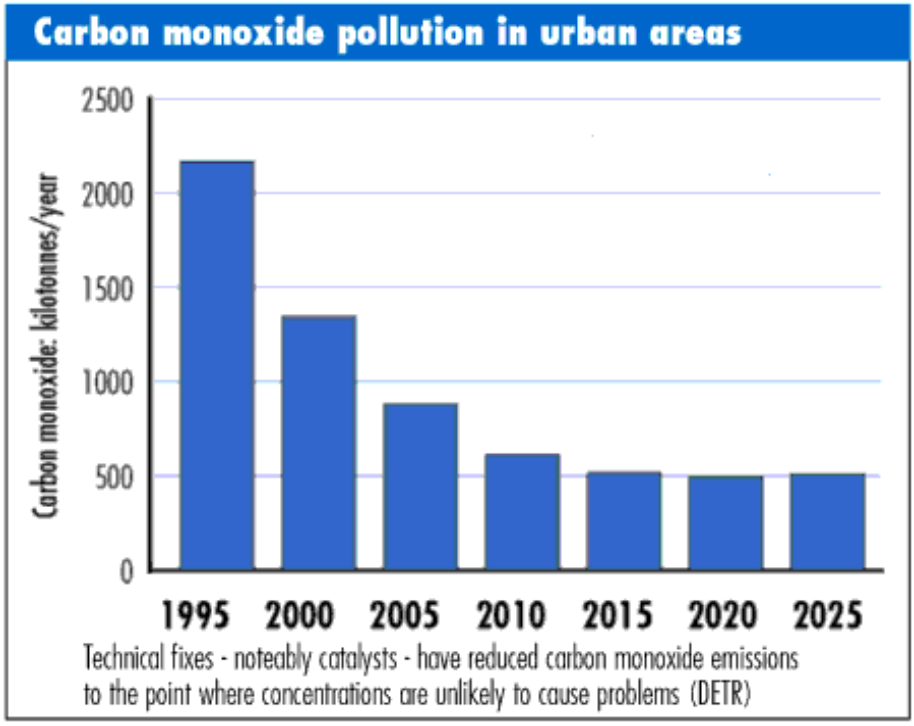


Table 5.1 - UK Emissions of Carbon Monoxide by Source in 1996

Source	Percentage of Total Emissions
Power Stations	4
Domestic	5
Other Industrial Combustion	1
Production Processes	1
Road Transport	71
Other Transport	16
Waste Treatment and Disposal	1

These national policies are expected to deliver the national air quality objective by the end of the year 2003 with the possible exception of heavily trafficked roads or in the vicinity of certain stationary sources.

Only those authorities with such sources which have the potential to result in elevated levels of CO in relevant locations are expected to proceed to a second or third stage review and assessment. It is expected that for this pollutant most local authorities will not need to progress past the first stage.

5.4 Information to be considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of carbon monoxide. Clearly these sources need to be in existence and/or operation in 2003. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, paragraph 1.17)[11] need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- information on existing and 2003 forecast annual average daily traffic flows for any existing or proposed roads in the authority's area, with traffic flows which could generate significant quantities of carbon monoxide;
- details of existing and/or proposed Part A authorised processes in the authority's area;
- details of existing and/or proposed Part B authorised processes in the authority's area;
- details of any planned developments in the authority's area, particularly if they will affect traffic flows;
- details of any significant sources of carbon monoxide in neighbouring areas which could impact within the authority's area.

5.5 Background Carbon Monoxide Concentrations

National maps are available which indicate the estimated background carbon monoxide concentrations across the UK.

Estimated background carbon monoxide concentrations for West Lothian are below 0.2 ppm. Areas around the M8, M9, A899, A89, A71 and A801 are estimated to have slightly higher levels of 0.21-0.3 ppm.

5.6 Carbon Monoxide Monitoring in the UK

By 1996 carbon monoxide was being monitored at 39 sites throughout the UK. The results show that carbon monoxide levels are currently showing declining levels, as expected due to the decline in total emissions. See Appendix 2 for map of main traffic routes.

The 1996 annual report on air pollution stated that annual mean concentrations appear to be decreasing at between 0.1 and 0.2 ppm per year at urban background locations and by nearly 0.4 ppm per year at the kerbside monitoring site at Cromwell Road in London.

There are currently four carbon monoxide monitoring sites within Scotland that are part of the UK automatic monitoring network.

These four sites are Edinburgh Centre, Glasgow Centre, Glasgow City Chambers and Glasgow Kerbside. The Glasgow Kerbside was only set up during 1997.

In 1996 the three sites that operated within Scotland all met the air quality standard. The annual statistics for 1996 were as follows:-

Table 5.2 - Carbon Monoxide Results for Scotland 1996 Automatic Monitoring Network (ppb)

	Ann. Mean	Max Hr	Max. Run 8 hr
Glasgow City Chambers	0.7	5.0	3.8
Edinburgh Centre	0.5	6.0	3.7
Glasgow Centre	0.6	9.0	6.8

In 1997 another site had been added in Scotland and again all four sites which were in operation complied with the air quality standard.

5.7 Carbon Monoxide Monitoring in West Lothian and Neighbouring Local Authorities

No Carbon Monoxide monitoring was been carried out by West Lothian Council until September 1999. Results from this monitoring will be discussed in Stage 2.

Falkirk Council have some historical monitoring data for six sites in the area, the locations were both roadside and urban background sites. The levels recorded were in the range <1-2 ppm. Indications from North Lanarkshire are that monitoring results from sites at busy road junctions have shown that carbon monoxide levels are unlikely to exceed 11.6 $\mu g/m^3$ (10 ppm) when expressed as an 8-hour running mean. No monitoring has taken place in South Lanarkshire.

5.8 Roads in West Lothian

West Lothian is served by two motorways M8 and M9 and four other main "A" Class roads A71, A89, A899, and A801. See maps in Appendix 2.

There are no major trunk road projects which are proposed.
The traffic flows for the existing road network were discussed in Section 2.4.7. Only the M8 motorway through West Lothian is likely to have a projected annual average daily flow greater than 50,000 by 2003 with the A899 dual carriageway serving Livingston currently having an annual average daily flow of 36,000. As discussed in the interim stage one submission, both of these roads and the other main traffic routes generally carry fast, free flowing traffic and have no known domestic properties within 50 metres of the carriageways.

It was therefore decided to concentrate monitoring in areas which are most likely to suffer from traffic related pollution – town centres.

5.9 Part A and Part B Authorised Processes

The review of authorised processes in accordance with the government guidance did not identify any Part A or Part B processes which could be a significant source of carbon monoxide.

5.10 Future Developments and Neighbouring Sources

There are no known planned developments within West Lothian which will be a significant source of carbon monoxide.

There are no sources within neighbouring local authorities which could impact significantly on West Lothian.

5.11 Conclusions for Carbon Monoxide

- There is no significant carbon monoxide source, industrial or road transport, located either within West Lothian or neighbouring areas which are likely to adversely affect air quality in West Lothian. However, due to a lack of monitoring data it was considered necessary to proceed to a Stage 2 Review for Carbon Monoxide. The town centres were again identified as being the most likely “hot spots”.

5.12 Stage 2 Carbon Monoxide

For the purposes of the Stage One Review and Assessment it was noted that there was no long-term ambient monitoring data for carbon monoxide available within West Lothian. However, an automatic real time ambient monitor was installed at 212 High Street, Linlithgow in September 1999. This site was identified during an earlier NO_2 diffusion tube survey as having some of the highest levels of traffic pollution in the area. See Map Diffusion Tube Survey in Appendix 3.

As can be seen from Figures 5.2 – 5.10, the data obtained between September 1999 and May 2000 shows that carbon monoxide levels, expressed as an 8-hour running mean, are normally in the range (0-1.2 ppm), with a few peaks in the range (1.2-2.4 ppm).

Figure 5.2 Periodic Report for September 1999 – Station : West Lothian

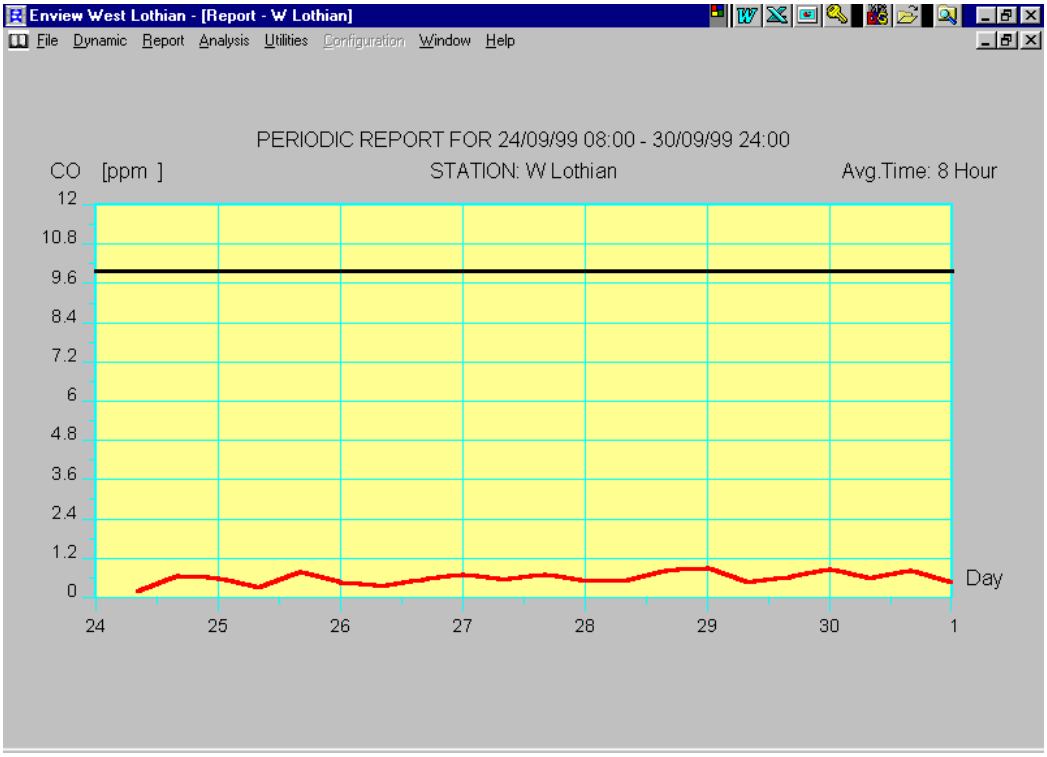


Figure 5.3 Periodic Report for October 1999 – Station : West Lothian

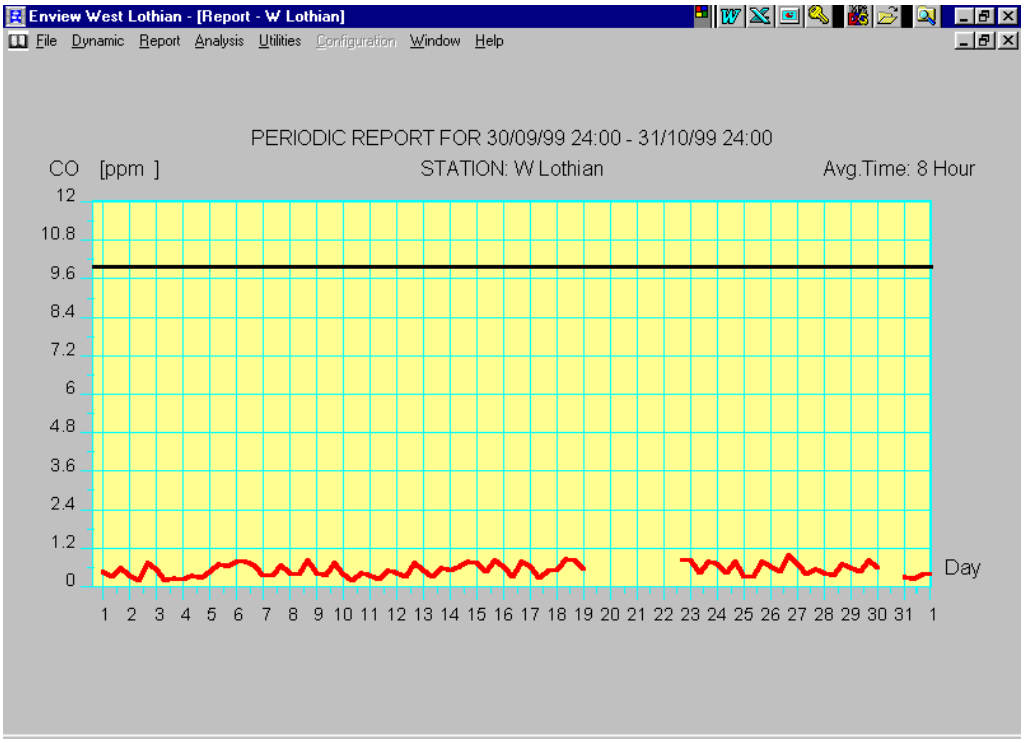


Figure 5.4 Periodic Report for November 1999 – Station : West Lothian

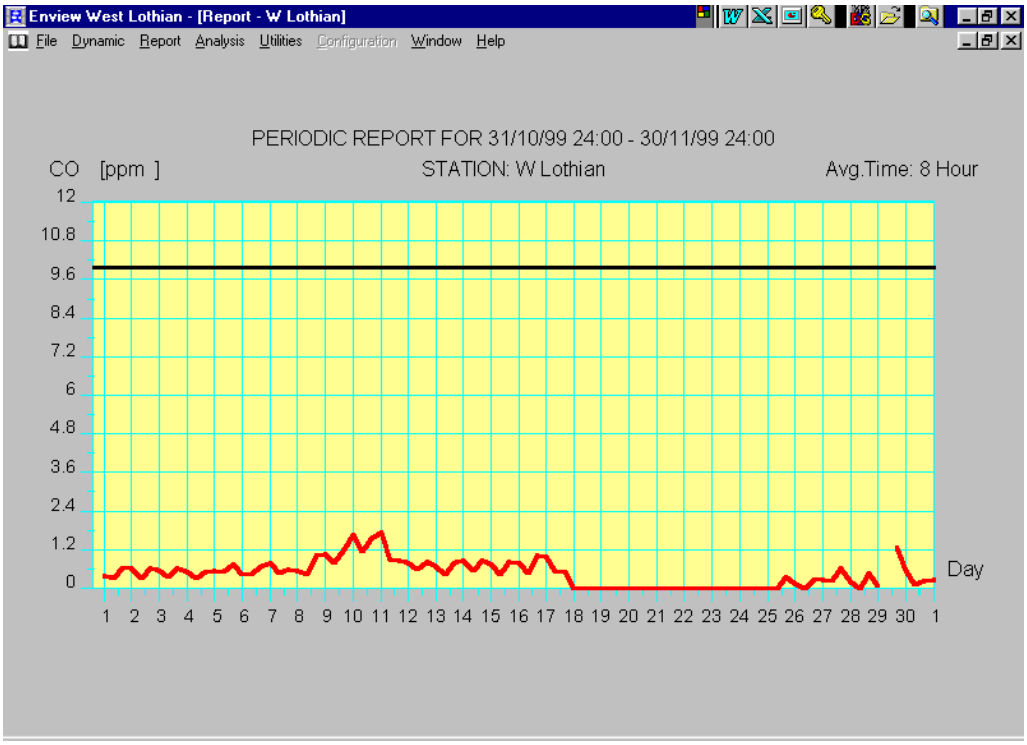


Figure 5.5 Periodic Report for December 1999 – Station : West Lothian

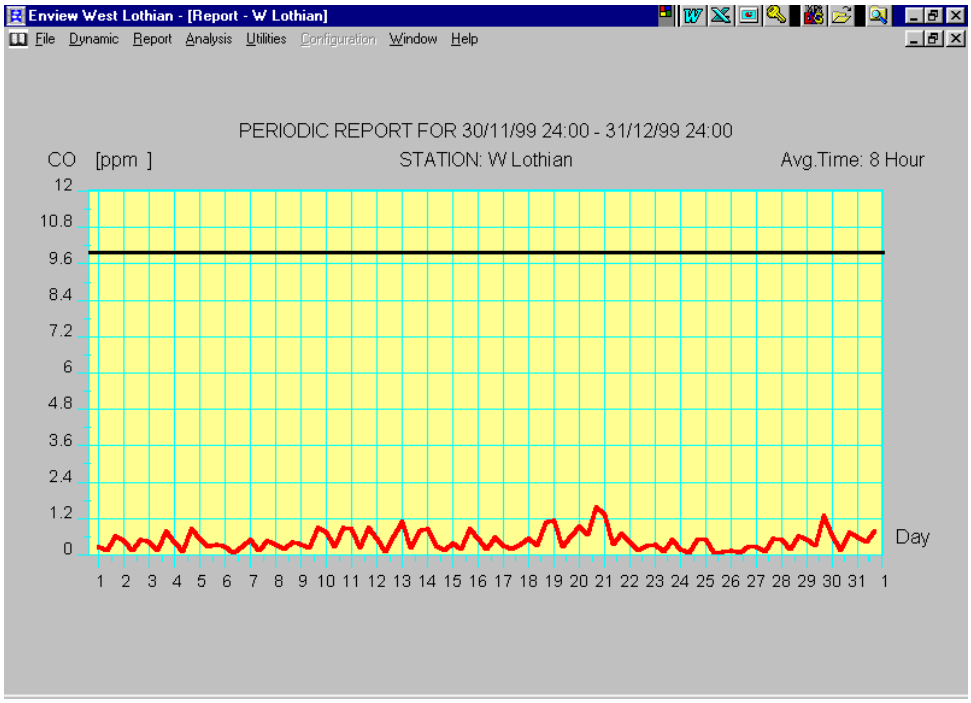


Figure 5.6 Periodic Report for January 2000 – Station : West Lothian

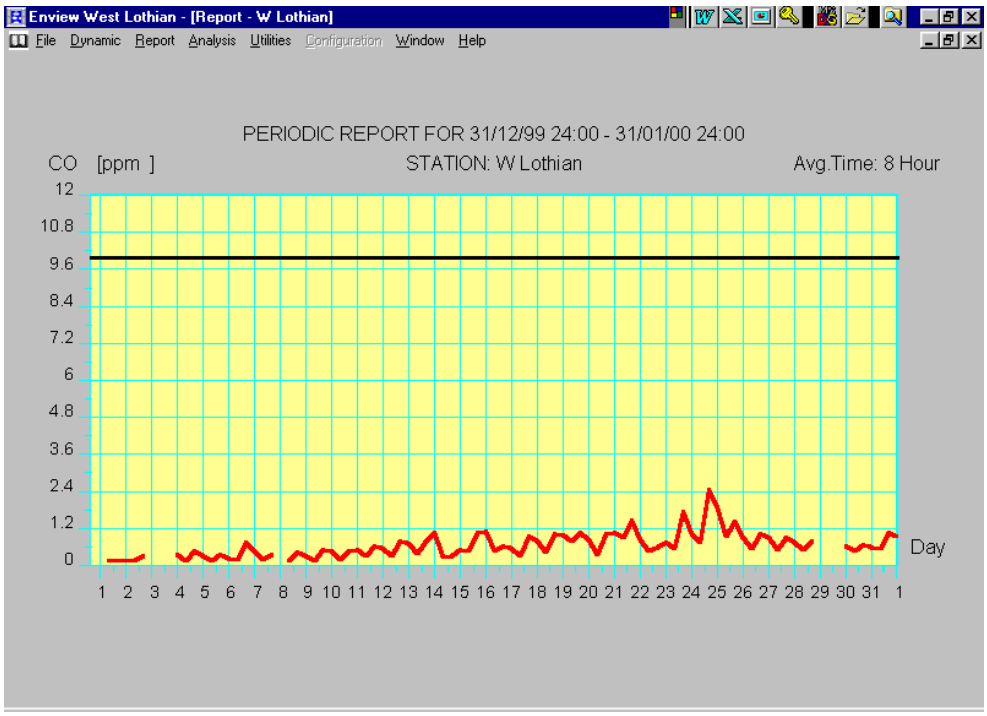


Figure 5.7 Periodic Report for February 2000 – Station : West Lothian

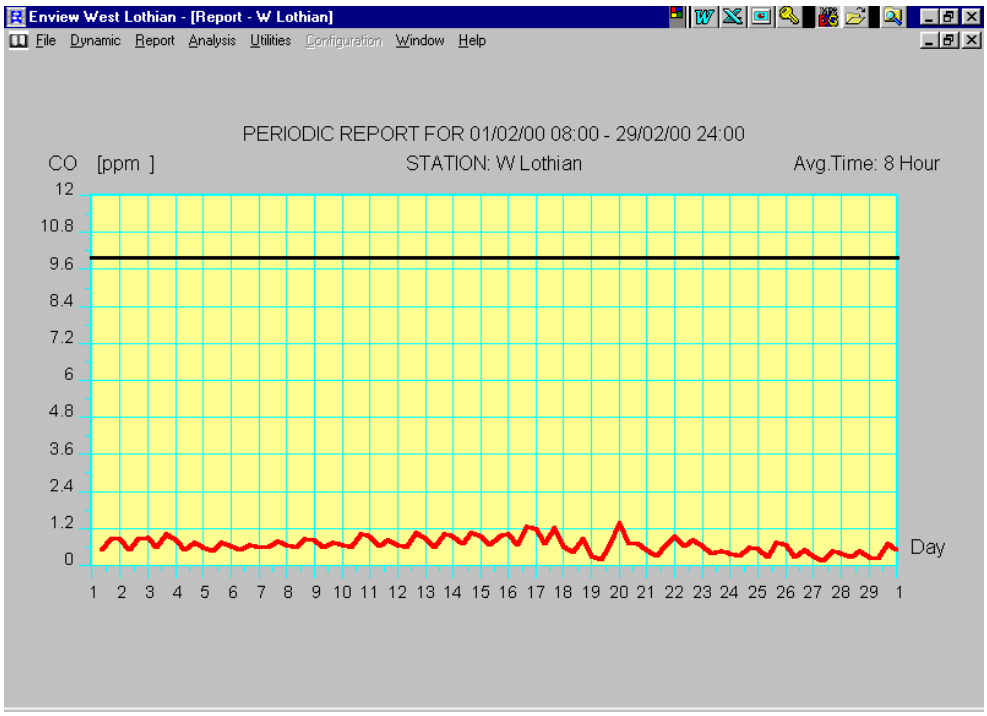


Figure 5.8 Periodic Report for March 2000 – Station : West Lothian

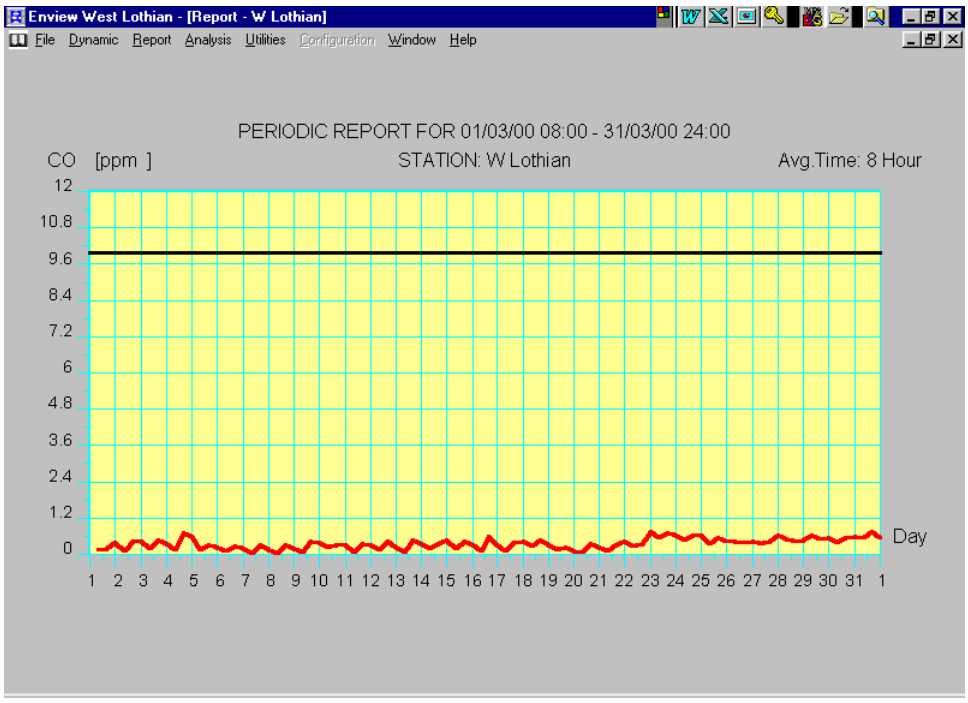


Figure 5.9 Periodic Report for April 2000 – Station : West Lothian

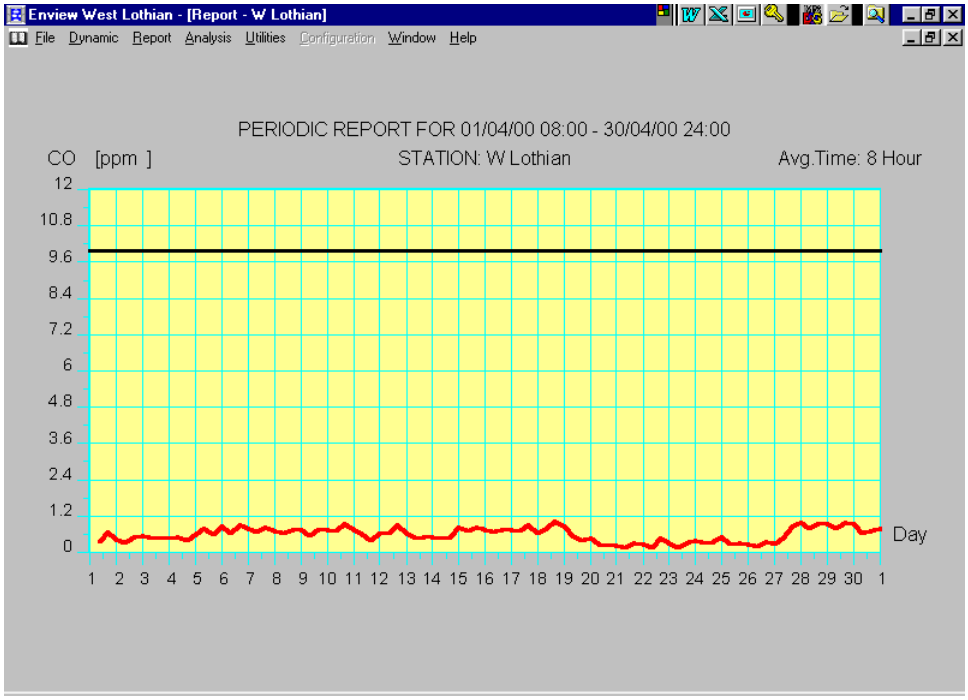
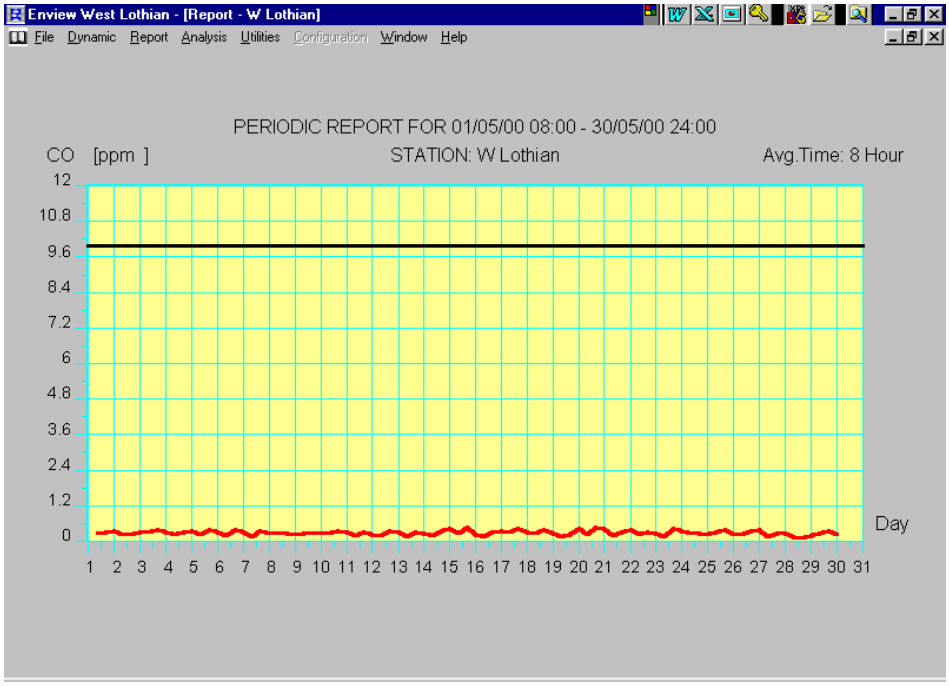


Figure 5.10 Periodic Report for May 2000 – Station : West Lothian



In addition, it was noted that the maximum running 8-hour mean recorded at the National Automated Urban Network Monitoring Site located at Glasgow City Chambers, between 1994 and 1997, was within the range of 3.8 – 6.8 ppm.

The report identified no areas of transport routes which currently have an annual average daily traffic flow greater than 50,000 and predicted that additional areas of transport routes, ie the M8 will exceed an annual average daily traffic flow of 50,000 by 2003. In addition, the report also identified no Part A process which may be a significant source of carbon monoxide.

Given the available data it was considered unlikely, by West Lothian Council, that the ambient concentration of carbon monoxide in West Lothian is exceeding the relevant standard at the present time or is likely to exceed it in the future assuming present trends.

As previously stated, for a period of 8 months, September 1999 to May 2000, an automatic real-time ambient monitor was installed at the monitoring site at High Street, Linlithgow. This monitoring location was selected in accordance with the guidance contained within the Department of Environment, Transport and Regions documents "Monitoring for Air Quality: Review and Assessments"[8] and "Review and Assessment: Pollutant Specific Guidance"[11]. The site selected was a source orientated monitoring location (ie worse case environment) due to it being a site in roadside location, with canyon effect where a previous NO_2 diffusion tube survey had shown some of the highest levels of traffic pollution in the area.

The site is in a mainly retail area with first floor domestic properties above shops. The site is located midway along the High Street between two pedestrian crossings and at a section of the road where a parking lay-by starts. This parking lay-by is in continual use serving the High Street shops and a hot food take-away in particular. It is not unusual for drivers to sit in the lay-by for some time with engines running, again making this probably worst case. The A803 has an annual average daily traffic flow of approximately 17,000. It was noted, when considering the suitability of the monitoring site, that high emissions of hydrocarbons, particles and carbon monoxide occur when there is incomplete combustion, for example when the engine is starting from cold, or accelerating suddenly. For non-catalyst cars, or ones where the catalyst is not working effectively, emissions of hydrocarbons and carbon monoxide will also be higher when idling. At very low speeds, such as those found in heavily congested areas, emissions of hydrocarbons and carbon monoxide are increased.

The site in question is located in a busy High Street where traffic flow is controlled by traffic signals and which is subject to heavy traffic congestion and thus it was considered that exceedences of the air quality standard for carbon monoxide may occur. In addition, it was noted that pollution levels are particularly likely to build up on roads bordered by high buildings, particularly when traffic is slow moving or queuing. The conditions suitable for this canyon effect are evident at the monitoring site selected.

Consequently, West Lothian Council are satisfied, after surveying the district, that the monitoring site selected represented a potential 'hot spot' for carbon monoxide and that, taking cognisance of the results obtained from September 1999 to May 2000 at the said site, carbon monoxide will not therefore be an issue of concern within urban areas throughout the district.

The transport route which potentially has annual average daily traffic flows in excess of 50,000 by the year 2003 is the M8, which could generate significant quantities of carbon monoxide. Concentrations of carbon monoxide are normally highest next to the kerbside and thereafter decrease rapidly so that at 200 m from a busy road the level will have fallen to approximately background level. It is therefore considered, by West Lothian Council, that these transport routes, on which the traffic is mainly free flowing, should, in terms of vehicle emissions, have less carbon monoxide emitted than in heavily congested areas such as the A803 in Linlithgow and are sufficiently distant from populated areas so as not to be an issue of concern.

To ensure that levels of carbon monoxide continue to meet the Government's proposed standard additional monitoring will be undertaken.

From winter 2000 the levels of carbon monoxide will be monitored in the town centre of Bathgate at a location near the traffic lights using a real time ambient monitor.

West Lothian Council also believe that the guidance pertaining to carbon monoxide contained within the document issued by the Scottish Executive "Revised Guidance: Framework for Review and Assessment of Air Quality"[4] is pertinent to the assessment as to whether carbon monoxide is or will be an issue of concern within the district. It states:

- **Carbon Monoxide - Eight-hour mean concentration of carbon monoxide currently being recorded in urban background locations are already below 11.6 mg/m^3 (10 ppm). An assessment of likely 8-hour concentrations at roadside locations suggests that policy measures now in place should lead to concentrations at all roadside locations falling below 11.6 mg/m^3 (10 ppm) by the end of 2003. Traffic management measures likely to achieve the objectives for other traffic relocated pollutants in busy urban areas will lead to further reductions in emissions of carbon monoxide. Only those authorities with certain stationary sources in their areas with the potential to cause elevated concentrations of carbon monoxide in relevant locations are expected to need to proceed beyond the first stage review and assessment. It is expected that, for this pollutant, many authorities will not need to progress past the first stage.**

As already stated, the Stage One Review and Assessment identified no Part A processes which may be a significant source of carbon monoxide.

STAGE 2 : CONCLUSION

Consequently, taking cognisance of the information contained within this chapter West Lothian Council are satisfied that it is unlikely that the standard, either existing or proposed, in the National Air Quality Strategy for carbon monoxide is being exceeded within West Lothian at the present time or is likely to be exceeded in the future assuming present trends. Therefore, there is no requirement to proceed to Stage 3.

6.0 First Stage Review and Assessment of Lead

6.1 Introduction

Lead occurs in the earth's crust and is released naturally through various processes including weathering of rocks, volcanic activity, and uptake and subsequent release from plants.

Lead in the environment as a result of human activity occurs through the mining and smelting of ores, the production, use, recycling and disposal of lead containing products and the burning of fossil fuels.

Industrial emissions and a large part of the vehicle emissions are in the form of particles of inorganic compounds of lead. Particles of lead emitted from petrol vehicles range from 0.015 mm in diameter and these aggregate to form larger particles with diameters of 0.1-1.0 mm which can remain in the air for 7-24 days. Industrially emitted particles tend to be around 0.1-5.0 mm in diameter depending on the process.

Currently the dominant contribution to airborne lead is from petrol combustion. This results from the use of lead as an additive to increase the octane rating of petrol. There are other sources of lead in the air in addition to lead emitted in motor exhausts. These include coal combustion, the production of non-ferrous metals and waste treatment and disposal.

Lead can be absorbed into the body both through the lungs and the stomach and intestines. Thus people may be at risk of absorbing it when exposed to lead either in the air, dust, soil or as a contaminant in food and drink. Exposure to high levels of lead has severe adverse effects on the blood, the nervous system and the kidneys. Low level exposure to lead can have an effect on the intellectual development of children.

Currently there is no convincing evidence of a threshold exposure to lead below which no effect on intelligence occurs. Therefore in setting a standard the aim has been to identify a level at which any effect on intelligence is likely to be so small as to be negligible.

6.2 Standard and Objective for Lead

The Air Quality (Scotland) Regulations 2000 established air quality standards and objectives as follows:-

- **Standard running annual mean of 0.5 micrograms per cubic metre (µg/m^3)**
- **Standard running annual mean of 025 micrograms per cubic metre (µg/m^3)**
- **Objective running annual mean of 0.5 micrograms per cubic metre (µg/m^3) to be achieved by end of 2004**
- **Objective running annual mean of 0.25 micrograms per cubic metre (µg/m^3) to be achieved by end of 2008**

The focus of an authority's review and assessment for lead should be non-occupational, near ground level outdoor locations with elevated lead concentrations in areas where a person might reasonably be expected to be exposed over a year (eg the vicinity of housing, schools and hospitals etc).

6.3 The National Perspective

Lead is the most widely used non-ferrous metal and has a large number of industrial applications, both in its elemental form and in alloys and compounds. The single largest use globally is in the manufacture of batteries, but other uses are as pigment in paints and glazes, in alloys, in radiation shielding, tank linings, piping and gunshot.

Most of the current emissions of lead in the UK arise from petrol-engine motor vehicles. In 1996 this amounted to 894 tonnes. The total UK emissions of lead were 1,357 tonnes from all sources.

Existing national policies are expected to deliver the prescribed objectives for lead at all, rural, urban background sites and roadside locations by the years 2004 and 2008. Only local authorities with significant industrial sources, which have the potential to results in elevated levels of lead in relevant locations, are expected to need to undertake a second or third stage review and assessment.

6.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of lead. Clearly these sources need to be in existence and/or operation in either/both 2004 and 2008. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, paragraph 1.17)[11] need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- details of existing and/or proposed Part A authorised processes in the authority's area;
- details of existing and/or proposed Part B authorised processes in the authority's area;
- details of any significant sources of lead in neighbouring areas which could impact within the authority's area.

It should be noted that emissions from road traffic do not need to be considered by the authority.

6.5 Background Lead Concentrations

National maps are available which indicate estimated background lead concentrations across the UK. The estimated background concentrations of lead for West Lothian are less than 20 ng/m^3 (0.02 µg/m^3).

6.6 Lead Monitoring in the UK

Lead has been monitored in the UK by the Government's national networks since 1976. Lead is measured under five different networks throughout the UK..

Urban levels have reduced to the extent that the maximum annual average values are now of the order of 0.15 µg/m^3. Rural values are rather smaller and currently range from 0.005-0.05 µg/m^3.

There are two lead monitoring sites in Scotland which are part of the multi-element monitoring network : Glasgow and Motherwell. Since monitoring began lead levels at these sites has reduced dramatically and in 1996 the annual mean concentration of lead was 52 ng/m^3 (0.052 µg/m^3) in Glasgow and 30 ng/m^3 (0.030 µg/m^3) in Motherwell.

6.7 Lead Monitoring in West Lothian and Neighbouring Local Authorities

No monitoring of airborne lead has been carried out in South Lanarkshire. North Lanarkshire has some historical information from one site at the Civic Centre Motherwell where the ambient lead levels were significantly lower than the NAQS standard. Falkirk Council also has some historical monitoring information which indicates that the area in general is well within the guidelines apart from one exception in the Larbert/Stenhousemuir area which has 3 working foundries. This information would indicate that lead concentrations within West Lothian will not be an issue of concern.

6.8 Part A and Part B Authorised Processes

The review of authorised processes in accordance with the pollutant specific guidance and in consultation with SEPA identified that there are two Part A processes within West Lothian with the potential to emit significant quantities of lead. See map in Appendix 1 which identifies the locations of the Part A process:-

- **Glacier Vander Vell, Whitehill Industrial Estate, Bathgate – Manufacturer of bearings and other products containing lead**
- **DKL Metals Ltd, Avontoun Works, Linlithgow – Foundry/Diecasting**

There are no Part B processes within West Lothian with the potential to emit significant quantities of lead, according to the Government guidance.

The consultation exercises with SEPA identified that the above two processes were operating satisfactorily and complying with emission standards and that it was highly unlikely that the emissions from these processes would result in exceedences of the air quality standards.

There are therefore no Part B processes within West Lothian which will give rise to significant quantities of lead.

6.9 Future Developments and Neighbouring Sources

There are no known planned developments within West Lothian which will be a significant source of lead.

There are no sources within neighbouring local authorities which could impact significantly on air quality within West Lothian.

6.10 Conclusions for Lead

- There is no significant industrial source of lead located either within West Lothian or neighbouring areas which is likely to adversely affect air quality in West Lothian.
- There is no need to proceed to a second stage review and assessment for lead.

7.0 First Stage Review and Assessment of Nitrogen Dioxide

7.1 Introduction

Nitrogen dioxide is a gas produced by reaction of nitrogen and oxygen in combustion processes. The reaction usually takes place in two stages, firstly, the formation of nitric oxide which is oxidised to produce nitrogen dioxide. Both oxides exist together and are collectively known as NO_x (nitrogen oxides).

Natural sources of nitrogen oxides include lightning and forest fires as well as bacterial activity in soils and plant metabolism. In the UK, however, the largest amount is formed during the combustion of fossil fuels especially motor transport and non-nuclear power stations.

The main sources of NO_x in the UK are road transport which in 1996 accounted for about 47% of the emissions of 2.1 million tonnes per year as nitrogen dioxide, power stations 22% and domestic sources 4%. In urban areas the proportion due to road transport is larger.

In the atmosphere nitrogen dioxide reacts to form nitric acid and nitrates which are removed by rain. Nitrates, however, can remain in the atmosphere as very small particles, contributing to the airborne concentration of PM_{10}.

Nitrogen dioxide is an irritant gas which has been known for many years to have serious and sometimes fatal effects on health when inhaled in very high concentrations associated with accidental exposure. More subtle effects on health may occur at lower concentrations found in the ambient atmosphere both outdoors and indoors. The major indoor source is cooking with gas, although cigarette smoke can also contribute significantly. It has been suggested that nitrogen dioxide may have both acute (short-term) and chronic (longer-term) effects on health particularly in people with asthma.

People with healthy lungs whether resting or exercising, show little response to inhalation of nitrogen dioxide at concentrations well above those occurring in ambient air even during extreme pollution episodes. However, in people with asthma some studies have shown impairment of lung function and the airways of some may become more sensitive to the inhalation of irritant chemicals after exposure to nitrogen dioxide at concentrations of about 200 ppb.

7.2 Standard and Objective for Nitrogen Dioxide

The Air Quality (Scotland) Regulations 2000 established air quality standards and objectives as follows:- (Please note that the software system presently used for the real-time monitoring station is set up to give measurement reading in ppb. The graphs that follow are all in ppb as opposed to $\mu g/m^3$ as is now used in the Regulations. Hence the reason for using both sets of values.

- **Standard annual mean of 40 micrograms per cubic metre (21 ppb) one-hour mean of 200 micrograms per cubic metre (105 ppb)**
- **Objective annual mean of 40 micrograms per cubic metre (21 ppb) to be achieved by the end of 2005 one-hour mean of 200 micrograms per cubic metre (105 ppb) not to be exceeded more than 18 times a year by the end of 2005**

The focus of an authority's review and assessment for the hourly objective should be any non-occupational, near ground level, outdoor locations given that exposures over one-hour are potentially likely in these locations.

The Government has also adopted an annual average of 40 µg/m^3 (21 ppb) as an air quality standard with an objective to achieve this by the end of 2005. The focus of an authority's review and assessment for the annual average objective should be non-occupational, near ground level, outdoor locations with elevated NO_2 concentrations where a person might reasonably be expected to be exposed over a year (eg in the vicinity of housing, schools or hospitals etc).

7.3 The National Perspective

The National Air Quality Strategy states that for nitrogen dioxide a reduction in NO_x emissions over and above that achieved by national measures will be required to ensure that air quality objectives are achieved everywhere by the end of 2005. Local authorities with major roads, or highly congested roads, which have the potential to result in elevated levels of nitrogen dioxide in relevant locations are expected to identify the need to progress to the second or third stage review and assessment for this pollutant.

Major roads are defined as busy roads, existing or proposed by 2005 with an actual or projected annual average daily traffic flow of greater than 20,000.

7.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of NO_x. Clearly these sources need to be in existence and/or operation in 2005. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, paragraph 1.17) need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- Estimated 2005 annual mean background NOx concentrations from the Internet site (www.aeat.co.uk/netcen/airqual/);
- Information on existing and 2005 forecast annual mean traffic flows for any existing or proposed roads in the authority's area which could generate significant quantities of NO_x;
- details of existing and/or proposed Part A authorised processes in the authority's area;
- details of existing and/or proposed Part B authorised processes in the authority's area;
- details of any planned developments in the authority's area, particularly if they will affect traffic flows;
- details of any significant sources of NOx in neighbouring areas which could impact within the authority's area.

7.5 Nitrogen Dioxide Monitoring in the UK

Nitrogen dioxide is measured nationally as part of the automatic monitoring network. In 1996, NO_2 was measured at five rural and 47 urban sites.

Sites with a data record of five years or more have shown significant trends. Two London sites have surprisingly shown an increase in annual mean NO_x concentrations but all the remaining observed trends in NO_2 and NO_x are down both in terms of the annual mean and the 98th percentile of hourly averages.

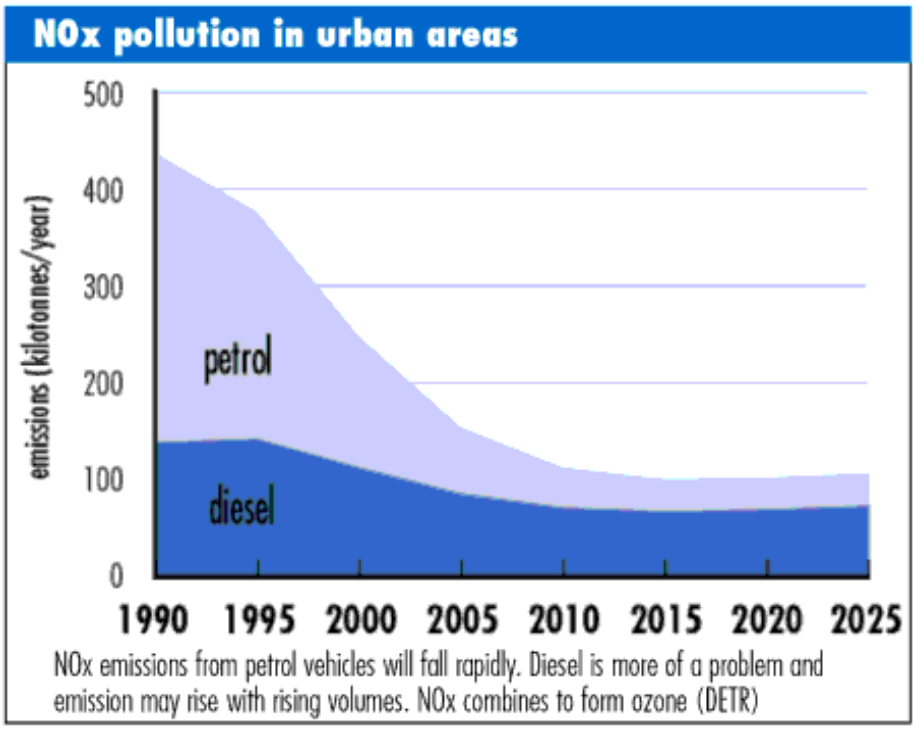
In 1996 there were four automatic monitoring network sites in Scotland: Glasgow City Chambers, Glasgow Centre, Edinburgh and Strath Vaich in the Highlands.

The three city locations complied with the hourly standard but were above the annual standard. However, the annual standards for 1996 for all three sites were below the 30 ppb level set in the government guidance which applied at that time. The remote site at Strath Vaich complied with both standards.

Nitrogen dioxide is also measured nationally through the NO_2 Diffusion Tube Survey.

Figure 7.1 below shows Annual and Estimated Emissions of NO_x in Urban Areas due to petrol and diesel vehicles for the period 1990-2025.

Figure 7.1 - NO_x Pollution in Urban Areas



7.6 Nitrogen Dioxide Monitoring in West Lothian

In West Lothian monitoring of nitrogen dioxide by passive diffusion tubes has been undertaken regularly since 1993, after earlier involvement in the two short national surveys. See Appendix 3 for maps identifying monitoring locations.

The aim of the NO_2 monitoring undertaken so far in West Lothian has been to measure pollutant concentrations at busy roads and junctions, especially near residential areas. Monitoring has also been undertaken at sites where the continuous frontage of buildings provides a canyon effect and allows pollutant levels to accumulate.

For the purposes of the Stage One Review and Assessment some historical ambient monitoring data within West Lothian was utilised. West Lothian District Council participated in two Department of the Environment funded diffusion tube surveys in 1986 and 1991. The sites chosen at that time were in the towns of Broxburn (intermediate site) and West Calder (background site).

Since January 1993 the Council has participated in the National Diffusion tube Survey of Nitrogen Dioxide Levels in the United Kingdom. The sites are operated in the towns of Whitburn (one near road site), Livingston (one urban background site) and Bathgate (one intermediate site and one urban background site).

In 1995 a further two kerbside sites were added to the survey although they were not part of the national survey these sites were in Broxburn (at a traffic light junction on the Main Street) and Linlithgow (High Street). These sites were selected as being some of the busiest and most traffic congested town centre sites, motorway or main traffic routes, intermediate and background sites.

Table 7.1 - 6 Monthly DoE Funded Survey Results (1986 and 1991) ppb

	1986	**1991**	**Limit**
Broxburn (Intermediate Site)	14.75	25.2	21
West Calder (Background Site)	9.1	12.2	21

Figure 7.2

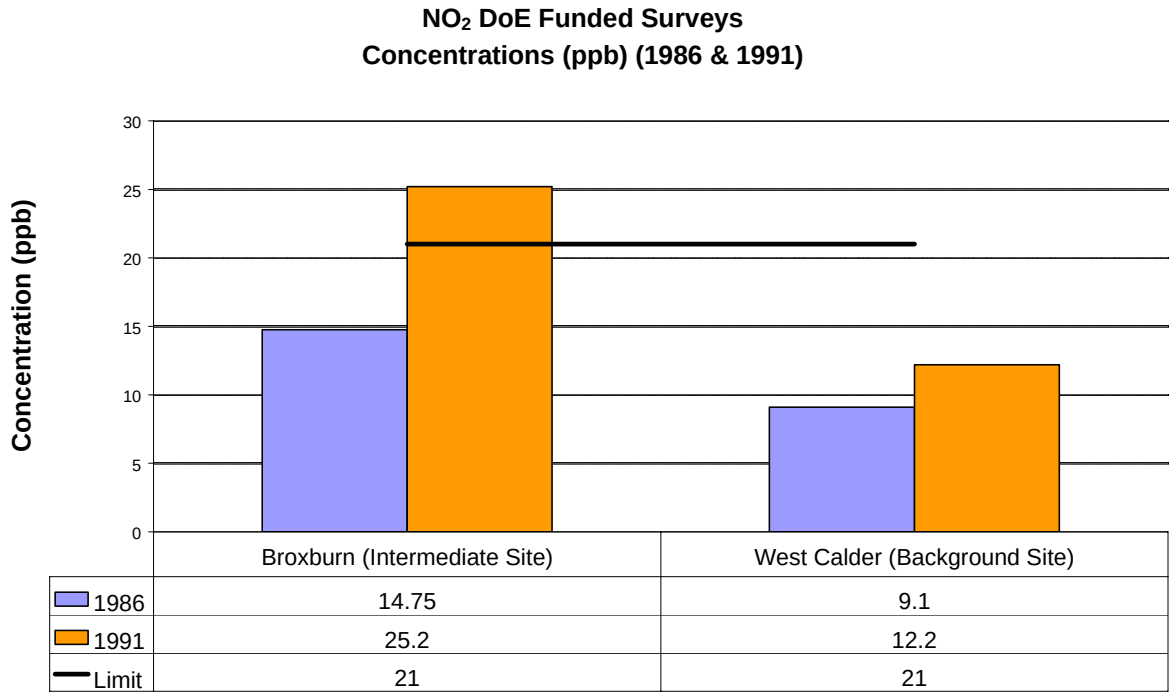
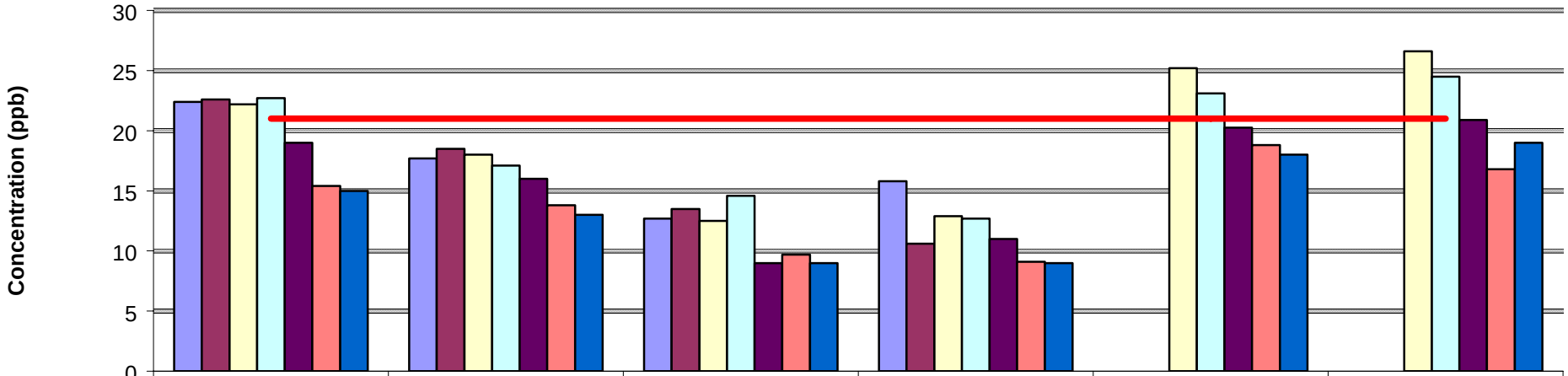


Table 7.2 - National UK Nitrogen Dioxide Diffusion Tube Sites (1993-1999)

	NO_2 Results (ppb)							
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**Limit**
WL1 (Whitburn)	22.4	22.6	22.2	22.7	19	15.4	15	21
WL2 (George Street, Bathgate)	17.7	18.5	18	17.1	16	13.8	13	21
WL3 (Dedridge Livingston)	12.7	13.5	12.5	14.6	9	9.7	9	21
WL4 High Street, Bathgate)	15.8	10.6	12.9	12.7	11	9.1	9	21
WL5 (East Main Street, Broxburn)			25.2	23.1	20.3	18.8	18	21
WL6 (High Street, Linlithgow)			26.6	24.5	20.9	16.8	19	21

Figure 7.3

NO_2 Concentrations (ppb)
West Lothian



	WL1 (Whitburn)	WL2 (George St, Bathgate)	WL3 (Dedridge Livingston)	WL4 High Street, Bathgate)	WL5 (East Main Street, Broxburn)	WL6 (High Street, Linlithgow)
1993	22.4	17.7	12.7	15.8		
1994	22.6	18.5	13.5	10.6		
1995	22.2	18	12.5	12.9	25.2	26.6
1996	22.7	17.1	14.6	12.7	23.1	24.5
1997	19	16	9	11	20.25	20.9
1998	15.4	13.8	9.7	9.1	18.8	16.8
1999	15	13	9	9	18	19
Limit	21	21	21	21	21	21

Table 7.3(a) - Extended Survey

Site	Location
Bathgate Fire Station (A89 Roundabout)	Boghall Roundabout, Bathgate
Contracts House (M8 Boundary)	Whitehill Industrial Estate, Bathgate
Freeport (B7015) Stoneyburn	Auchenard Cottage, Stoneyburn
West Lothian House – Intermediate	Almondvale Boulevard, Livingston
Bankton Park West – Intermediate	Lizzie Bryce Roundabout, Livingston
Winchburgh (M9 Boundary)	Muirhall House, Winchburgh
Wilkieston (A71) – Near Road	1 Orchardfield Terrace, Wilkieston
Kirknewton – Background	Ainville Farm, Kirknewton
Mid Calder	Bank Street, Mid Calder
Broxburn Fire Station (A89) – Near Road	Main Street, Broxburn
Uphall	Main Street, Uphall
West Calder (A71) – Near Road	Council Offices, East End, West Calder
St David House (A89) – Near Road	South Bridge Street, Bathgate
Armadale Council Offices (A89) – Near Road	Armadale Cross at corner of East Main Street and South Street, Armadale
Beecraigs - Background	Country Park, Linlithgow

Table 7.3 (b) - Extended Survey

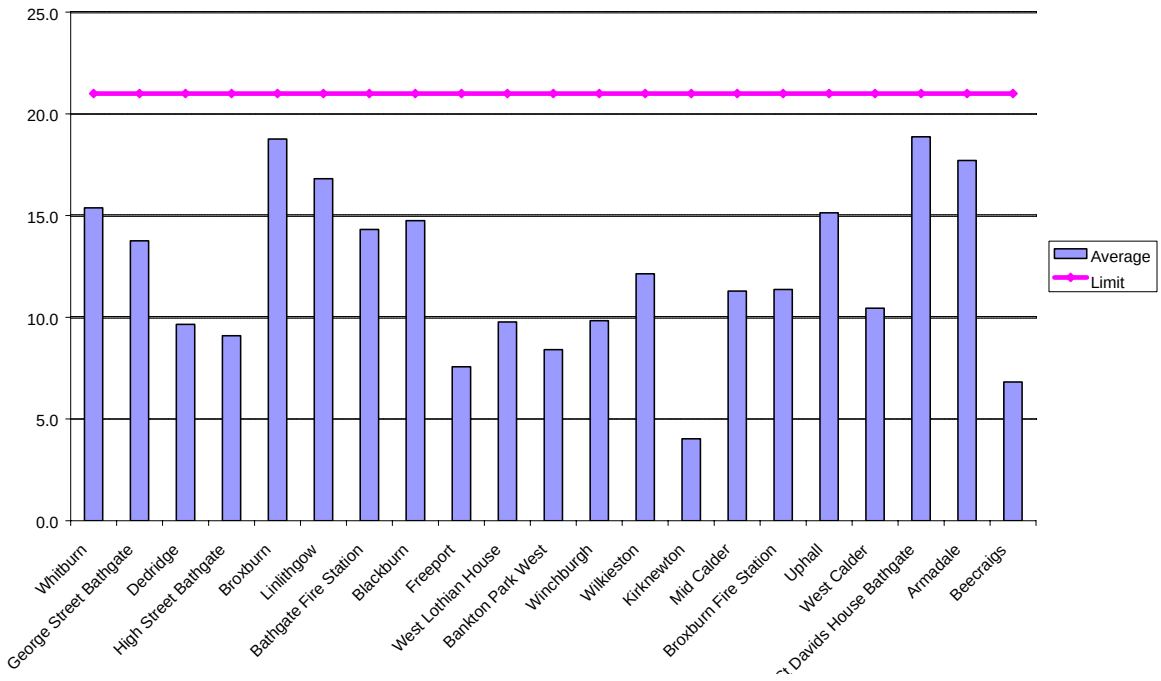
	Bathgate Fire Station	Blackburn	Freeport	West Lothian House	Bankton Park West	Winchburgh	Wilkieston
Jan-98	4.1	11.8	9.6	8.8	8.8	6.5	9.8
Feb-98	14.7	0.8	4.8	6.8	6.1	7.1	11.6
Mar-98	11.8	14.3	3.8	8.3	6	4.3	5.6
Apr-98	12.6	12	4.9	7.1	8.1	8.5	7.8
May-98	18.6	12.9	7.8	11.3	9.1	12.3	13.3
Jun-98	15.4	15.9	6.8	9.5	6.6	10.7	11.9
Jul-98	10.4	13	6.5	6.7	6.4	7.1	11.3
Aug-98	12.3	13.4	7.6	8.4	7.6	9.2	12.8
Sep-98	16.3	19.7	10.5	13.2	10.6	14.7	15.5
Oct-98	18.6	20.2	9.6	11.2	9.9	12	16.3
Nov-98	19.8	22.6	10.4	13.2	11	13.7	17.2
Dec-98	17.3	20.4	8.5	12.7	10.7	11.9	12.6
Average	**14.3**	**14.8**	**7.6**	**9.8**	**8.4**	**9.8**	**12.1**
Limit	**21**	**21**	**21**	**21**	**21**	**21**	**21**

Table 7.3 (c) - Extended Survey

	Kirknewton	Mid Calder	Broxburn Fire Station	Uphall	West Calder	St David House	Armadale	Beecraigs
Jan-98	2.8	8.1	6.1	7	12.9	14	12	6.6
Feb-98	2.4	0.1	9.6	17.9	5.7	14.8	12.8	6.5
Mar-98	2.1	13.3	10.6	12.1	7.2	19.7	14.6	4.3
Apr-98	2.9	8.3	4.9	11.6	8.2	16.1	17	5.7
May-98	8.1	12.6	12.9	14.5	14.3	21.7	15.8	5.5
Jun-98	2.9	10.7	9.5	15.6	9.5	17.2	17	4.2
Jul-98	2.1	8.6	9.6	12	8.5	12.6	12.4	2.6
Aug-98	3.6	10.6	11.6	14.5	9.7	14.9	16.6	5.7
Sep-98	5.8	14.1	13.6	16.5	11.5	25.7	21.5	7.2
Oct-98	4.5	15.5	16.7	18.6	12.4	23.1	21.8	9.1
Nov-98	6.6	18.4	16.7	20.7	14	25.2	27.1	13.5
Dec-98	4.5	15.2	14.6	20.6	11.5	21.5	23.9	11
Average	**4.0**	**11.3**	**11.4**	**15.1**	**10.5**	**18.9**	**17.7**	**6.8**
Limit	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**21**

Figure 7.4

Annual Average of NO_2 1998



It was found that the mean nitrogen dioxide measurements collected at the diffusion tube site in Whitburn exceeded the National Air Quality Strategy standard of 40 µg/m^3 (21 ppb), expressed as an annual mean, for 1993 – 1996 and the intermediate and two background diffusion tube sites in Bathgate and Livingston met the National Air Quality Strategy standards of 40 µg/m^3 (21 ppb), expressed as an annual mean, for 1993 – 1999. See Table 7.2 and Figure 7.2.

The two additional sites selected in 1995 as being some of the busiest town centres in the District namely Broxburn and Linlithgow also exceeded the National Air Quality Strategy standard of 40 µg/m^3 (21 ppb), expressed as an annual mean, for 1995 – 1996. See Table 7.2 and Figure 7.2.

The data from 1997–1999 shows that levels in Whitburn, Broxburn and Linlithgow had all decreased to meet the National Air Quality Strategy standards of 40 µg/m^3 (21 ppb), expressed as an annual mean, for 1997–1999. See Table 7.2 and Figure 7.2.

It should be noted that the data from the Diffusion Tube Survey is based on monthly mean figures and therefore it was not possible to assess compliance with the National Air Quality Strategy standards of 200 µg/m^3 (105 ppb), expressed as an hourly mean at these locations.

Consequently, it was considered necessary to carry out further investigations and monitoring and therefore, undertake a Stage Two Review and Assessment for this pollutant.

Although the town centre sites have in the past failed the 21 ppb air quality annual standards West Lothian Council have purchased a mobile automatic monitoring station which will monitor CO, SO_2, NO_2 and PM_{10} continuously and will be used initially to measure more accurately the pollution levels in Linlithgow High Street. See Stage 2 Report.

7.7 Part A and Part B Authorised Processes

West Lothian Council's First Stage Review and Assessment identified three Part A and two Part B processes considered to be potential sources of nitrogen dioxide. See Appendix 1 for map locating processes.

The Part A's were: **Shin Etsu Handotai Europe Ltd, Livingston**
NEC Semiconductors (UK) Ltd, Livingston
British Gas Plc Compressor Station, Bathgate

The Part B's were: **Caradale Traditional Brick, Armadale**
Premier Refactories, Linlithgow

After an initial desktop screening SEPA were able to advise at a meeting of the local air quality forum as follows:-

It is considered that whilst Shin Etsu Handotai Europe Ltd, Livingston have nitrogen dioxide emissions they are very low concentrations and are not considered to be significant.

The same conclusion was reached for another micro-electronics site in Livingston, NEC Semi-conductors (UK) Ltd. Nitrogen Dioxide emissions are at very low concentrations and are not considered to be significant.

With regard to the British Gas Plc Compressor Station, Bathgate, the advice was that the process emissions would require further screening and review. As will be mentioned in Stage 2, a letter from SEPA dated 14 April 2000 concerning all the Part A and B processes requiring further review and assessment enclosed a report which indicated that NO2 emissions from the British Gas Plc Compressor Station at Bathgate based on dispersion modelling results from a similar site suggest that there is no significant risk that emissions will fail to meet the objective, particularly since there are no residential properties within 400 metres and no history of complaint.

The two Part B processes are both brickworks Caradale Traditional Brick. Armadale and Premier Refactories, Linlithgow, both required further review and assessment following the forum meeting of February 2000. The letter from SEPA dated 14 April 2000 concerning all the Part A and B processes requiring further review and assessment enclosed a report which indicated that NO_2 emission concentrations from both sites are well below the quantity expected to give rise to a 99.8^{th} percentile hourly mean concentration of 40 $\mu g/m^3$ (LAQM.TG4(00))[11](6.17).

Ambient air monitoring carried out within West Lothian during the period 1993 – 1999 in every part of the district has indicated no exceedences of the present or proposed standards due to industrial processes.

Consequently, nitrogen dioxide levels from authorised processes identified in West Lothian's First Stage Review and Assessment are considered not to exceed the present or proposed standards.

7.8 Roads in West Lothian

There are traffic count sites located throughout the area. These have identified only three roads where the current and projected annual daily traffic flow exceeds 20,000 vehicles, namely M8, M9 and A899. See Appendix 2 and Section 2.4.7.

These roads are at least 50 metres from the domestic properties, the area surrounding the roads are open and exposed to the prevailing winds. The traffic on all roads is normally free moving and fast flowing without congestion. It is likely therefore that NO_2 generated by the traffic will be adequately dispersed to minimise if not remove the risk of exceeding the standard at these locations.

Diffusion tube monitoring has been carried out on the banking of the M8 at Whitehill Industrial Estate. This point is closer than any housing at Blackburn, Whitburn or East Whitburn and was identified as giving a worst case monitoring location. (See map in Appendix 3 for location).

Diffusion tube monitoring has also been carried out on the banking of the A899 at the Lizzie Bryce Roundabout, at Wester Bankton. This is probably the closest housing to the roundabout which receives traffic from the A71 and the A899. (See maps in appendix 3 for locations).

The results for these sites are shown in Table 7.3 and Figure 7.4. It can be seen that these levels are well below the annual mean standards confirming that there is adequate dispersion around this area.

Table 7.5 below identifies the roads with AADT flows of more than 25,000.

Table 7.5 - Current Exceedences of AADT Levels

AADT	ROAD
>20,000	None
>25,000	A899 dual carriageway serving Livingston M9 motorway passing North edge of district
>50,000	M8 motorway corridor through the area

7.9 Future Developments and Neighbouring Sources

A future development which may be a source of nitrogen dioxide is the proposed extension of the A801 road at the Avon Gorge which links the M8 and M9 motorways. Current annual daily traffic flows are 12,000. It is unclear whether the extension is likely to exceed 25,000 vehicles per day as an annual average.

However, this trunk road project is currently subject to review as part of the Scottish Office Trunk Road Programme Review and it is highly unlikely that this project would be completed by 2005.

There are no known planned developments within West Lothian which will be a significant source of NO_2.

Having consulted Falkirk Council where modelling work has been carried out and having viewed the likely impact of Grangemouth and Longannet, West Lothian are satisfied that with the prevailing wind mainly from the south west (see Section 2.4.5), there are no sources within neighbouring local authorities which could impact significantly on air quality within West Lothian.

7.10 Conclusions for Nitrogen Dioxide

- There are three Part A processes:- Shin Etsu Handotai Europe Ltd, Livingston; NEC Semiconductors (UK) Ltd, Livingston; and, British Gas Plc Compressor Station, Bathgate.
- SEPA have advised that emissions at both the micro-electronics industries identified in Livingston are at very low concentrations and are not considered significant. The other site, British Gas Plc Compressor Station, Bathgate, required further investigation and thus requires a Stage 2 review and assessment.
- There are two Part B processes, Caradale Traditional Brick, Armadale; and, Premier Refactories, Linlithgow.

- SEPA have advised that both industries identified required further investigation and thus require a Stage 2 review and assessment.
- Although there are roads which area likely to exceed 20,000 as an annual daily traffic flow by 2005 monitoring data for the area indicates that the annual air quality standard is being complied with.
- There are no monitoring sites where the annual average level of NO_2 in 1996 was greater than 30 ppb.
- Although the elevated levels of NO_2 at Whitburn Cross, Linlithgow High Street and Greendykes Road in Broxburn do not breach the 30 ppb standard and have not breached the 21 ppb standard from 1997, they are of concern and it is considered appropriate to proceed to a Stage 2 review and assessment for their investigation. The areas will continue to be subject to detailed monitoring and the results of the new continuous mobile monitor will give a more accurate understanding of the levels in the area.
- West Lothian Council have proceeded to a second stage review and assessment to investigate further the nitrogen dioxide levels generated by the Part A process, two Part B processes and possible traffic problems in town centre areas.

Ambient air monitoring carried out within West Lothian during 1993-1999 in every part of the district has indicated no exceedences of the present or proposed standards due to industrial processes.

7.11 STAGE 2 : Nitrogen Dioxide

In 1998 it was decided to expand the diffusion tube survey by adding a further fifteen sites, these being a mixture of town centre sites, motorway or main traffic routes, intermediate and background sites. See Table 7.3 and Figure 7.3.

It was found that the annual mean nitrogen dioxide measurements collected at the diffusion tube site in Whitburn exceeded the National Air Quality Strategy standard of 40 µg/m3 (21 ppb), expressed as an annual mean, for 1993 – 1996 and the intermediate and two background diffusion tube sites in Bathgate and Livingston met the National Air Quality Strategy standards of 40 $\mu g/m^3$ (21 ppb), expressed as an annual mean, for 1993 – 1999.

The two additional sites selected in 1995 as being some of the busiest town centres in the District, namely Broxburn and Linlithgow, also exceed the National Air Quality Strategy standard of 40 $\mu g/m^3$ (21 ppb), expressed as an annual mean, for 1995 – 1996.

The data from 1997 – 1999 shows that levels in Whitburn, Broxburn and Linlithgow had all decreased to meet the National Air Quality Strategy standard of 40 $\mu g/m^3$ (21 ppb), expressed as an annual mean, for 1997 – 1999. See Table 7.2 and Figure 7.3.

It should be noted that the data from the Diffusion tube Survey is based on monthly mean figures and therefore it was not possible to assess compliance with the National Air Quality Strategy standards of 200 $\mu g/m^3$ (105 ppb), expressed as an hourly mean at these locations.

Since September 1999 additional, ambient air quality monitoring data for nitrogen dioxide has been available from the Council's automatic real time continuous monitoring site, currently located at 212 High Street, Linlithgow. The same address as the diffusion tube survey for Linlithgow High Street. See Appendix 3 for monitoring locations map.

Figure 7.5 - Periodic Report for September 1999 - Station : West Lothian

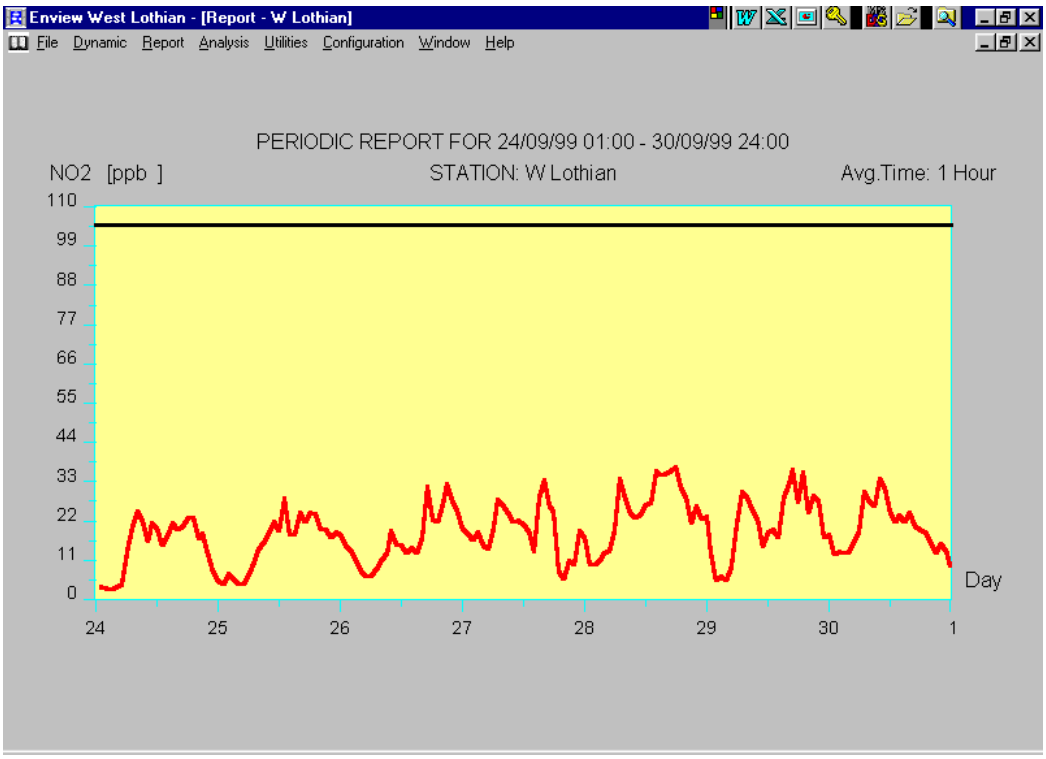


Figure 7.6 - Periodic Report for October 1999 - Station : West Lothian

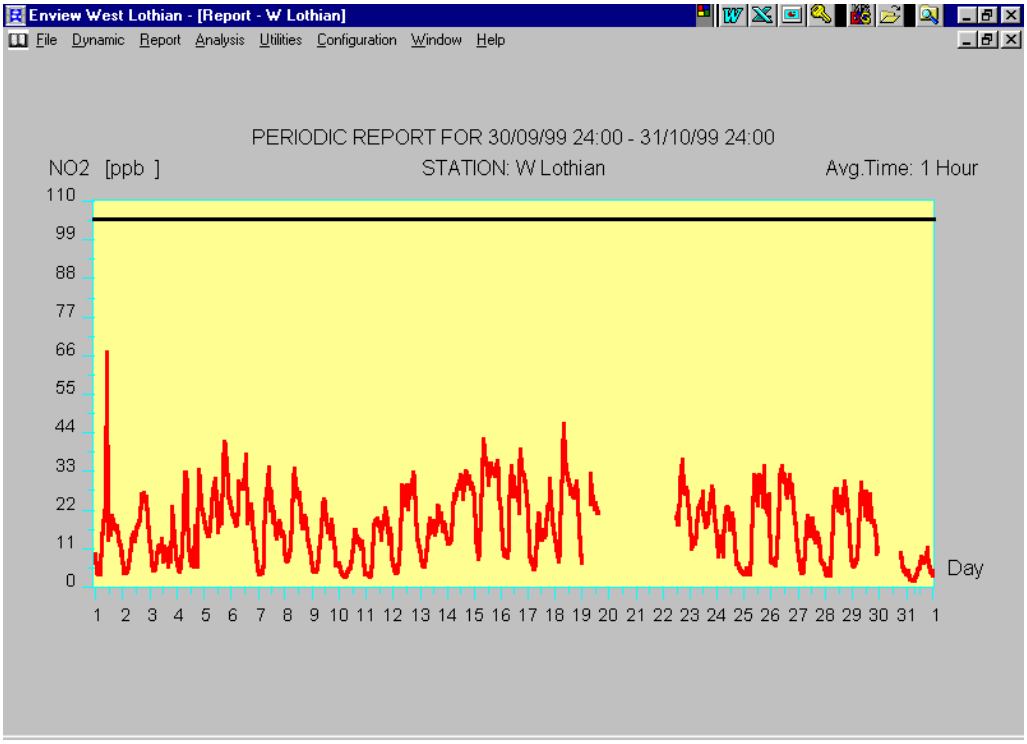


Figure 7.7 - Periodic Report for November 1999 - Station : West Lothian

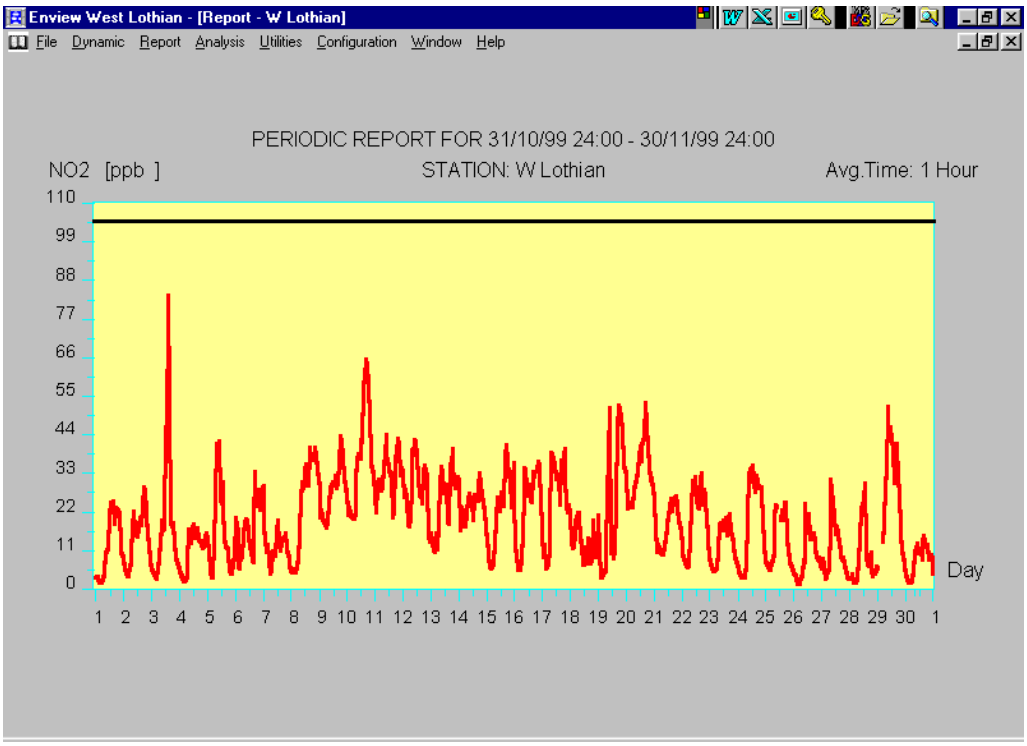


Figure 7.8 - Periodic Report for December 1999 - Station : West Lothian

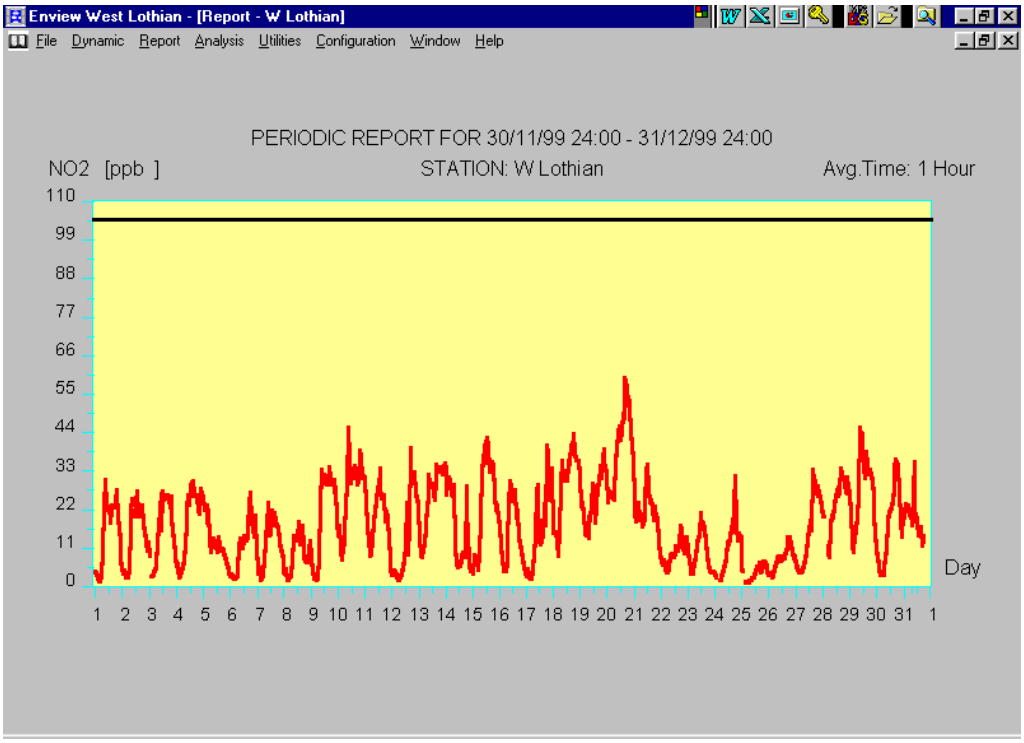


Figure 7.9 - Periodic Report for January 2000 - Station : West Lothian

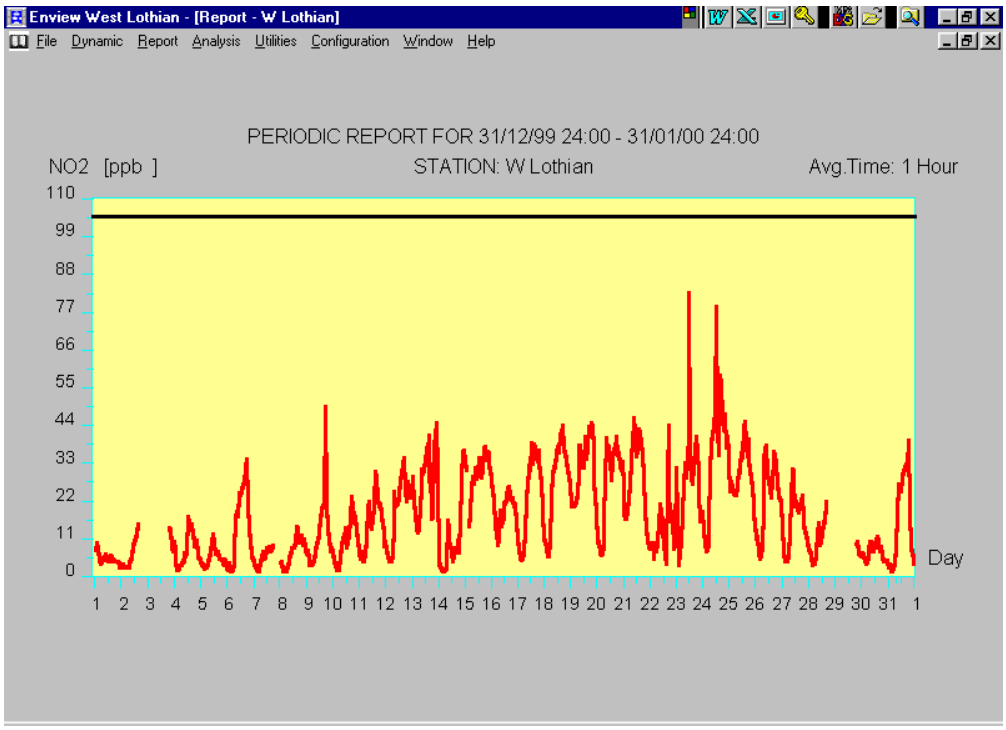


Figure 7.10 - Periodic Report for February 2000 - Station : West Lothian

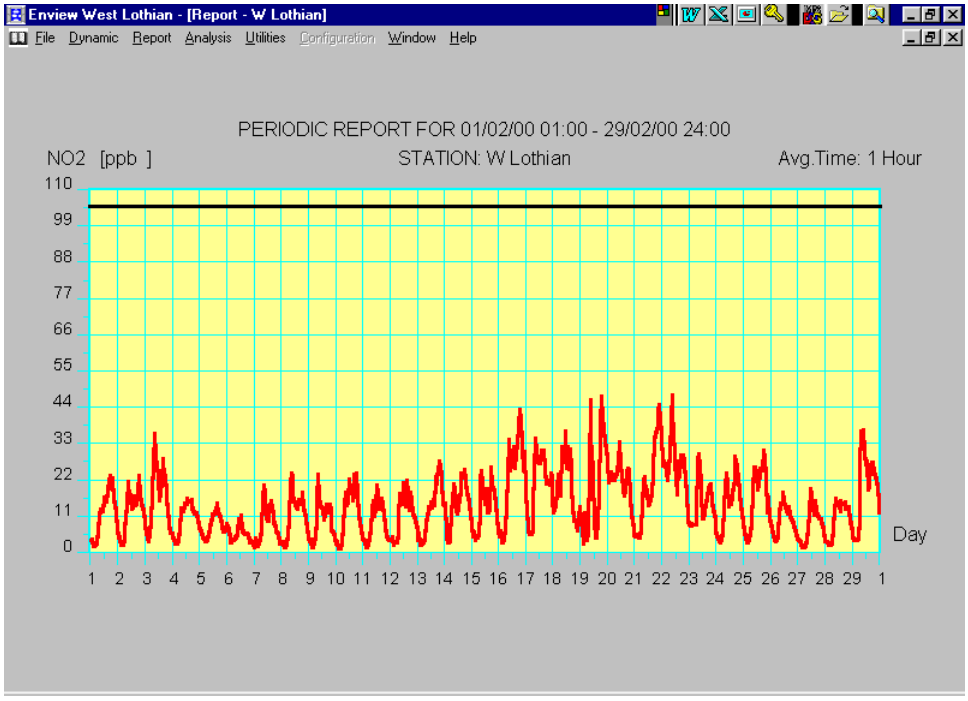


Figure 7.11 - Periodic Report for March 2000 - Station : West Lothian

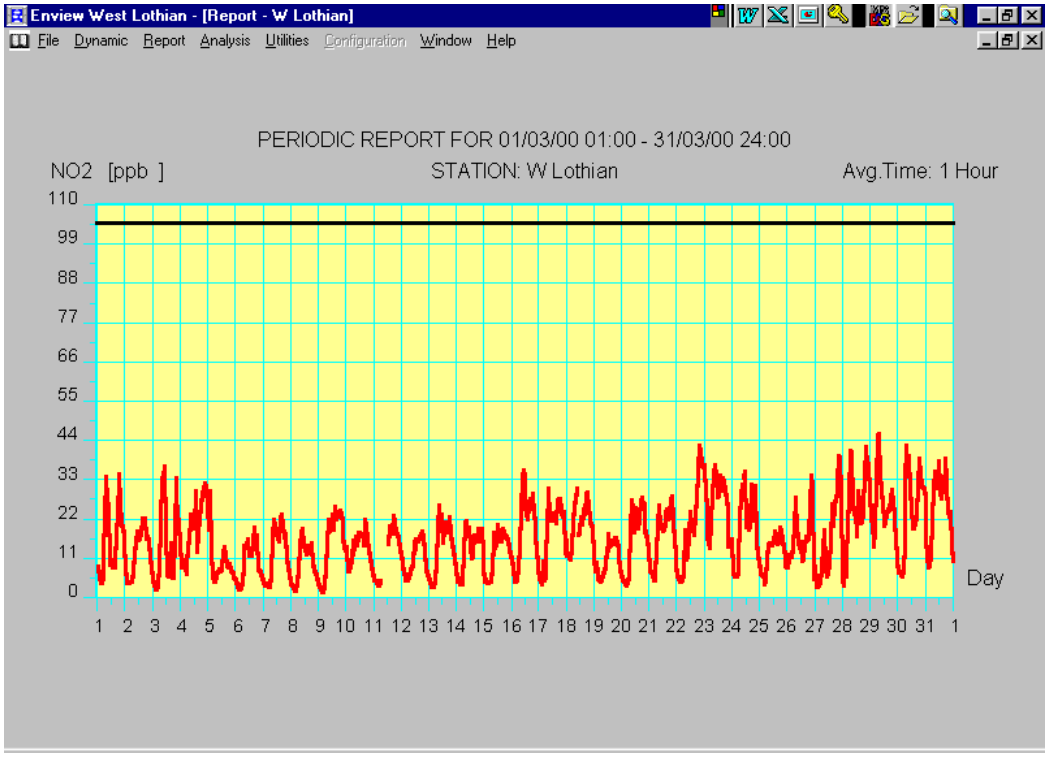


Figure 7.12 - Periodic Report for April 2000 - Station : West Lothian

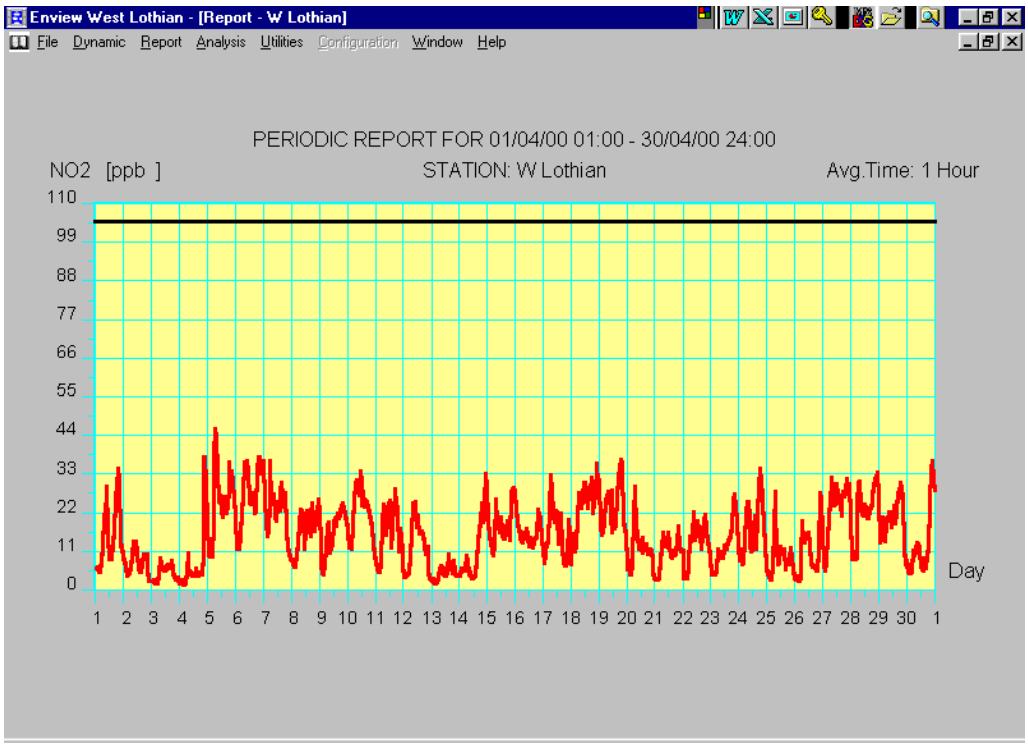
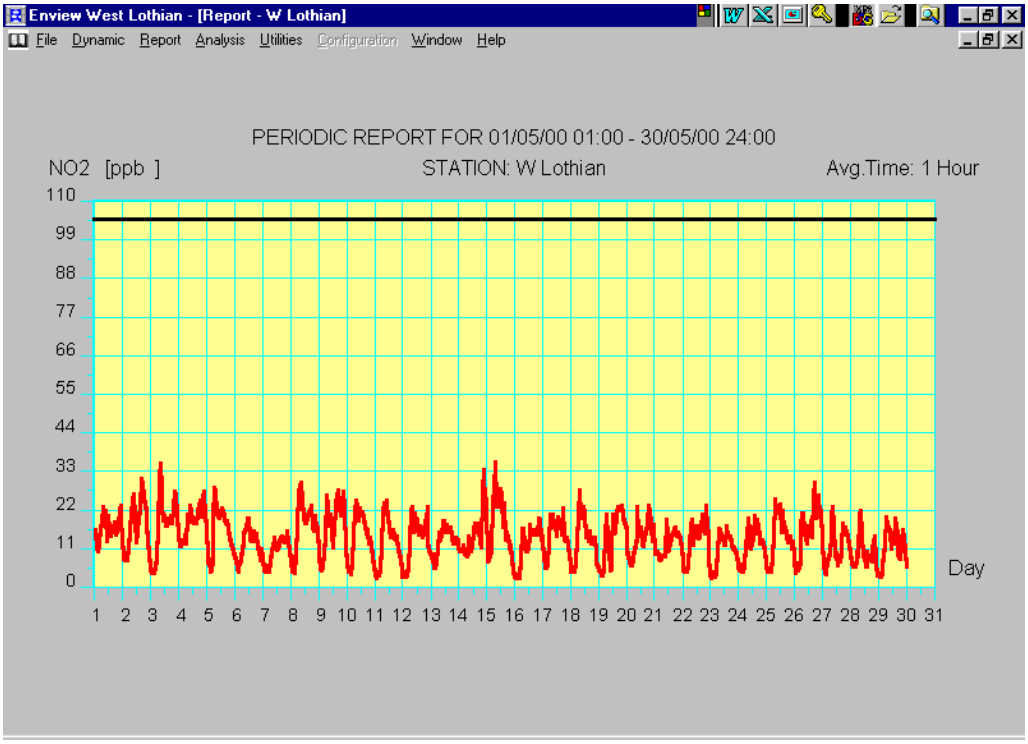


Figure 7.13 - Periodic Report for May 2000 - Station : West Lothian



It was shown (see Figures 7.5-7.13) that the 1-hour monthly mean ranged from 5-50 ppb (9.55-95.5 µg/m^3) and consequently the calculated annual mean was below the standard of 40 µg/m^3 (21 ppb) at this site. It was also shown (see Figures 7.5–7.13) that the maximum measured values of nitrogen dioxide for this site was within the range of 77-85 ppb (147-162 µg/m^3). Therefore, the site complied with the National Air Quality Strategy standard of less than 200 µg/m^3 (105 ppb), expressed as an hourly mean. In addition, the calculated annual mean was below the standard of 40 µg/m3 (21 ppb) for this location.

The Stage 1 Review and Assessment also identified two areas of transport routes which exceed an annual average daily flow greater than 20,000 and one Part A and two Part B processes within the district, which were considered potential significant sources of nitrogen dioxide. See Sections 7.7 and 7.8.

Consequently, it was considered necessary to carry out further investigations and monitoring and therefore undertake a Stage 2 Review and Assessment for this pollutant.

Monitoring Strategy

For the purpose of the Stage 2 Review and Assessment West Lothian Council devised and carried out a monitoring strategy the aim of which was to provide further screening within the district. The position and number of monitoring locations were selected on the basis of local knowledge and the findings of the Stage 1 Review and Assessment carried out by West Lothian Council.

Additionally, in devising the monitoring strategy West Lothian Council has taken cognisance of relevant technical guidance issued by the Scottish Executive and the Department of Environment, Transport and Regions[11]. Cognisance has also been taken of comments pertaining to West Lothian Council's Stage 1 Review and Assessment made by statutory consultees in terms of Schedule 11 of the Environment Act 1995.

As previously stated, West Lothian Council utilised monitoring data for nitrogen dioxide from the 6 existing sites (Table 7.2) for the purpose of the Stage 1 Review and Assessment. Subsequent monitoring data from these sites are assessed for the purpose of this report. An additional 15 diffusion tubes were sited (1998) at locations identified by the Stage 1 Review and Assessment, where likely exceedences of the relevant standard and objectives for nitrogen dioxide may occur. These locations and the basis for their selection will be expanded upon within this section.

As previously stated, it was found within the Stage 1 Review and Assessment that the standard for nitrogen dioxide of 21 ppb expressed as an annual mean within the Air Quality (Scotland) Regulations 2000 was exceeded at the following diffusion tube sites shown in Table 7.5.

Table 7.5 - National UK Nitrogen Dioxide Diffusion Tube Sites which Exceeded the Relevant Standard 1993-1996

Site	Location	Years
Whitburn 1N – Kerbside	East Main Street, Whitburn	1993-1996
Broxburn 5N – Kerbside	East Main Street, Broxburn	1995-1996
Linlithgow 6N - Kerbside	High Street, Linlithgow	1995-1996

With regard to the three diffusion sites Whitburn 1N, Broxburn 5N and Linlithgow 6N new monitoring data 1996 – 1999 has been utilised for the purposes of this report.

Additionally, in order to facilitate a more accurate review and assessment of these sites, continuous real time monitoring was carried out over a period of time at the Linlithgow site. West Lothian Council's mobile air quality station was sited at High Street, Linlithgow since September 1999.

It should be noted when considering the monitoring data obtained from several diffusion tube sites, that it is important to assess the measurements with respect to the exposure of the public to nitrogen dioxide.

Some sites were located at busy junctions, roundabouts, and motorway bankings, where the site was remote from any areas of population.

For this reason it was decided to locate an additional diffusion tube at Wester Bankton, Livingston to provide screening nitrogen dioxide at the nearest populated area to the Lizzie Bryce Roundabout.

An examination of Figures 7.5 - 7.13 illustrates that existing NO_2 standards and proposed standards were not exceeded between September 1999 and May 2000.

Table 7.3 (a) and Figure 7.4 illustrates which major roads were monitored by the diffusion tube survey in 1998. Locations for the diffusion tube survey were selected for major roads at worst case busy junctions and as close to motorway areas as possible adjacent to populated areas in accordance with guidance. See Appendix 2 Road Locations and Appendix 3 Monitoring Locations.

Table 7.3(a) - Extended Survey

Site	Location
Bathgate Fire Station (A89 Roundabout)	Boghall Roundabout, Bathgate
Contracts House (M8 Boundary)	Whitehill Industrial Estate, Bathgate
Freeport (B7015) Stoneyburn	Auchenard Cottage, Stoneyburn
West Lothian House – Intermediate	Almondvale Boulevard, Livingston
Bankton Park West – Intermediate	Lizzie Bryce Roundabout, Livingston
Winchburgh (M9 Boundary)	Muirhall House, Winchburgh
Wilkieston (A71) – Near Road	1 Orchardfield Terrace, Wilkieston
Kirknewton – Background	Ainville Farm, Kirknewton
Mid Calder	Bank Street, Mid Calder
Broxburn Fire Station (A89) – Near Road	Main Street, Broxburn
Uphall	Main Street, Uphall
West Calder (A71) – Near Road	Council Offices, East End, West Calder
St David House (A89) – Near Road	South Bridge Street, Bathgate
Armadale Council Offices (A89) – Near Road	Armadale Cross at corner of East Main Street and South Street, Armadale
Beecraigs - Background	Country Park, Linlithgow

Figure 7.4

Annual Average of NO_2 1998

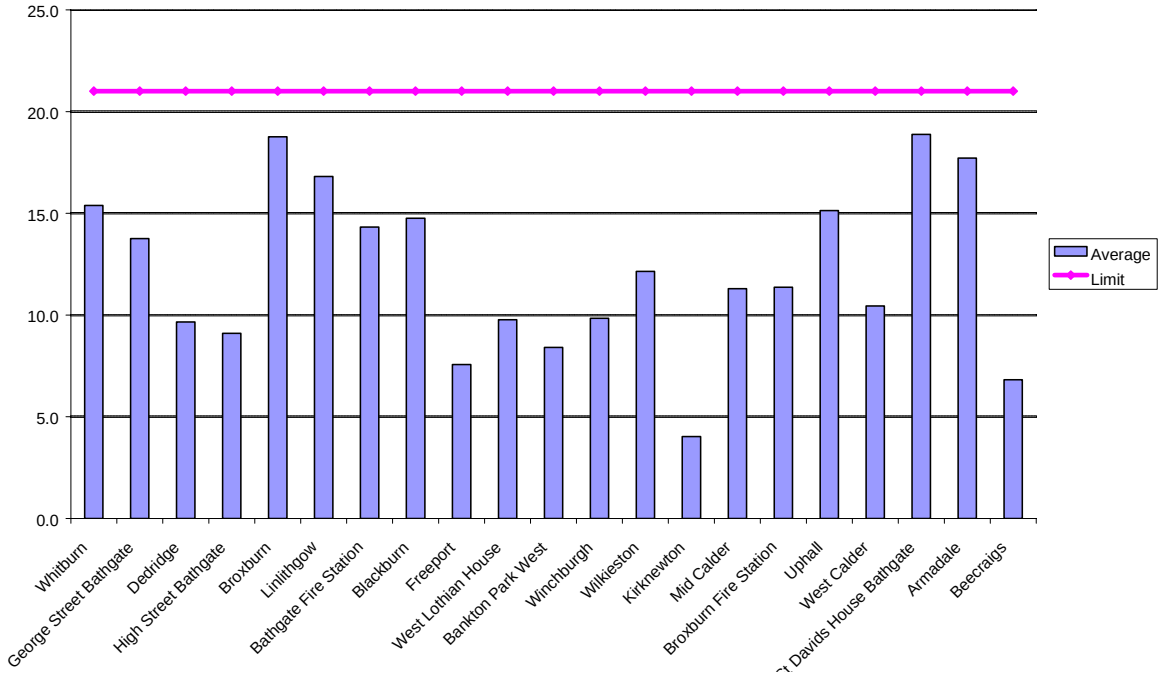


Table 7.6 below identifies the roads with predicted AADT flows of more than 20,000 by 2005.

Table 7.6 - Predicted Exceedences of AADT Levels

AADT	ROAD
>20,000	None
>25,000	A899 dual carriageway serving Livingston M9 motorway passing North edge of district
>50,000	M8 motorway corridor through the area

As a means of confirming the monitoring data for Linlithgow High Street, Stangers Design Manual for Roads and Bridges[16] spreadsheet was used. Utilising information provided by West Lothian Council's Highways Department, Annual Average Vehicle flow per hour of 700 with 3% HDV and Average Speed of 31 km/hr (See Appendix 2 on traffic information and table for A803 Linlithgow 1/1/00 to 30/6/00). The background concentration was worked out from the data provided from the real time analyser in Linlithgow High Street. Using the method prescribed in the guidance corrected background figure for 2005 of 47.6 µg/m^3 was attained. The resultant NO_2 annual mean assuming no change in traffic volumes and flow rates was 34.62 µg/m^3 (See Table 7.7).

Table 7.8 is used to show that with an increase in traffic flow from 700 to 1200 veh/hr and a reduction in average speed from 31 to 27 km/hr a figure of 39.90 µg/m^3 will be achieved.

These figures confirm that emissions from traffic are unlikely to exceed the standards and objectives for NO_2.

The site at the A803 Linlithgow was used as an example of worst case in West Lothian and also because accurate monitoring and traffic data was available for this site. It is intended to do further modelling using DMRB[16] in the future as traffic and monitoring data becomes available for other roads in the district.

Table 7.7 - DMRB Spreadsheet for 212 High Street, Linlithgow Using Existing Traffic Flows and Average Speed

STEP 1 **ENTER YOUR TRAFFIC INFORMATION IN THIS SECTION**

RECEPTOR NAME	212 HIGH STREET LINLITHGOW	YEAR TO BE MODELLED (THE SAME FOR EVERY RUN)	2005

Link	Description of Link	Distance to Receptor (from centre of road) (m)	Distance to Receptor (from kerbside) (m)	Annual Average Vehicle Flow (veh/hr)	% HDV	Average Speed (km/hr)
1	A803 ROAD THROUGH LINLITHGOW	5	2	700	3	31
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

STEP 2 **ENTER YOUR BACKGROUND CONCENTRATIONS IN THIS SECTION**

THE BACKGROUND CONCENTRATIONS SHOULD BE ADJUSTED FOR THE YEAR YOU ARE ASSESSING
NOTE: use background NO_x and not NO_2
NOTE: use background PM_{10} gravimetric

YEAR ADJUSTED BACKGROUND VALUES			
CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$) gravimetric
-	-	**47.60**	-

REFER TO THE POLLUTANT SPECIFIC GUIDANCE FOR BACKGROUND REDUCTION METHODOLOGY (LAQM TG 4 /00)

RESULTS

RECEPTOR LOCATION= 212 HIGH STREET LINLITHGOW

YEAR OF ASSESSMENT= 2005

	Annual Mean			
	CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
CONTRIBUTION FROM ALL ROADS	0.09	0.43	26.21	1.14
BACKGROUND CONTRIBUTION	-	-	47.60	-
TOTAL ANNUAL MEAN CONCENTRATION (INCLUDING BACKGROUND)	#VALUE!	#VALUE!	73.81	#VALUE!

Estimated Pollutant Concentrations for Comparision with the AQO.

CO (mg/m^3)	Maximum 8-hr mean	#VALUE!
BENZENE ($\mu g/m^3$)	Maximum running Annual mean	#VALUE!
Nitrogen Dioxide (NO_2 $\mu g/m^3$)	Annual Mean	34.62
PM_{10} ($\mu g/m^3$)	90th percentile of daily means	#VALUE!

NOTES

1. **The above concentrations are estimated using the methodology described in LAQM.TG4(00).**
2. **The 99.8th percentile of 1-hour mean NO_2 concentrations should be estimated using the method described in para 6.47 of LAQM.TG4(00).**

Table 7.8 - DMRB Spreadsheet for 212 High Street, Linlithgow Using Increased Traffic Flows from 200-1200 and Average Speed Reduced from 31-27 km/hr

STEP 1 **ENTER YOUR TRAFFIC INFORMATION IN THIS SECTION**

RECEPTOR NAME	212 HIGH STREET LINLITHGOW	YEAR TO BE MODELLED (THE SAME FOR EVERY RUN)	2005

Link	Description of Link	Distance to Receptor (from centre of road) (m)	Distance to Receptor (from kerbside) (m)	Annual Average Vehicle Flow (veh/hr)	% HDV	Average Speed (km/hr)
1	A803 ROAD THROUGH LINLITHGOW	5	2	1200	3	27
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

STEP 2 **ENTER YOUR BACKGROUND CONCENTRATIONS IN THIS SECTION**

THE BACKGROUND CONCENTRATIONS SHOULD BE ADJUSTED FOR THE YEAR YOU ARE ASSESSING
NOTE: use background NO_x and not NO_2
NOTE: use background PM_{10} gravimetric

YEAR ADJUSTED BACKGROUND VALUES			
CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$) gravimetric
-	-	**47.60**	-

REFER TO THE POLLUTANT SPECIFIC GUIDANCE FOR BACKGROUND REDUCTION METHODOLOGY (LAQM TG 4 /00)

RESULTS

RECEPTOR LOCATION= 212 HIGH STREET LINLITHGOW

YEAR OF ASSESSMENT= 2005

	Annual Mean			
	CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
CONTRIBUTION FROM ALL ROADS	0.17	0.82	47.41	2.06
BACKGROUND CONTRIBUTION	-	-	47.60	-
TOTAL ANNUAL MEAN CONCENTRATION (INCLUDING BACKGROUND)	#VALUE!	#VALUE!	95.01	#VALUE!

Estimated Pollutant Concentrations for Comparision with the AQO.

CO (mg/m^3)	Maximum 8-hr mean	#VALUE!
BENZENE ($\mu g/m^3$)	Maximum running Annual mean	#VALUE!
Nitrogen Dioxide (NO_2 $\mu g/m^3$)	Annual Mean	39.90
PM_{10} ($\mu g/m^3$)	90th percentile of daily means	#VALUE!

NOTES

1. **The above concentrations are estimated using the methodology described in LAQM.TG4(00).**
2. **The 99.8th percentile of 1-hour mean NO_2 concentrations should be estimated using the method described in para 6.47 of LAQM.TG4(00).**

West Lothian Council's First Stage Review and Assessment identified three Part A and two Part B processes considered to be potential sources of nitrogen dioxide. See Appendix 1 for map of process locations.

After an initial desktop screening SEPA provided the following advice at a meeting of the local air quality forum on 29 February 2000.

It is considered that whilst Shin Etsu Handotai Europe Ltd Livingston have nitrogen dioxide emissions they are at very low concentrations and are not considered to be significant.

The same conclusion was reached for another microelectronics site in Livingston NEC Semiconductors (UK) Ltd. Nitrogen dioxide emissions are at very low concentrations and are not considered to be significant.

With regard to the British Gas Plc Compressor Station, Bathgate the advice was that the process emissions would require further screening and review. A letter from SEPA dated 14 April 2000 concerning all the Part A and B processes requiring further review and assessment enclosed a report which indicated that NO_2 emissions from the British Gas Plc Compressor Station Bathgate based on dispersion modelling results from a similar site suggest that there is no significant risk that emissions will fail to meet the objective, particularly since there are no residential properties within 400 metres and no history of complaint.

The two part B processes are both brickworks Caradale Traditional Brick, Armadale and Premier Refactories Linlithgow, both required further review and assessment following the forum meeting of February 2000. The letter from SEPA dated 14th April 2000 concerning all the Part A and B processes requiring further review and assessment enclosed a report which indicated that NO_2 emission concentrations from both sites are well below the quantity expected to give rise to a 99.8th percentile hourly mean concentration of 40 µg/m^3 (LAQM.TG4(00)) (6.17 – 6.23)

Conclusion

Ambient air quality monitoring carried out in within West Lothian during 1993-1999 in every part of the district has indicated no exceedences of the present or proposed standards due to industrial processes. The real time monitoring carried out in Linlithgow September 1999 – May 2000 indicates that the standard and objectives for NO_2 are likely to be achieved in West Lothian. It is, however, the intention of West Lothian Council to carry out further monitoring for NO_2 in busy town locations in the future. There is no need to proceed to a third stage review and assessment for nitrogen dioxide.

8.0 Chapter 8-First and Second Stage and Second Review and Assessment of PM_{10}

8.1 Introduction

Unlike the individual gaseous pollutants discussed elsewhere in this report, which are single, well defined substances, particulate matter in the atmosphere is composed of a wide range of materials arising from a variety of sources.

Natural sources of particles include wind blown dust and sea-salt, and biological particles such as pollens and fungal spores.

Man-made airborne particles result mostly from combustion processes, from the working of soil and rock, from many other industrial processes and from the attrition of road surfaces by motor vehicles.

These types of particles together with those derived from natural combustion sources, may be classified as either primary or secondary; the former such as carbon particles from combustion, mineral particles derived from stone abrasion and salt from the sea, are released directly into the air, while the latter are formed in the atmosphere by the chemical reaction of gases, first combining to form less volatile compounds which in turn condense into particles.

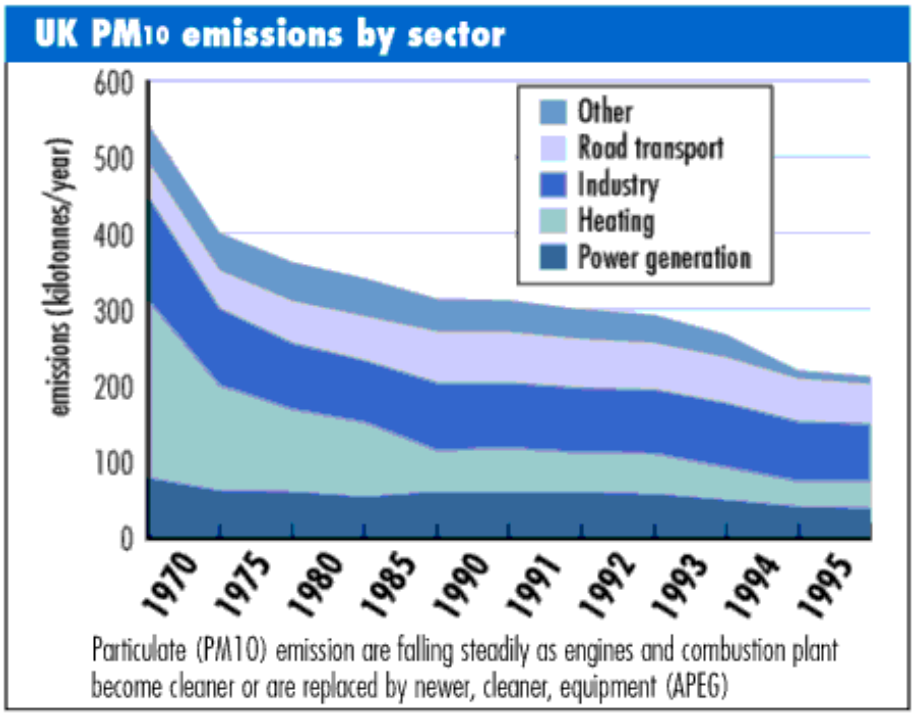
PM_{10} is defined as particles, whatever their source or composition, which fall within the appropriate size range. In general, particles smaller than about 10 µm have the greatest likelihood of reaching the lung and thus the mass fraction of such particles are termed PM_{10}.

National UK emission of primary PM_{10} have been estimated as totalling 213,000 tonnes in 1996. The sources of these emissions are shown in table 8.1.

Table 8.1 - UK Emissions of PM_{10} by Source in 1996 (%)

Source	Percentage of Total Emissions
Power Stations	16
Refineries	1
Domestic	14
Commercial, Public & Agricultural Combustion	3
Iron and Steel	1
Other Industrial Combustion	8
Production Processes	27
Road Transport	25
Other Transport	2
Waste Treatment & Disposal	3

Figure 8.1 - UK PM10 Emissions by Sector



Average levels of particles in the air in UK towns and cities derived from domestic coal burning have decreased at some locations by as much as tenfold in the past 25-30 years following the Clean Air Act of 1956 and subsequent restrictions of coal burning in the domestic sector. Over this period, measurements of particles in the air have been made using the "Black Smoke" method whereby air is drawn through a filter paper for 24 hours and the blackness of the stain produced is then measured. This is a relatively crude and simple technique which is now being superseded by direct weighing (gravimetric) techniques which give a more direct measurement of particle concentrations in the atmosphere.

Although many of the obvious effects of air pollution disappeared with the earlier smogs, research over the last few years has suggested that, even at the much lower levels now found in the UK, particulate air pollution appears to be associated with a range of medical conditions including effects on: the respiratory and cardiovascular systems; asthma; and mortality.

The Expert Panel on Air Quality studied the evidence on health effects of particulates and concluded that the present evidence supports a causative link between exposure to particulate air pollution in the urban environment and certain indices of ill health. They indicated that public health benefits could accrue from further reduction in particle concentrations in our towns and cities in terms of fewer episodes of doctor consultation and hospitalisation for respiratory and cardiovascular diseases.

8.2 Standard and Objective for PM_{10}

The Air Quality (Scotland) Regulations 2000 set the following objectives:-

- **50 micrograms per cubic metre (50 µg/m^3 or less, when expressed as a 24-hour mean, not to be exceeded more than 35 times a year by 31 December 2004**

- **40 micrograms per cubic metre (40 µg/m^3 or less, when expressed as an annual mean by 31 December 2004**

The focus of an authority's review and assessment for PM_{10} should be non-occupational, near ground level outdoor locations with elevated PM_{10} concentrations in areas where a person might reasonably be expected to be exposed over a 24 hour period (eg in the vicinity of housing, schools or hospitals etc).

8.3 The National Perspective

There are already reduction measures in place for most of the man-made sources of PM_{10}. Over the next ten years they should substantially reduce particle emissions in the UK from these sources. This should in turn lead to much lower concentrations of PM_{10} in the air. Most of the reduction will come from primary transport emissions and secondary aerosol.

However it is recognised that this will be the most difficult of the air quality objectives to achieve for most authorities.

It is anticipated that many local authorities will have to proceed to a second or third stage review for this pollutant. Exceptions would be authorities in the north and west of the UK where secondary pollutant concentrations are small, land use is such that dust resuspension is low, local emissions densities are below the national average for urban areas and there are no significant industrial sources.

8.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the local authority needs to identify those which have the potential, either singly or together, to emit significant quantities of PM_{10}. Clearly, the sources will need to be in existence and/or in operation in 2004. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at relevant locations (as described in Chapter 1, para 1.17 LAQM.TG4(00)) need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- estimated annual mean background PM_{10} concentrations (gravimetric) for 2004;
- traffic data for existing or proposed roads (excluding those with daily average traffic flows of less than 5,000 vehicles per day);
- information on domestic solid fuel use (if applicable);
- information on existing and/or proposed Part A and Part B authorised processes;
- information on sources of uncontrolled or fugitive dust emissions, such as quarries, landfill sites, major construction works, coal and aggregate stock yards etc;

- details of any planned developments in the area, particularly if they will affect traffic flows;
- details of any significant sources of PM_{10} in neighbouring areas which could impact within the authority's data.

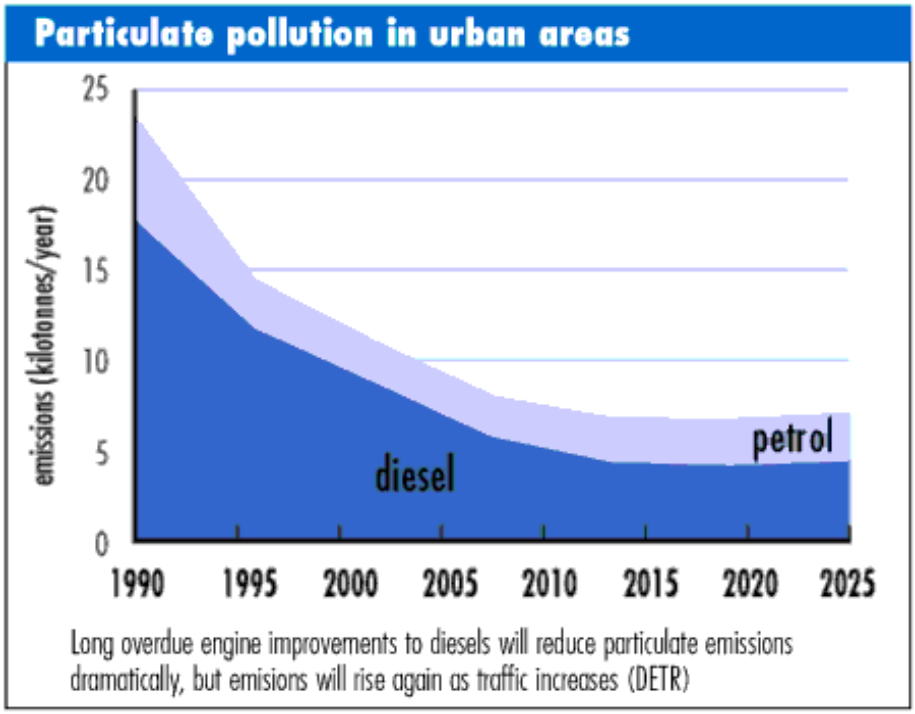
8.5 Background PM_{10} Concentrations

National maps are available which indicate the estimated background PM_{10} concentrations across the UK. Estimated background PM_{10} concentrations for West Lothian area are between 15.1 µg/m^3 - 17.5 µg/m^3.

8.6 Background Secondary PM_{10} Concentrations

National maps for secondary particulate concentrations in the UK are also available. The secondary particulate maps for the area indicate that the estimated secondary particulate background concentrations for West Lothian is 7 µg/m^3 based on 1996 data. By the end of 2004 reductions in emissions of sulphur dioxides and nitrogen dioxides will lead to a fall in the concentrations of secondary particles. NETCEN have stated that it would be reasonable to assume that the annual mean concentrations of secondary particles in 2004 will be 0.7 times that of 1996.

Figure 8.2 - Particulate Pollution in Urban Areas



8.7 Estimated Emissions of PM_{10}

The national atmospheric emissions inventory provides information on approximate emission densities at a national scale. This information is available on the Internet[17]. The information indicates that emissions from domestic and road traffic sources acting in conjunction would be a maximum of 3 tonnes per 1 x 1 km grid square. The maps also give information on low level industrial sources and indicate that there are a few grid squares within West Lothian which have emission densities of up to 9.99 tonnes per 1 x 1 km grid square. These squares all correspond to sites of authorised processes.

There are no adjacent squares on average exceeding 5 tonnes.

8.8 PM_{10} Monitoring in the UK

PM_{10} is monitored nationally as part of the automatic monitoring network. In 1996 the sites involved in the network, except Lough Navar (a remote site) exceeded the National Air Quality Standard of 50 $\mu g/m^{-3}$ as a 24 hour running mean.

Most monitoring sites recorded PM_{10} particle concentrations which were described as "High" for a number of days. A significant number of sites also recorded "Very High" for this pollutant.

The network sites include two urban centre sites, one in Glasgow and one in Edinburgh. These sites both failed the standard in 1996.

8.9 PM_{10} Monitoring in West Lothian

Over the years smoke monitoring using the "black smoke method" has been carried out in conjunction with SO_2 in the local area.

In the 1980s West Lothian District Council set up pollution monitoring stations in the form of 8 port smoke and SO_2 bubbler stations at various locations throughout the area.

The results of this monitoring indicated that the main town areas, particularly those with heavier industries and heavy domestic coal usage, had the main burden of smoke pollution.

Armadale, Whitburn and Bathgate were found to have the highest levels for smoke, followed by West Calder, Broxburn and Linlithgow. This was due to the topography in the area, the local industrial sources and domestic coal usage in what was a predominantly mining area.

Four Smoke Control Areas were designated in the Livingston New Town area two in 1964 and two in 1970. Two small parts of this area were excluded from the orders namely old Livingston Station (now the Deans Area of Livingston) and the old part of Livingston Village. Both these areas are hatched out in red on the maps.

Maps of the Smoke Control Areas are shown in Appendix 4.

This has been a major step forward in the reduction of pollution locally.

Monitoring continues to the present day although the number of sites has been reduced. Significant reductions in black smoke have been measured. These reductions are represented graphically in Figures 8.3 - 8.6.

Figure 8.3

Smoke Annual Mean Levels (µg/m^3)
(1982-1988)

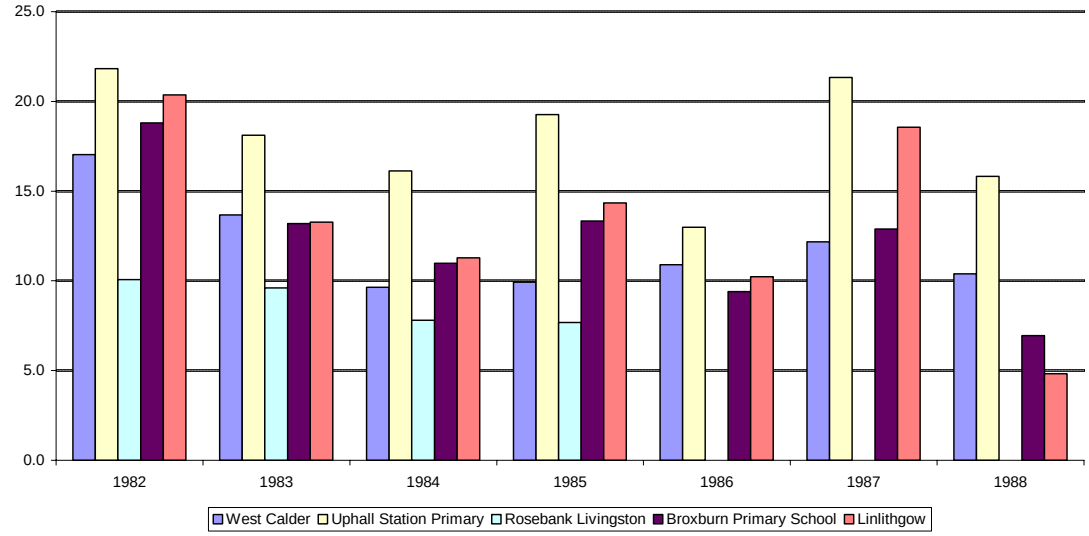


Figure 8.4

Smoke Annual Mean Levels (µg/m^3)
(Whitburn Sites 1990-1999)

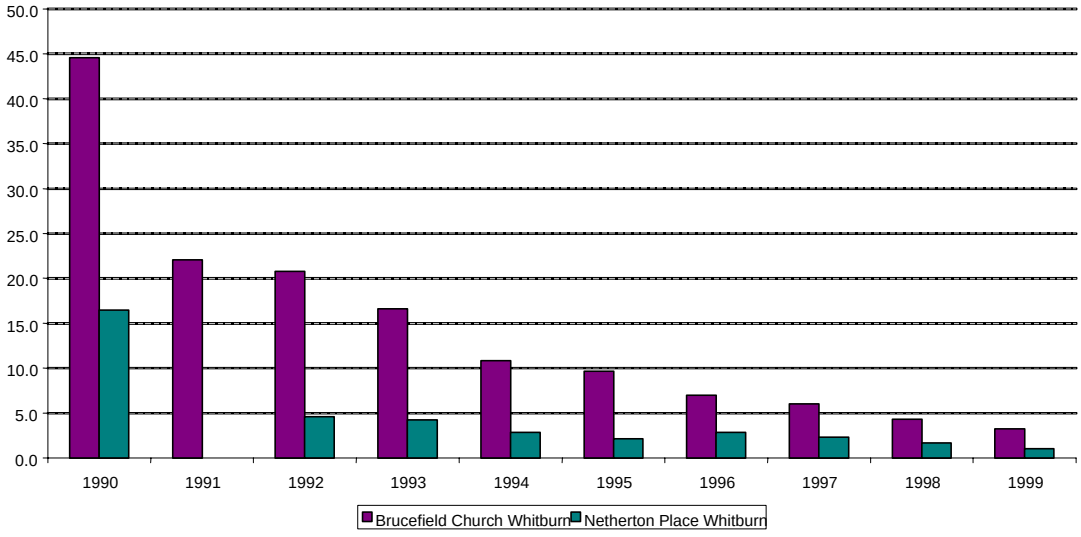


Figure 8.5

Smoke Annual Mean Levels (µg/m^3)
(Armadale Sites 1989-1999)

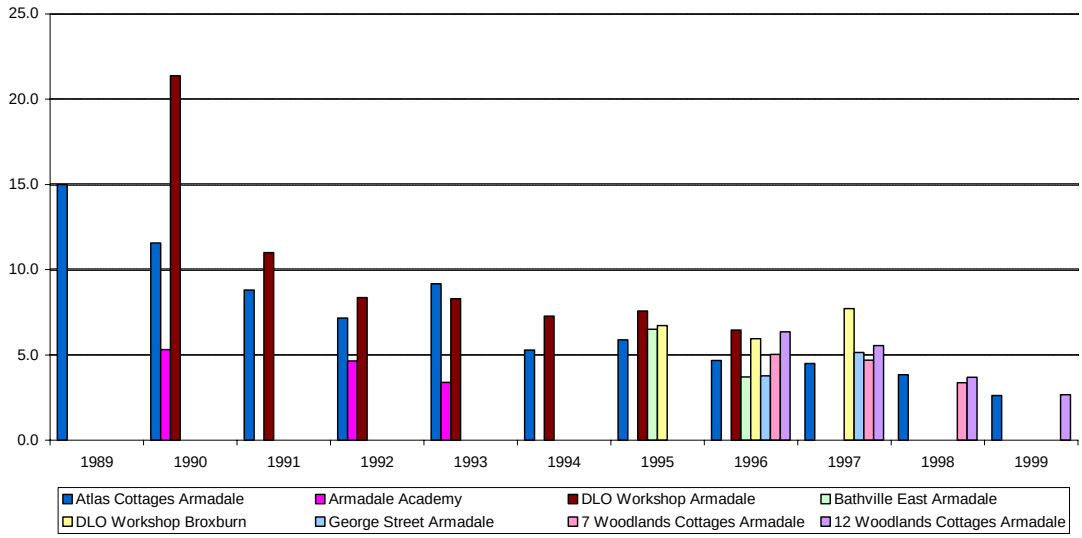
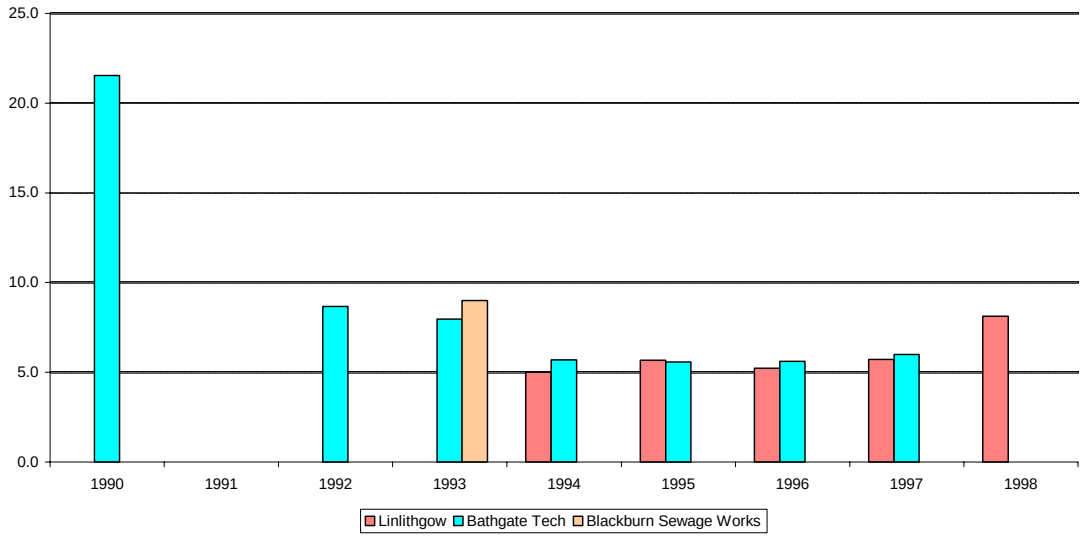


Figure 8.6

Smoke Annual Mean Levels (µg/m^3)
(Linlithgow, Bathgate and Blackburn Sites 1990-1998)



During the 1970s and 80s numerous of the Council's monitoring stations were part of the national survey. They were taken out of the national survey in the late eighties. However, West Lothian Council continued to operate these stations independently.

The Council reviewed the results in 1993 and discovered that the Smoke Control Programme and trends in fuel use over the years meant smoke pollution from area sources was no longer a problem in West Lothian. Therefore, most of the smoke stations were discontinued in 1994.

West Lothian Council had not carried out any specific PM_{10} monitoring until a dedicated air quality monitoring unit was set up at 212 High Street, Linlithgow in September 1999.

8.10 Part A and Part B Authorised Processes

The review of authorised processes using the government guidance identified 4 Part A processes which could be a source of PM_{10}. See Appendix 1 for location map. These are:-

- **Shin Etsu Handotai Europe Ltd, Livingston**
- **NEC Semiconductors (UK) Ltd, Livingston**
- **Glacier Vander Vell, Bathgate**
- **DKL Metals Ltd, Linlithgow**

Consultation with SEPA was undertaken to determine the significance of these emissions. This consultation exercise produced the following information. Shin Etsu is only likely to emit very low concentrations of PM_{10} and is not considered significant. NEC is only likely to emit very low concentrations of PM_{10} and is not considered significant.

Thus only two Part A processes had the potential to emit significant quantities of PM_{10} to air and they are Glacier Vander Vell, Whitehill Industrial Estate, Bathgate and DKL Metals Ltd, Linlithgow. The Glacier Vander Vell process is within the Whitehill Industrial Estate and as such is approximately 1 km from the nearest residential areas. The prevailing wind direction is from the south west sector and therefore takes any plume towards Deans Industrial Estate or the Starlaw, Boghall area where the nearest residential area is approximately 2 km away. The DKL Metals site is at Avontoun Works, to the West of Linlithgow and has one house located approximately 100 metres to the South and other residential areas at Avontoun Park and Kettlestoun Mains approximately 0.5 km away. The prevailing wind is from the south west sector and therefore takes the plume towards the Linlithgow Bridge, Avontoun Park areas.

In consultation with SEPA the following information was provided:-

DKL Metals Ltd : PM_{10}

Emission concentrations from the main stack:-

1999	Total particulate = 0.27 mg/m^3
1997	Total particulate = 0.61 mg/m^3
June 1995	Total particulate = 0.21 mg/m^3

Mass emissions (all sources):-

1999	Total particulate = 0.00049 tonnes
1998	Total particulate = 0.01000 tonnes
1997	Total particulate = 0.01000 tonnes
1996	Total particulate = 0.01000 tonnes

Estimated annual mass emissions of total particulate matter from this process are well below the quantity expected to give rise to a 98th percentile 24 hour average concentration of 1 µg/m^3 **[11]**. PM_{10} concentrations are expected to be even lower. In addition, there is one residential property within 400 metres and no history of complaint from the process. This indicates that there is no significant risk that emissions of PM_{10} form this process will fail to meet the objective.

Glacier Vander Vell Ltd : PM_{10}

Emission concentrations from bronze smelter stack:-

January 2000	Total particulate = 3.20 mg/m^3
June 1999	Total particulate = 0.71 mg/m^3
March 1998	Total particulate = 0.86 mg/m^3
March 1997	Total particulate = 4.67 mg/m^3
September 1996	Total particulate = 1.30 mg/m^3

Annual mass emissions (all sources):-

1999	Total particulate = 0.50 tonnes
1998	Total particulate = 2.10 tonnes
1997	Total particulate = 4.42 tonnes
1996	Total particulate = 5.09 tonnes

Estimated annual mass emissions of total particulate matter from the main combustion stack are below the quantity expected to give rise to a 98th percentile 24 hours average concentration of 1 µg/m^3 **[11]**. This indicates that there is no significant risk that emissions of PM_{10} from this stack will tail to meet the objective.

Even if we assume that half of the latest estimated annual mass emissions are from fugitive low level sources, the 98th percentile of daily 24 hour mean ground level concentration is not expected to exceed 1 µg/m^3 beyond 200 metres from the process**[11]**. PM_{10} concentrations are expected to be even lower. Since there are no residential properties within 400 metres and no history of complaint from the site, the information provided indicates that there is no significant risk that emissions of PM_{10} from this process as a whole will fail to meet the objective.

Screening of the Part B processes also identified five processes which could be a significant source of PM_{10}:-

- **ANI Edgar Allen, Bathgate**
- **CPL (Scotland) Woodend Washer, Armadale**
- **Caradale Brick, Armadale**
- **Hepworth Minerals Levenseat Quarry, Fauldhouse**
- **Premier Refactories, Linlithgow**

Consultation with SEPA was undertaken to determine the significance of these emissions. This consultation provided information that the Part B processes were operating satisfactorily and meeting their emission standards and thus should not result in any exceedences of the air quality standard.

8.11 Roads in West Lothian

As discussed in section 2.4.7, there is a combined traffic counter site on the A899 trunk road running through Livingston linking the M8, the A89 at the North end and the A71 at the South end, where the current and projected annual daily traffic flow of 32,000 exceeds 25,000 vehicles. See Appendix 2 Road Maps and Traffic Counters. Although this road passes through Livingston, housing estates, schools etc are all at least 50 m from the carriageway. The area surrounding the road is open and exposed to the prevailing winds. It is likely therefore that PM_{10} generated by the traffic will be adequately dispersed to minimise if not remove the risk of exceeding the standard at these locations.

The NO_2 monitoring does not indicate elevated traffic pollution levels in the vicinity of this road. (Figure 7.3 Bankton park West) A diffusion tube site was located in the housing estate nearest the Lizzie Bryce Roundabout at South end of the road as it joins the A71.

The NO_2 monitoring programme recorded the highest values in Linlithgow High Street where the current annual daily traffic flow is 16,800. Taking this as the worst case it was decided that monitoring equipment should be purchased and located in Linlithgow High Street.

8.12 Future Developments and Neighbouring Sources

Future developments which may be a source of PM_{10} is the proposed extension of A801 road at the Avon Gorge which links the M8 and M9 motorways. Current figures of annual daily traffic flow of 12,000 are available for daily traffic flows in the West Lothian section. It is unclear whether they are likely to exceed 25,000 vehicles. However, this trunk road is currently subject to review and it is highly unlikely that this project would be completed by 2004.

There are no other known planned developments within West Lothian which will be a significant source of PM_{10}. Having consulted Falkirk Council where modelling work has been undertaken and having viewed the likely impact of Grangemouth and Longannet, West Lothian Council are satisfied that with the prevailing wind mainly from the south west (see Section 2.9), there are no sources within neighbouring local authorities which could impact significantly on air quality within West Lothian.

8.13 First Stage Conclusions for PM_{10}

- There are no significant industrial sources of PM_{10} either within West Lothian or neighbouring areas with the potential for exposure of individuals in the relevant location.
- Estimated background PM_{10} concentrations are between 15.1 $\mu g/m^3$ to 17.5 $\mu g/m^3$.
- The estimated annual average regional background level due to secondary particulates is $<8\ \mu g/m^3$.
- The estimated emissions from low level sources greater than 10 tonnes correspond to industrial sites. These have been shown not to be a significant source or not to be in a relevant location.

- The M8, M9 and A899 have annual average daily traffic flows of over 25,000 vehicles, however, the topography and weather information means it is unlikely that there will be an exceedence of the standard.
- It was decided that due to a lack of monitoring data for PM_{10} it would be appropriate to monitor at Linlithgow High Street taking this as a worst case due to traffic flow problems, canyon effect, stationery vehicles, deliveries, pedestrian crossings and traffic lights.
- There is no need to proceed to a second stage review for PM_{10} other than to monitor the High Street in Linlithgow.

8.14 STAGE 2 : PM10

8.14.1 Monitoring Strategy

The monitoring strategy employed by West Lothian Council for the Stage 2 Review and Assessment for PM_{10} was derived as a result of information gained from the Stage 1 Review and Assessment, from local experience and taking cognisance of the information contained within the supplementary guidance documents "Assistance with the Review and Assessment of PM_{10} Concentration in Relation to the Proposed EU Stage 1 Limit Values".

Cognisance has also been taken of comments pertaining to West Lothian Council's Stage 1 Review and Assessment made by statutory consultees in terms of Schedule II of the Environment Act, 1995.

The Scottish Executive in their role as statutory consultee in terms of Schedule II of the Environment Act 1995 stated: The Scottish Executive considers that exceedence of the proposed objectives might be found in areas adjacent to busy roads, particularly within major urban areas; in areas which have significant emissions from domestic burning of solid fuels; in areas in the vicinity of industrial plant or which have significant uncontrolled or fugitive emissions (for example quarrying materials handling facilities etc).

West Lothian Council had previously considered these points taking cognisance of the need to progress to Stage 2 Review and Assessment for this pollutant. Consequently, the Council's Mobile air Quality Station was sited at 212 High Street, Linlithgow in order to measure PM_{10} levels produced from road traffic.

8.14.2 Stage 2 Monitoring in West Lothian

For the purposes of the Stage 1 Review and Assessment no ambient air quality monitoring for PM_{10} data was available within West Lothian. Given that the first stage review and assessment had shown that contributions from domestic and industrial sources to be insignificant it was decided to concentrate our monitoring resources in assessing the impact of traffic on background PM_{10} levels. The site chosen to collect the data from the real time continuous PM_{10} analyser (TEOM instrument (Tapered Element Oscillating Microbalance)) was 212 High Street, Linlithgow, as previous diffusion tube surveys for NO_2 had shown the highest levels of NO_2 in the area. This busy town centre with a narrow road, slight canyon effect and at peak times, slow moving and stationary vehicles waiting at traffic lights and pedestrian crossings. The site was selected as a probable worst case due to these features.

Monitoring of PM_{10} is undertaken using a TEOM instrument. This instrument is recognised in the guidance[11] as a suitable means of measuring PM_{10} (LAQM.TG4(00)) All results shown are taken from this instrument.

The conversion factor of (X1.3) is used to convert the results to those which would be shown using a gravimetric instrument. Ref[11].

The conversion factor is usefully applied where monitoring has taken place at a single site over a period of one year.

The site at Linlithgow has not been operational for a whole year with data only available from the 24 September 1999 till May 2000 giving eight months information.

For example the measured eight month mean PM_{10} concentration at High Street, Linlithgow 24 September 1999 – end of May 2000 was (12.2 µg/m^3 TEOM) = 15.86 µg/m^3 gravimetric. This was with a data capture over the period of 95% with a maximum fifteen minute reading of (28.9 µg/m^3 TEOM).

As can be seen from the following graphs (Figure 8.7 – 8.15) there are no exceedences of the 24 hour mean 50 µg/m^3 limit value.

Figure 8.7 - September 1999

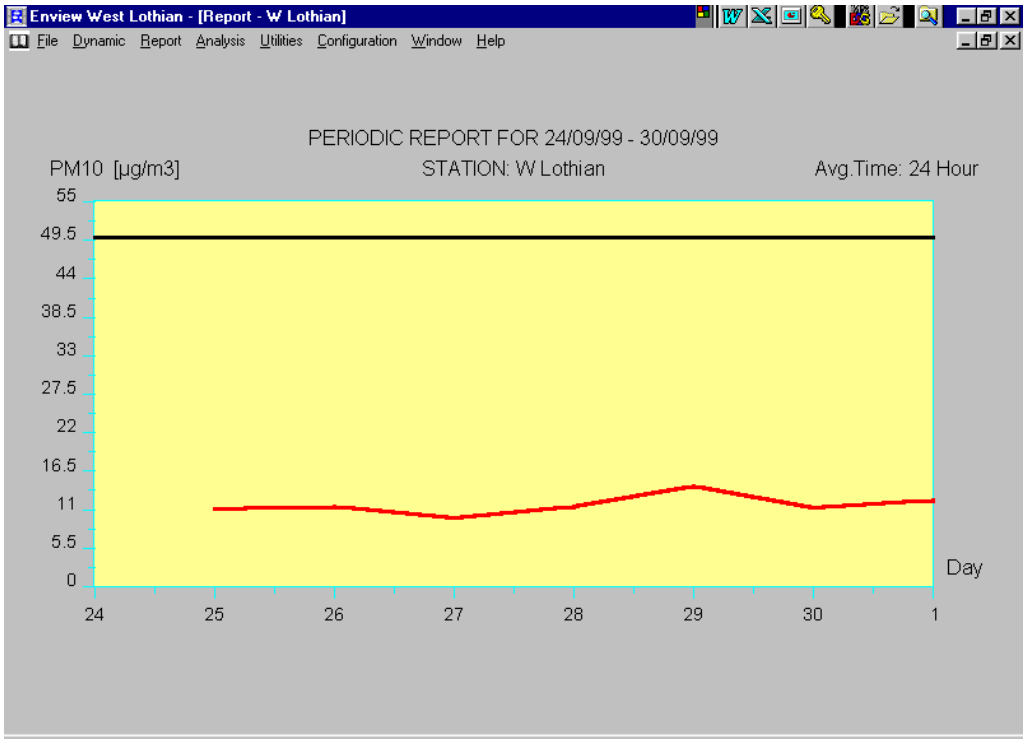


Figure 8.8 - October 1999

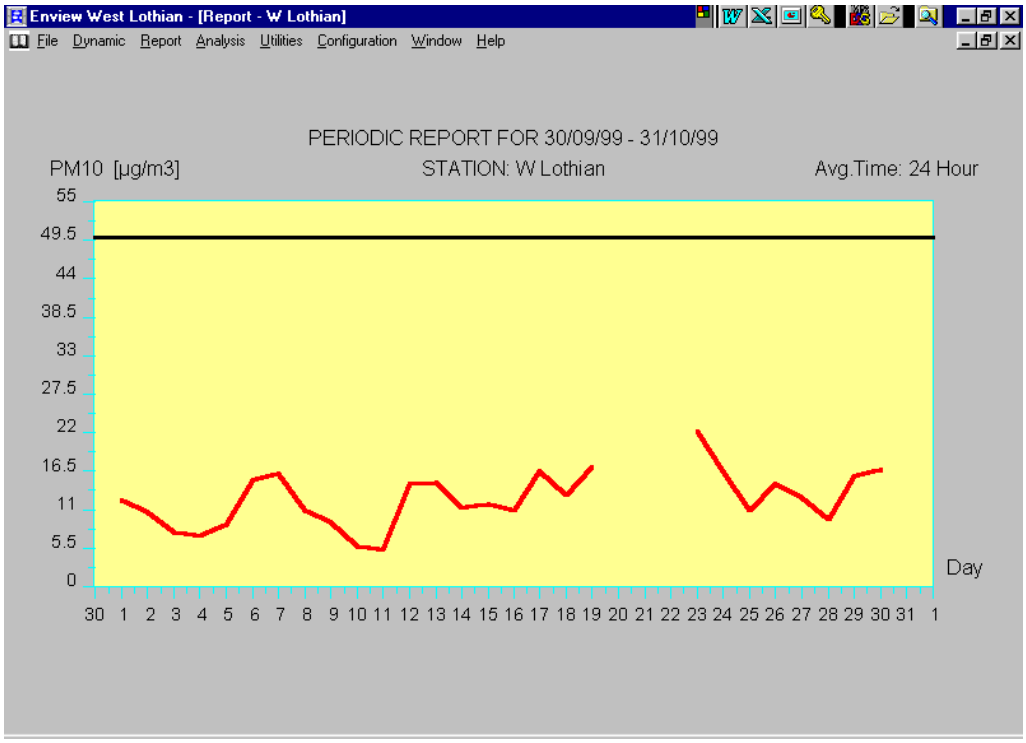


Figure 8.9 - November 1999

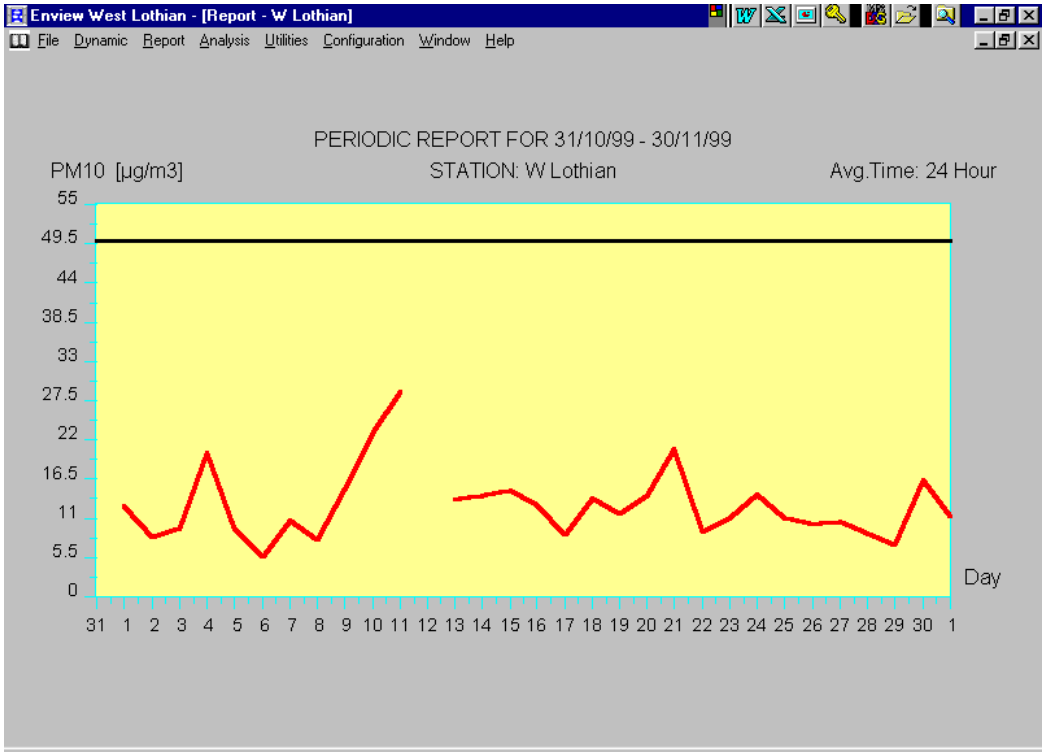


Figure 8.10 - December 1999

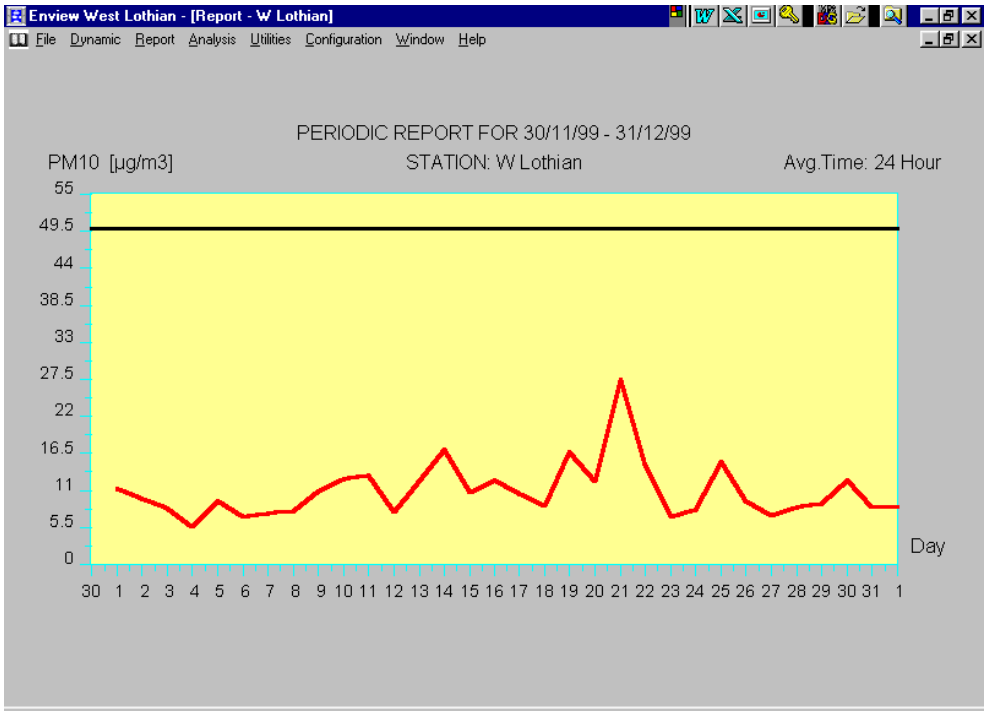


Figure 8.11 - January 2000

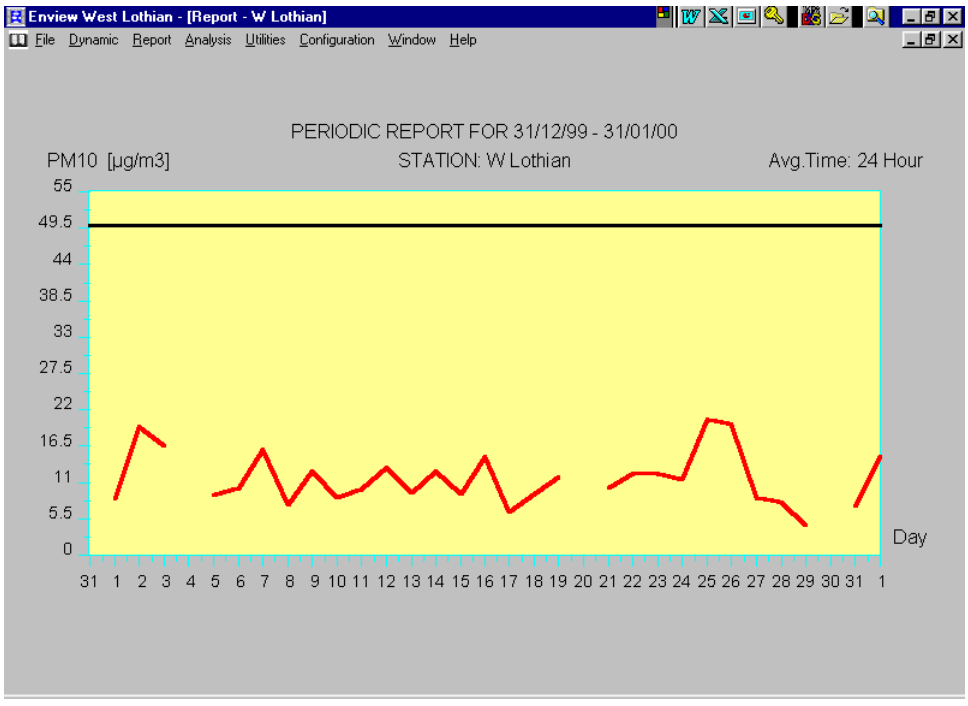


Figure 8.12 - February 2000

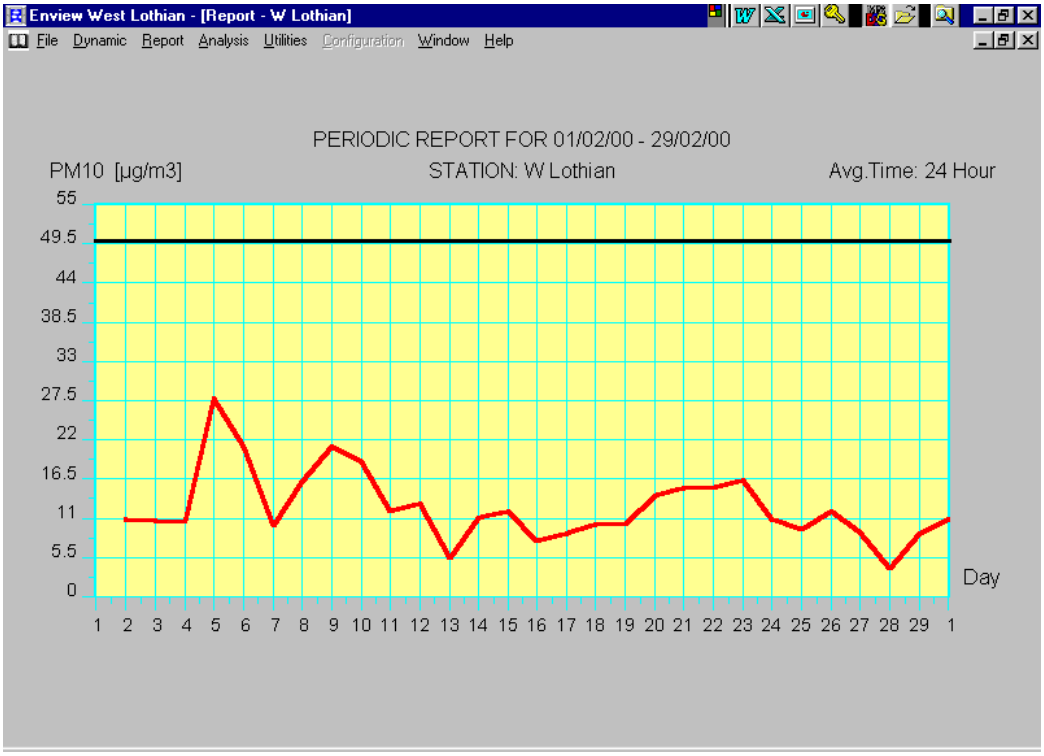


Figure 8.13 - March 2000

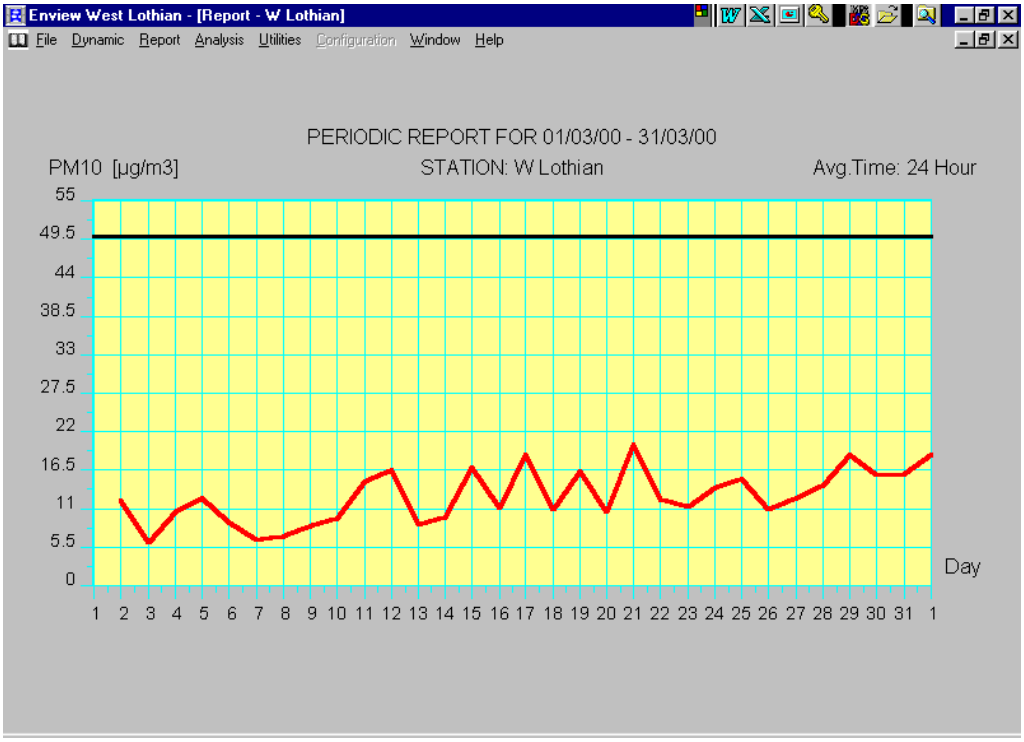


Figure 8.14 - April 2000

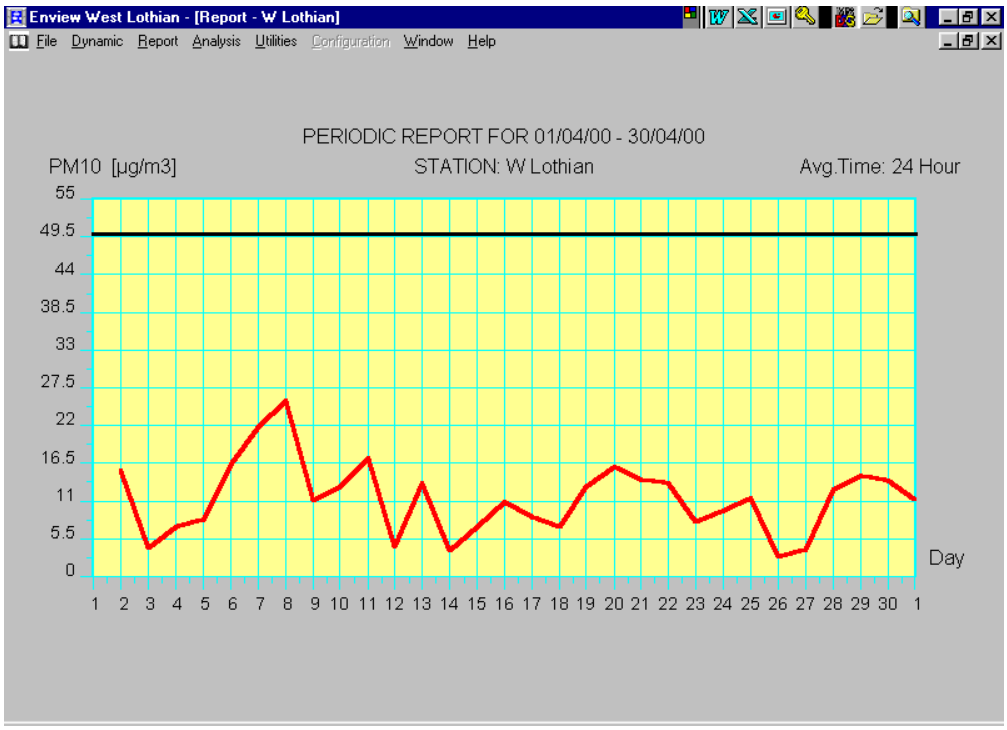
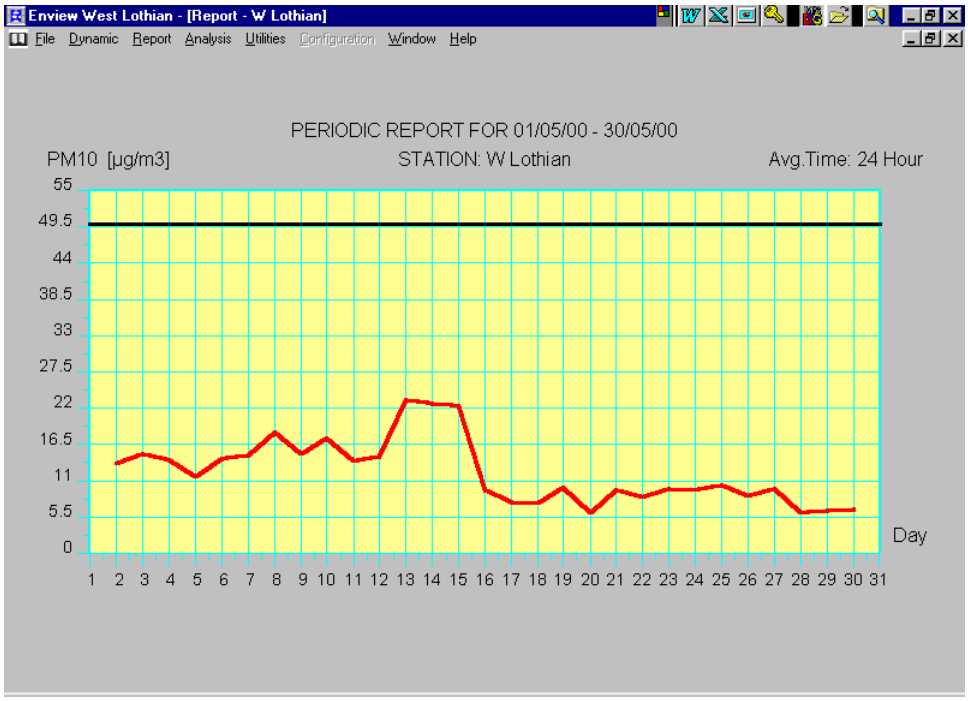


Figure 8.15 - May 2000



As a means of confirming the monitoring data for Linlithgow High Street, Stangers DMRB[16] spreadsheet was used. Utilising information provided by West Lothian Council's Highways Department Combined Annual Average vehicle flow per hour of 700 with 3% HDV and average speed of 31 km/hr (See Appendix 2 traffic information A803 Linlithgow).

The background concentration was worked out using data collected from the automatic real time analyser in Linlithgow High Street. Using the method prescribed in the guidance a negative figures was attained at the stage E = -0.44 (following advice received from the DETR Help Desk a figure of 8 was used in the equation instead of 10.5. This allowed the rest of the equation to be completed giving a year adjusted background for 2004 of 18 which was used in the spreadsheet.

The resultant PM_{10} annual mean assuming no change in traffic figures was 34.53 µg/m^3 (see Table 8.2).

Table 8.3 is used to show that with an increase in traffic flow from 700 – 1200 veh/hr, a reduction in average speed from 31-25 km/hr and an increase in HDV for 3%-10% a future of 40 µg/m^3 will be achieved.

These figures confirm that emissions from traffic are unlikely to exceed the standards and objectives for PM_{10}.

The site at the A803 Linlithgow was used as an example of worst case in West Lothian and also because accurate monitoring and traffic data was available for this site. It is the intention of West Lothian Council to carry out further modelling using DMRB[16] in the future as traffic and monitoring data becomes available.

Table 8.2

STEP 1 **ENTER YOUR TRAFFIC INFORMATION IN THIS SECTION**

RECEPTOR NAME	212 HIGH STREET LINLITHGOW	YEAR TO BE MODELLED (THE SAME FOR EVERY RUN)	2004

Link	Description of Link	Distance to Receptor (from centre of road) (m)	Distance to Receptor (from kerbside) (m)	Annual Average Vehicle Flow (veh/hr)	% HDV	Average Speed (km/hr)
1	A803 ROAD THROUGH LINLITHGOW	5	2	700	3	31
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

STEP 2 **ENTER YOUR BACKGROUND CONCENTRATIONS IN THIS SECTION**

THE BACKGROUND CONCENTRATIONS SHOULD BE ADJUSTED FOR THE YEAR YOU ARE ASSESSING
NOTE: use background NO_x and not NO_2
NOTE: use background PM_{10} gravimetric

YEAR ADJUSTED BACKGROUND VALUES			
CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$) gravimetric
-	-	-	**18.00**

REFER TO THE POLLUTANT SPECIFIC GUIDANCE FOR BACKGROUND REDUCTION METHODOLOGY (LAQM TG 4 /00)

RESULTS

RECEPTOR LOCATION= 212 HIGH STREET LINLITHGOW

YEAR OF ASSESSMENT= 2004

	Annual Mean			
	CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
CONTRIBUTION FROM ALL ROADS	0.10	0.51	29.22	1.29
BACKGROUND CONTRIBUTION	-	-	-	18.00
TOTAL ANNUAL MEAN CONCENTRATION (INCLUDING BACKGROUND)	#VALUE!	#VALUE!	#VALUE!	19.29

Estimated Pollutant Concentrations for Comparision with the AQO.

CO (mg/m^3)	Maximum 8-hr mean	#VALUE!
BENZENE ($\mu g/m^3$)	Maximum running Annual mean	#VALUE!
Nitrogen Dioxide (NO_2 $\mu g/m^3$)	Annual Mean	#VALUE!
PM_{10} ($\mu g/m^3$)	90th percentile of daily means	34.53

NOTES

1. **The above concentrations are estimated using the methodology described in LAQM.TG4(00).**
2. **The 99.8th percentile of 1-hour mean NO_2 concentrations should be estimated using the method described in para 6.47 of LAQM.TG4(00).**

Table 8.3

STEP 1 **ENTER YOUR TRAFFIC INFORMATION IN THIS SECTION**

RECEPTOR NAME	212 HIGH STREET LINLITHGOW	YEAR TO BE MODELLED (THE SAME FOR EVERY RUN)	2004

Link	Description of Link	Distance to Receptor (from centre of road) (m)	Distance to Receptor (from kerbside) (m)	Annual Average Vehicle Flow (veh/hr)	% HDV	Average Speed (km/hr)
1	A803 ROAD THROUGH LINLITHGOW	5	2	1200	10	25
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
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15						
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17						
18						
19						
20						

STEP 2 **ENTER YOUR BACKGROUND CONCENTRATIONS IN THIS SECTION**

THE BACKGROUND CONCENTRATIONS SHOULD BE ADJUSTED FOR THE YEAR YOU ARE ASSESSING
NOTE: use background NO_x and not NO_2
NOTE: use background PM_{10} gravimetric

YEAR ADJUSTED BACKGROUND VALUES			
CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$) gravimetric
-	-	-	**18.00**

REFER TO THE POLLUTANT SPECIFIC GUIDANCE FOR BACKGROUND REDUCTION METHODOLOGY (LAQM TG 4 /00)

RESULTS

RECEPTOR LOCATION= 212 HIGH STREET LINLITHGOW

YEAR OF ASSESSMENT= 2004

	Annual Mean			
	CO (mg/m^3)	BENZENE ($\mu g/m^3$)	NOx ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
CONTRIBUTION FROM ALL ROADS	0.20	1.17	126.39	4.35
BACKGROUND CONTRIBUTION	-	-	-	18.00
TOTAL ANNUAL MEAN CONCENTRATION (INCLUDING BACKGROUND)	#VALUE!	#VALUE!	#VALUE!	22.35

Estimated Pollutant Concentrations for Comparision with the AQO.

CO (mg/m^3)	Maximum 8-hr mean	#VALUE!
BENZENE ($\mu g/m^3$)	Maximum running Annual mean	#VALUE!
Nitrogen Dioxide (NO_2 $\mu g/m^3$)	Annual Mean	#VALUE!
PM_{10} ($\mu g/m^3$)	90th percentile of daily means	40.00

NOTES

1. **The above concentrations are estimated using the methodology described in LAQM.TG4(00).**
2. **The 99.8th percentile of 1-hour mean NO_2 concentrations should be estimated using the method described in para 6.47 of LAQM.TG4(00).**

Therefore, taking cognisance of the above information, West Lothian Council believe that neither the standards or objectives in the Air Quality (Scotland) Regulations 2000 are being exceeded, or are likely to be exceeded in the future, assuming present trends.

The above PM_{10} data was expressed as a 24 hour mean value as opposed to a 24 hour running mean value as laid down in the National Air Quality Strategy standard. However, it is considered valid that if the 24-hour mean value has not been exceeded then neither has the 24-hour running mean.

The above data showed that at the time in question the existing National Air Quality Standard of 50 g/m^3 was not exceeded as the 90^{th} percentile of the running 24-hour mean (35 days/year).

8.14.3 Conclusion

Real time PM_{10} monitoring carried out September 1999 – May 2000 at 212 High Street, Linlithgow indicates that the standards and objectives for PM_{10} are likely to be achieved in West Lothian. It is, however, the intention of West Lothian Council to carry out further monitoring for PM_{10} in busy town centre locations in the future. In addition further modelling using DMRB will be carried out as traffic and monitoring data becomes available.

9.0 First Stage Review and Assessment of Sulphur Dioxide

9.1 Introduction

Sulphur Dioxide (SO_2) is formed by the combination of one atom of sulphur and two atoms of oxygen. At normal temperature and pressure it is a gas. Sulphur dioxide dissolves in water to give an acidic solution which is readily oxidised to sulphuric acid.

Natural sources of sulphur dioxide include volcanic activity and marine organisms.

In the United Kingdom the predominant source of sulphur dioxide is the combustion of sulphur containing fossil fuels, principally coal and heavy oils.

Sulphur dioxide is an irritant when it is inhaled because of its acidic nature, and high concentrations may cause breathing difficulties in people exposed to it. Recent studies have shown that people suffering from asthma may be especially susceptible to the adverse effects of sulphur dioxide and that, within the range of concentrations that occur in pollution episodes, it may provoke attacks of asthma.

9.2 Standard and Objectives for Sulphur Dioxide

The Air Quality (Scotland) Regulations 2000 set the following objectives:-

- **350 micrograms per cubic metre or less, when expressed as an hourly mean, not to be exceeded more than 24 times a year by 31 December 2004**
- **125 micrograms per cubic metre or less, when expressed as a 24 hour mean, not to be exceeded more than 3 times a year by 31 December 2004**
- **266 micrograms per cubic metre or less, when expressed as 15 minute mean, not to be exceeded more than 35 times a year by 31 December 2005**

The Regulations also include limit values for sulphur dioxide for the protection of vegetation and ecosystems. However, these limit values are to be treated as national objectives, against which compliance will be monitored at national level and are thus not considered within this Review and Assessment.

The focus of an authority's review and assessment should be any non-occupational, near ground level, outdoor location given that exposures over 15 minute periods are potentially likely in these locations.

9.3 The National Perspective

For the first half of the twentieth century, emissions of sulphur dioxide were dominated by the combustion of fossil fuels (predominantly coal and fuel oil) in power stations and industry as well as in the domestic sector. This gave rise to the smogs of the 1950s and the associated effects on health.

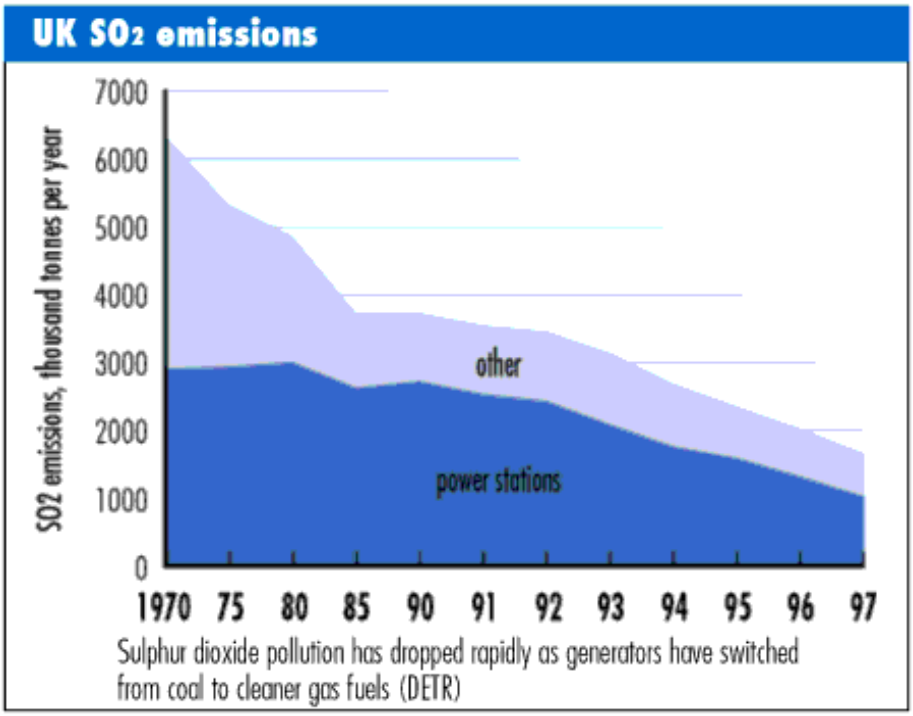
The occurrence of these pollution episodes led to the introduction of the first Clean Air Act in 1956. This and the subsequent moves to the increased use of energy sources such as natural gas and electricity mean that emissions in towns have fallen considerably. Power generation has become concentrated in larger, more efficient stations situated in rural areas.

As a result of the above national emissions of sulphur dioxide have decreased by 63% since 1970, and by 52% since 1980. Urban smogs like those in the 1950s are now a thing of the past and average levels of sulphur dioxide have decreased by around fivefold since the 1960s. Emissions are now dominated by fossil-fuelled power stations which currently account for 65% of the national total. Table 9.1 shows the national inventory of sources for 1996.

Table 9.1 - UK Emissions of SO_2 by Source, 1996 (%)

Source	Percentage Contribution
Power Stations	65
Refineries	6
Domestic	3
Commercial, Public & Agricultural Combustion	3
Iron and Steel	3
Other Industrial Combustion	10
Production Processes	5
Road Transport	2
Other Transport	2
Other	1

Figure 9.1 - SO_2 Emissions



Sulphur dioxide is currently measured nationally through a variety of monitoring networks including the automatic monitoring networks, the smoke and SO_2 network and the rural SO_2 network.

These monitoring networks have indicated a UK wide decline in SO_2 concentrations over the years.

However, it is recognised that exceedences of the standard do occur in the vicinity of industrial processes for which the stack heights were designed to meet previous air quality standards and in areas where significant quantities of coal are used for heating. Further measures than those applicable nationally may be required to achieve the air quantity objective.

In view of this, local authorities subject to the potential for elevated levels of SO_2 from pollution sources, are likely to need to progress to a second or third stage review and assessment for this pollutant.

9.4 Information to be Considered for a First Stage Review and Assessment

For each existing or proposed emissions source, the authority needs to identify those which have the potential, either singly or together, to emit significant quantities of SO_2. Clearly these sources need to be in existence and/or operation in 2004/2005 the prescribed dates in the Regulations[12]. Authorities are also reminded that only those sources which have the potential to cause exposure of the public at **relevant locations** (as described in Chapter 1, paragraph 1.17) need be considered.

To carry out the First Stage review and assessment, the authority should collate the following information:

- details of existing or proposed Part A authorised processes in the authority's area;
- details of existing or proposed Part B authorised processes in the authority's area;
- details of any small combustion plant (5MW thermal) using solid fuels or fuel oil – these are likely to be associated with schools, hospitals, and other large commercial and institutional buildings;
- details of the density of houses burning coal or Solid Smokeless Fuel (if appropriate);
- details of any significant sources of SO_2 in neighbouring areas which could impact within the authority's area (see 7.19).

9.5 Sulphur Dioxide Monitoring in UK

Sulphur dioxide is currently measured nationally through a variety of monitoring networks including the automatic monitoring networks, the smoke and SO_2 network and the rural SO_2 network.

These monitoring networks have indicated a UK wide decline in SO_2 concentrations over the years.

9.6 Sulphur Dioxide Monitoring in West Lothian

In 1964 and 1970 the former Midlothian and West Lothian County Councils considered that it was appropriate to ensure that the future and developing Livingston New Town should be a smoke control area. With two orders in 1964 and two in 1970, the area with two exceptions, namely old Livingston Station (now the Deans Area of Livingston) and the old part of Livingston Village.

A map outlining the smoke control areas and the different phases is attached to this report in Appendix 4. The two exempted areas of old Livingston Station and old Livingston Village have been hatched out in red on the map.

Over the years smoke and SO_2 have been monitored extensively throughout the local area. See Figures 9.2 – 9.12.

In the 1980s the former West Lothian District Council set up 8 port smoke and SO_2 bubbler pollution monitoring stations at various locations throughout the area. 8-port bubblers have been used extensively throughout the UK in order to determine sulphur dioxide concentrations, and whilst their use has declined in recent years the data can still be of use in review and assessment. The bubbler technique is used to measure daily average sulphur dioxide concentrations which can be directly compared against the 24-hour mean objective.

Pollutant specific guidance[11] Chapter 7.29-7.32 advises of a method to relate daily maximum values to 15-minute and one hour objectives. The daily maximum level is the single highest days recorded level in a given year. The method advises that the maximum value be multiplied by 1.25 to allow for inaccuracy in the bubbler method. The relationship for the 1-hour objective 350µg/m^2 advises the maximum daily value be multiplied by 1.25 and be further multiplied by 1.3691.

The relationship for the 15-minute objective (266µg/m^3) advises the maximum daily value be multiplied by 1.25 and be further multiplied by 1.8962.

SO_2 monitoring results for various sites are represented graphically in Figures 9.2 to 9.12.

Figure 9.2 gives an indication of historical monitoring and shows that generally the maximum daily value is below the 125µg/m^3 24-hour mean objective.

Figure 9.2

Sulphur Dioxide Annual Maximum Daily Levels (µg/m^3)
Historical Monitoring (1982-1988)

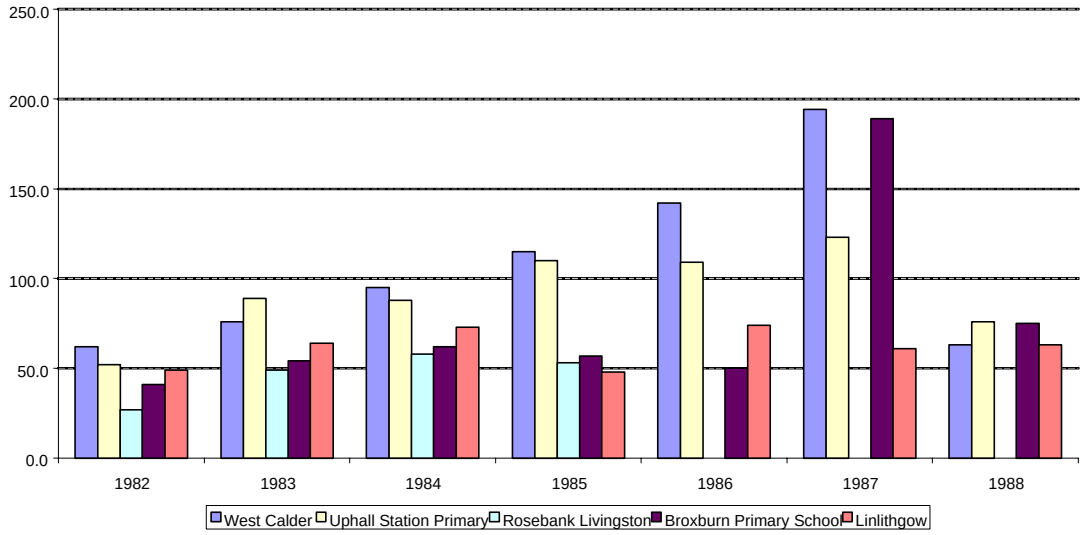


Figure 9.3, 9.4 and 9.5 indicate that the sites in and around Livingston, Whitburn, Linlithgow and Bathgate are likely to meet the objective.

Figure 9.3

Sulphur Dioxide Annual Maximum Daily Levels (µg/m^3)
(Livingston Sites 1989-1998)

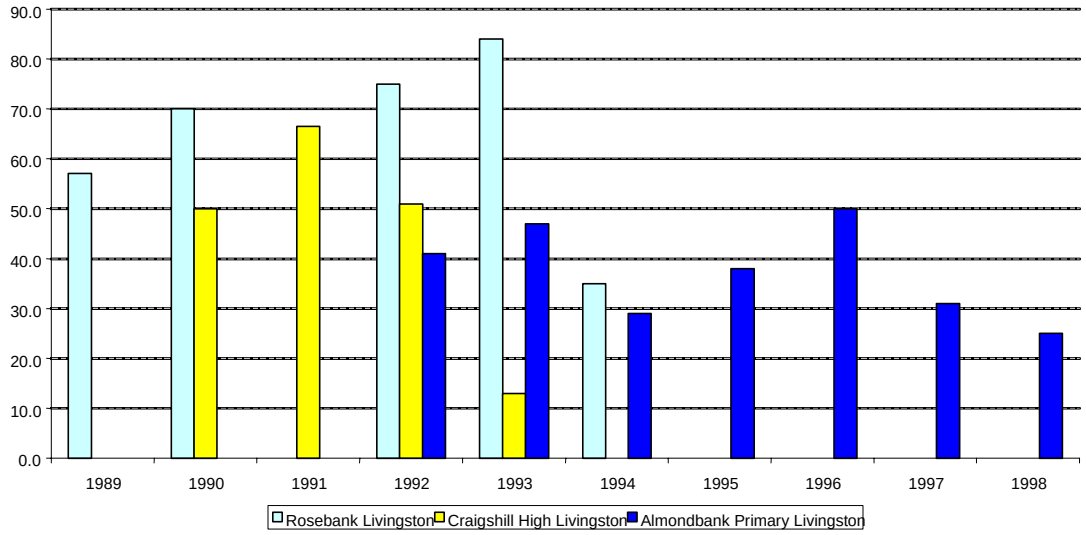


Figure 9.4

Sulphur Dioxide Annual Maximum Daily Levels (µg/m^3)
(Whitburn Sites 1989-1999)

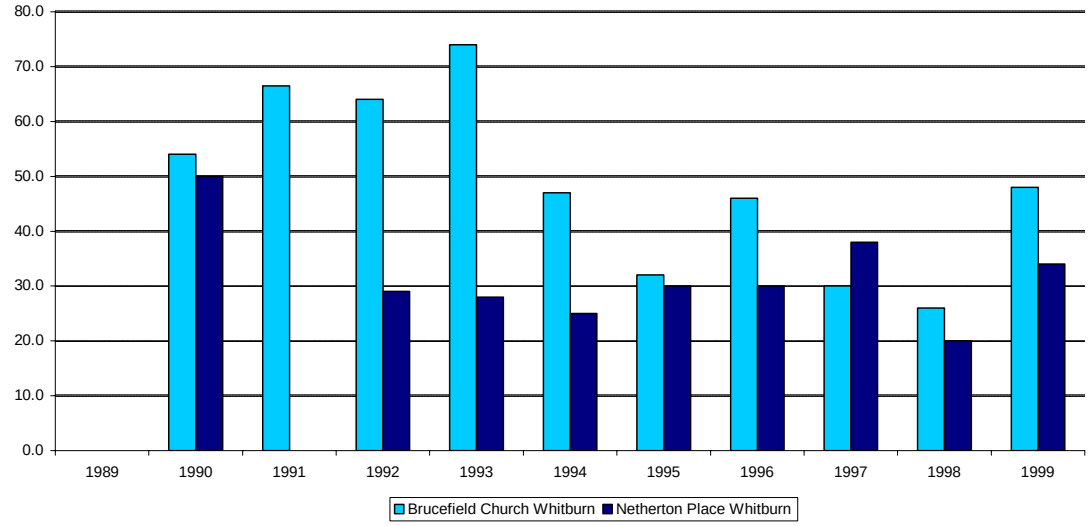
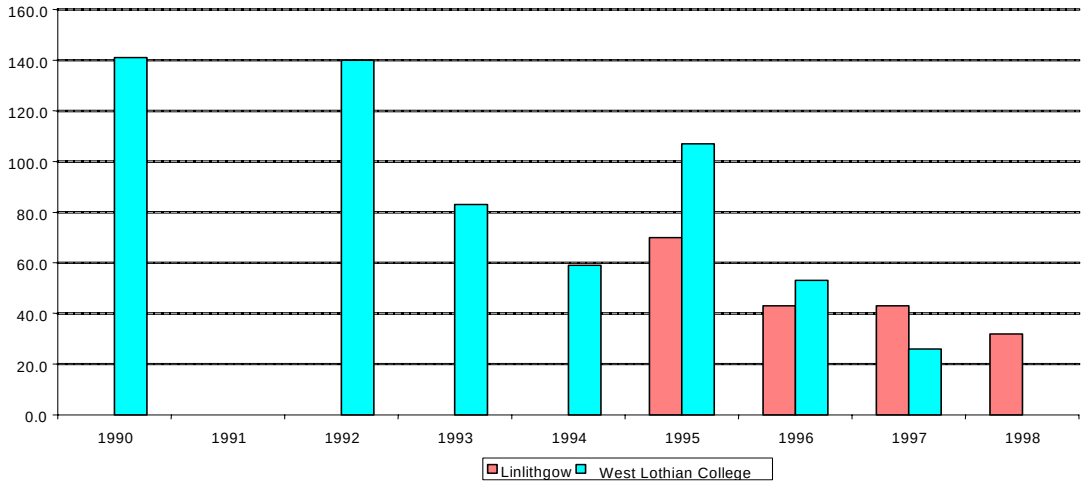


Figure 9.5

Sulphur Dioxide Annual Maximum Daily Levels (µg/m^3)
(Linlithgow and Bathgate Sites 1989-1999)



During the 70s and 80s a number of the Council's monitoring stations were part of the national survey of smoke and sulphur dioxide. These were taken out of the national network in the late eighties, however West Lothian Council has continued to operate these stations independently.

In 1994 a review indicated that due to the smoke control programme and trends in fuel use over the years, smoke pollution from area sources was no longer a problem in West Lothian. However, the monitors continued to detect some short duration elevated levels of SO_2. It was noted that these pollution episodes originated from industrial sources. The main elevated levels identified were around Atlas Cottages, Armadale. The results from readings taken at monitoring stations in this area were at risk of exceeding the EEC limit values, although no actual exceedences occurred. This was due to both the topography in the area and the local sources of pollution mainly Caradale Brickworks (formerly known as GISCOL Brickworks).

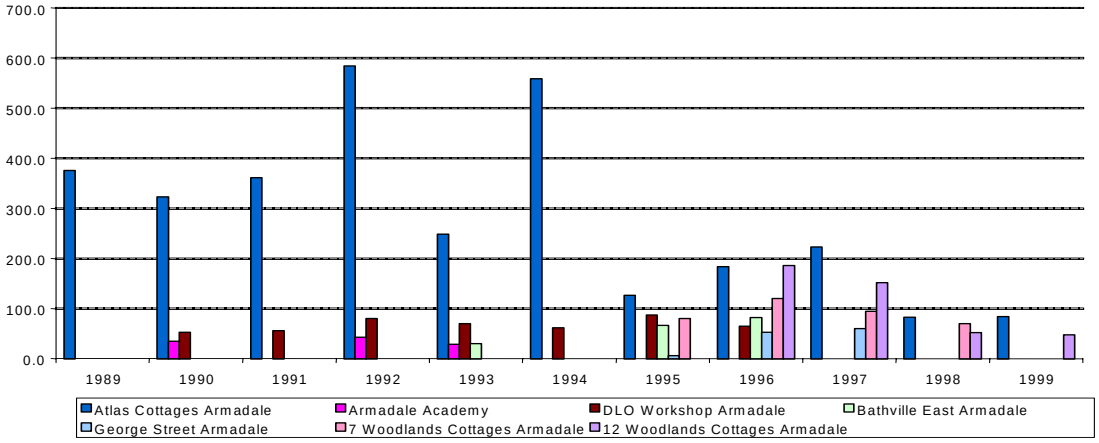
Current monitoring data and some historical monitoring data is available for nearly every town in the area and there is no indication from these results that the air quality standard is likely to be breached even around local industrial sources.

West Lothian Council set up 4 bubbler sites in Armadale surrounding the Caradale Brickworks (4 Atlas Cottages, 7 Woodlands Cottages, 12 Woodlands Cottages and Bathville East). The results for the sites over the period 1989-1999 are shown in Figure 9.6.

The figure highlights the historical problem at Atlas Cottages 1989 to 1997 and the improvement since then.

Figure 9.6

Sulphur Dioxide Annual Maximum Daily Levels (µg/m^3)
(Armadale Sites 1989-1999)



There are occasional episodes of elevated SO_2 concentrations. The wind direction data assists the identification of possible sources. Levels of SO_2 within the West Lothian area are generally low with the exception of Atlas Cottages, Armadale and the annual mean results reflect this (Figs 9.7 to 9.12). The results for Atlas Cottages have generally improved over the years, mainly as a result of reducing SO_2 emissions from Caradale Brickwork, as source control and management practices have been implemented or improved at the works (see Section 9.11).

Figure 9.7

Sulphur Dioxide Annual Mean Levels (µg/m^3)
(Armadale Sites 1989-1999)

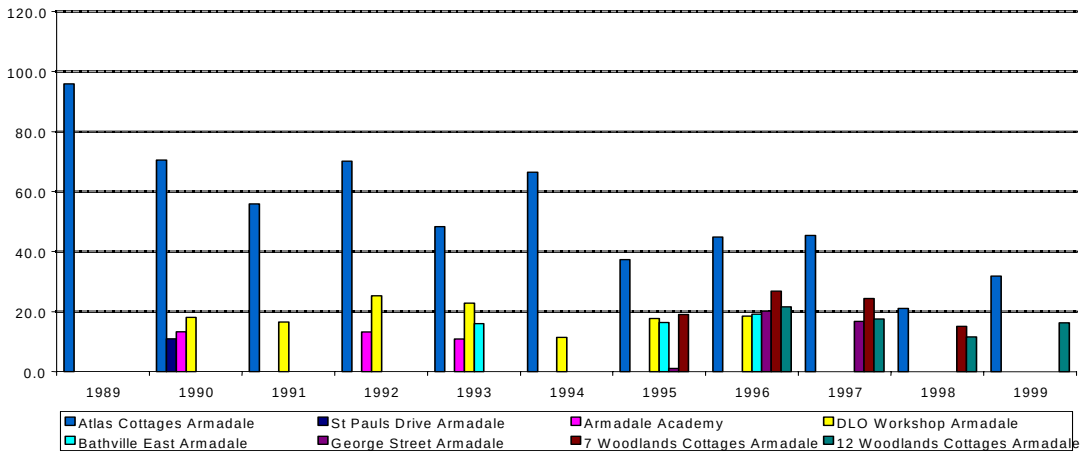


Figure 9.8

Sulphur Dioxide Annual Mean Levels (µg/m^3)
Historical Monitoring (1982-1988)

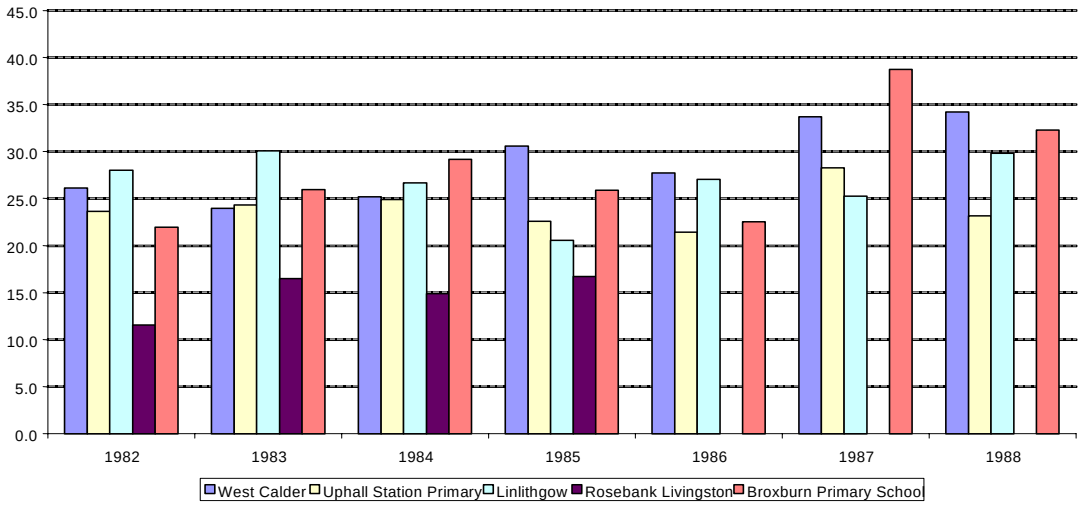


Figure 9.9

Sulphur Dioxide Annual Mean Levels (µg/m^3)
(Livingston Sites 1989-1999)

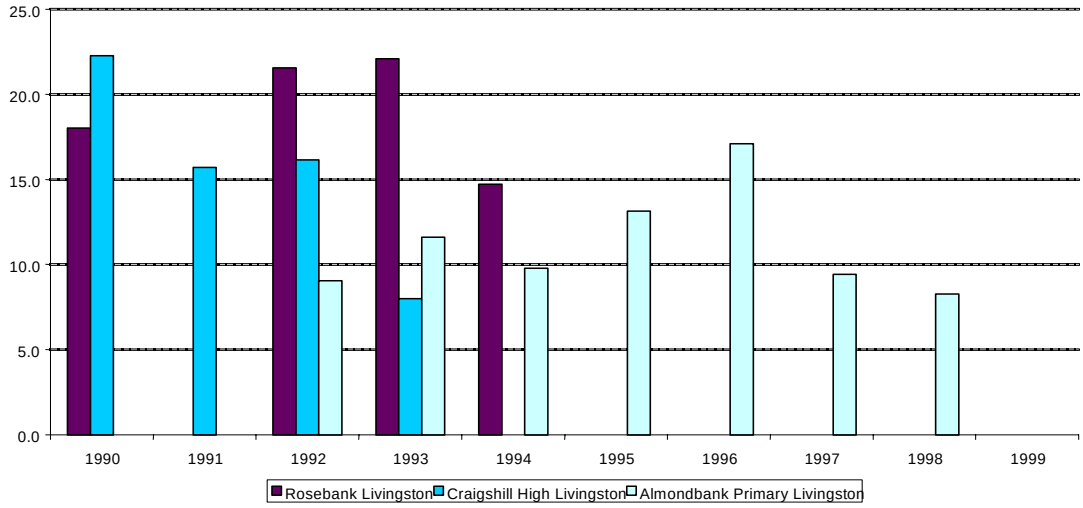


Figure 9.10
Sulphur Dioxide Annual Mean Levels (µg/m^3)
(Whitburn Sites 1990-1999)

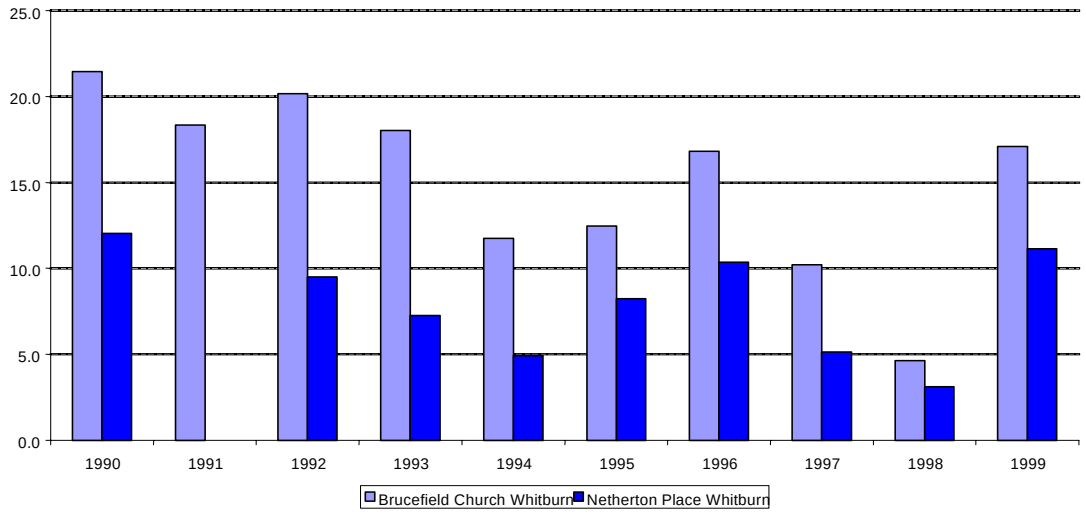


Figure 9.11

Sulphur Dioxide Annual Mean Levels (µg/m^3)
(Linlithgow and Bathgate 1990-1998)

As part of the Stage 1 Review and Assessment the following information was collected from SEPA with regard to the SO_2 stack emission concentrations from Caradale Brickworks.

These were as follows:-

January 2000 SO_2 = 144.8 µg/m^3 (monitoring by SEPA both the Hoffmann and the intermittent kiln were operational at this time)

October 1998 SO_2 = 46.0 µg/m^3

Average emission rate from the 43 m high chimney was 68,486 m^3/hour In January 2000

Mass emission rate:-

SO_2 = 9916.8 g/hr (based on 144.8 µg/m^3 x 68,486/hour).

Since the process operates continuously, we can roughly estimate the annual mass emissions of particulate matter as follows:-

$9916.8 \times 24 \times 7 \times 52 \times 10^{-6}$ = 86.6 tonnes per annum.

Estimated annual mass emissions of sulphur dioxide from this process are therefore well below the quantity expected to give rise to a 99.9th percentile 15 minute ground level mean concentration of 53.2 µg/m^3 [11].

Although there are residential properties within about 100 metres and a history of complaints from the site, the process uses only low sulphur clay and emission concentrations are low. This indicates that there is no significant risk that emissions of SO_2 from this process will fail to meet the objective.

9.7 Part A and Part B Authorised Processes

The review of authorised processes in accordance with the guidance identified no Part A processes which had the potential to emit significant quantities of SO_2 and two Part B processes, namely Caradale Traditional Brick, Armadale and Premier Refactories, Linlithgow (See Appendix 1 for location maps).

Consultation with SEPA indicated that Part B processes are generally complying with their authorisation and emissions limits and it is unlikely that they would cause an exceedence of the air quality objectives.

The monitoring of SO_2, both historically and currently, throughout the area has indicated that only one of the industrial sources has caused an exceedence of the standard ie Caradale Brickworks, Armadale (see section 9.11).

9.8 Combustion Sources Greater than 5 MW

In order to identify combustion systems greater than 5 MW which use solid fuel or fuel oil the following work was undertaken:-

- Consultation with SEPA.
- Consultation with other Council Departments (property owning departments)
- Consultation with Health Board
- Check of historical chimney height applications.

This information search provided the following information:-

There are no Council properties which have combustion systems with a thermal power rating greater than 5 MW. However there are a significant number of primary and secondary schools which have coal fired plant less than 5MW - 26 in total. There is a planned programme of boiler replacement, however a lack of funding has delayed this programme. There are no Health Board properties which have combustion systems greater than 5 MW. SEPA was unaware of any such processes. Chimney height applications are all processed by the Environmental Health Service Unit. Any boilers which have combustion systems greater than 5MW would be identified.

9.9 Future Developments and Neighbouring Sources

There are no known planned developments within West Lothian which will be a significant source of SO_2.

Having consulted Falkirk Council and having assessed modelling outputs of pollutants from Grangemouth and Longannet West Lothian Council is satisfied that there are no sources within neighbouring local authorities which could impact significantly on air quality within West Lothian. The prevailing winds are mainly from the south west (see 2.9) taking the pollution from these sources beyond the West Lothian boundary.

9.10 Conclusions for Stage 1

The smoke control programme undertaken by West Lothian County Council and Midlothian County Council has ensured reduced sulphur dioxide levels in the Livingston and surrounding area. The extensive historical and existing monitoring programme for SO_2 in West Lothian has covered every urban area and results that indicate that the air quality standard is currently being met with the exception of historical exceedences at Caradale Brickworks in Armadale. There is no need to progress to a second stage review and assessment for sulphur dioxide other than the aforementioned site in Armadale.

9.11 STAGE 2 : Sulphur Dioxide

Background

For the purpose of the Stage One Review and Assessment substantial historical ambient air quality monitoring data was available for sulphur dioxide within West Lothian. Sources of data consisted of 24 of which four are part of the National UK Smoke and Sulphur Dioxide Monitoring Network. (Table 9.2)

Table 9.2 - Smoke / SO_2 Monitoring Sites Within the National Network

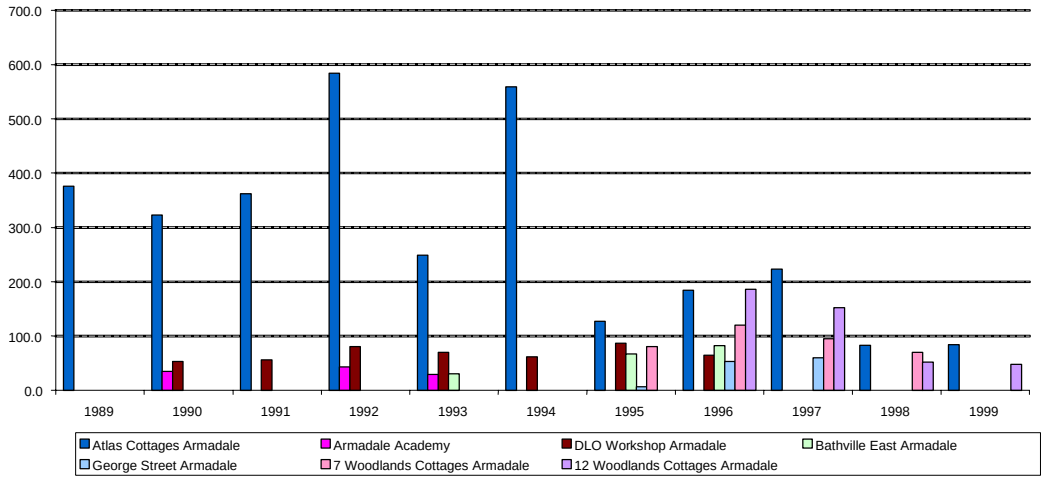
Site	Address
Armadale 2	**4 Atlas Cottages**
Armadale 3	**Town Centre, Armadale**
Whitburn 3	**Brucefield Church (town centre), Whitburn**
Livingston 1	**Almondbank Primary School, Craigshill, Livingston**

The Stage One Review and Assessment identified the Caradale Brickworks in Armadale as the point source most likely to require further review and assessment, due to some high maximum annual daily concentrations monitored at Atlas Cottages. To monitor further the emissions from Caradale, 4 monitoring stations in total were established around the brickwork site (Table 9.3).

Table 9.3 - Smoke / SO_2 Monitoring Sites Around Caradale Brickworks

Site
4 Atlas Cottages
7 Woodland Cottages
12 Woodland Cottages
Bathville East

Figure 9.6
Sulphur Dioxide Annual Maximum Daily Levels (µg/m3)
(Armadale Sites 1989-1999)



- **Part of National UK Smoke and Sulphur Dioxide Monitoring Network**

The two sites located in Almondbank, Livingston and Brucefield Church, Whitburn, which are part of the National UK Smoke and Sulphur Dioxide Monitoring Network, showed annual mean (1990 to 1998) within the range of 16-34µg/m^3.

The third monitoring site, located at Armadale 3 (DLO Workshop) and George Street (town centre), it should be noted that both these sites have the same geographical reference, showed annual mean (1990 to 1997) within the range of 11-25 µg/m^3.

The fourth monitoring site, located at Armadale 2 (Atlas Cottages), recorded higher levels of sulphur dioxide (1989 to 2000), with the annual mean ranging from 21-96 µg/m^3. It was not possible to obtain 15 minute mean readings, however, extrapolation of the daily data indicated the National Air Quality Strategy standard of 100 ppb (expressed as a 15 minute mean) would have been exceeded. This higher level was due to the close proximity to local industrial processes.

As an indication of the general trend in SO_2 it is useful to note that ambient air quality data for sulphur dioxide was also made available by Edinburgh Medical School for the Edinburgh Centre Continuous Monitoring Site. It was apparent from this data that the 15-minute mean value for sulphur dioxide has decreased nationally each year from 1993 to 1997. Additionally, it was noted that since 1994 levels have been below the National Air Quality Strategy standard of 266 µg/m^3 (expressed as a 15 minute mean).

The report also identified no Part A and two Part B processes within West Lothian which are potentially significant sources of sulphur dioxide.

Consequently, it was considered, necessary to carry out further investigation and monitoring, thus undertaking a Stage 2 Review and Assessment for this pollutant.

9.11.1 Monitoring Strategy

For the purpose of the Stage Two Review and Assessment West Lothian Council devised and carried out a monitoring strategy the aim of which is to provide further screening of sulphur dioxide concentrations within the district. The position and number of monitoring locations were selected on the basis of local knowledge and the findings of the Stage 1 Review and Assessment carried out by the Council.

Additionally, in devising the monitoring strategy West Lothian Council has taken cognisance of relevant technical guidance issued by the Scottish Executive and the Department of Environment, Transport and Regions. Cognisance has also been taken of comments, pertaining to West Lothian Council's Stage One Review and Assessment, made by statutory consultees, in terms of Schedule 11 of the Environment Act, 1995.

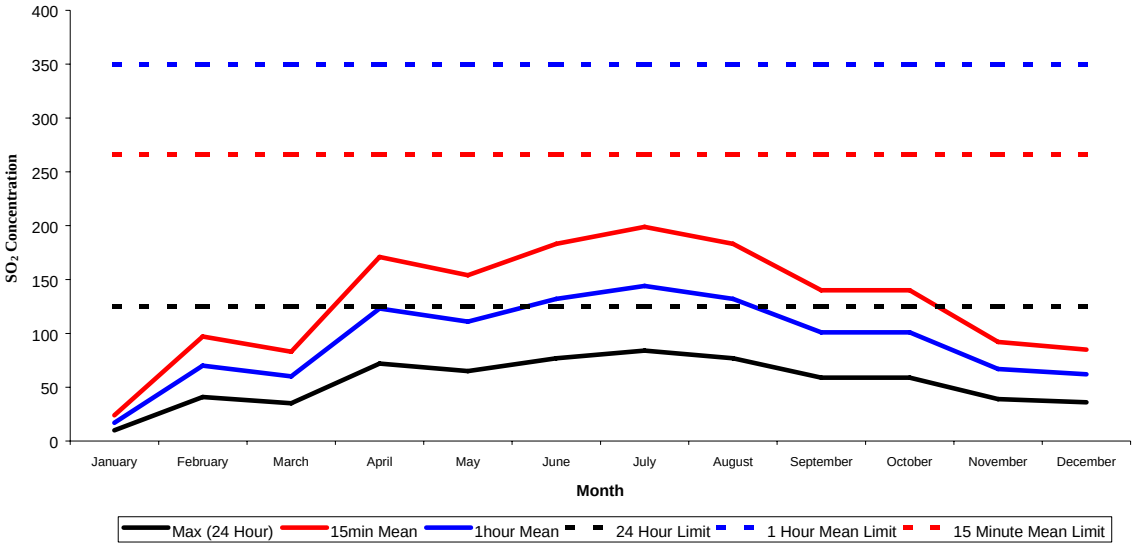
As previously stated, West Lothian Council utilised monitoring data, for sulphur dioxide, from several existing sites (figures 9.2-9.12) for the purpose of the Stage One Review and Assessment. Four of these sites are part of the National UK Smoke and Sulphur Dioxide Monitoring Network (Table 9.2). Although it is not possible to obtain 15-minute mean readings, subsequent monitoring data from these sites are assessed for the purpose of this report.

The historical bubbler data from 4 Atlas Cottages, 7 Woodlands Cottages and 12 Woodlands Cottages when studied in conjunction with wind directions strongly indicate that Caradale Brickworks (formerly GISCOL) was the source of the local SO_2 pollution.

Bubbler data is available from 1989 till the present for Atlas Cottages. A vast improvement can be seen from the measured data for both annual mean levels and annual daily maximum levels (see Armadale graphs (Figures 9.6 and 9.7)) + 1999 graph showing maximum 24-hour, 15-minute and 1-hour mean figures. (Figure 9.12)

Figure 9.12

Atlas Cottages (8 Port) Sulphur Dioxide Monthly Maximum Levels ($\mu g/m^3$) 1999



LAQM.TG4(00)[11] (7.29-7.32) Pollutant Specific Guidance Advises of the relationship between the Annual Maximum Daily SO_2 values as measured using the Bubbler method and both the 15 minute mean objective of 266 $\mu g/m^3$ and the 1 hour objective of 350 $\mu g/m^3$. The maximum annual daily concentrations for the bubbler sites around Caradale Brickworks, Armadale from 1989 – 1997 exceeded the 24-hour mean standard of 125$\mu g/m^3$.

West Lothian Council, taking cognisance of the need to progress to a Stage Two Review and Assessment for this pollutant, consequently purchased an automatic real time monitor for the monitoring of sulphur dioxide. The said monitor, came into operation in 1996 and was sited temporarily at Atlas Cottages for a six month period before being located within the Council's mobile air quality station.

Since 1996 four separate surveys have been undertaken at sites around Caradale Brickworks. The first in 1996-97 was carried out by West Lothian District Council using a thermo Environmental Instruments model 43C SO_2 analyser. This was fitted with an internal data logger and programmed to record 15 minute SO_2 averages. The background concentration at Atlas Cottages were typically below 5 ppb (13 $\mu g/m^3$). However, a number sporadic elevated concentrations were over 266 $\mu g/m^3$ (100 ppb) 15-minute mean standards.

In the period 18 September 1996 to 19 February 97 SEPA carried out a survey of SO_2 concentrations at 5 sites around Caradale Brickworks. A 24-hour mean notional standard of 120 µg/m^3 (this compares to the current standard of 125 µg/m^3) was adopted and the bubbler method used. During the monitoring period the standard was exceeded on 3 occasions, on two occasions at 4 Atlas Cottages and the other at 7 Woodlands Cottages. These samples were taken on days the locations were downwind of GISCOL.

A further SEPA survey from 9 April 1998 to 19 August 1998 was carried out with the same type of automatic real time analyser mentioned above. The standard adopted for this report was the EPAQs recommended one of 100 ppb (266 µg/m^3) measured as a 15 minute mean. The analyser was in operation at 4 Atlas Cottages for a period of 118 days and the 15 minute sampling periods could be related directly to the EPAQs standard of 100 ppb (266 µg/m^3).

The measured levels over the period ranged from 0 to a peak of 97.5 ppb (0-259 µg/m^3). The 100 ppb (266 µg/m^3) standard was not exceeded over this period. Again, however, sporadic elevated concentrations with respect to background levels were detected for relatively short periods.

From March to June 1999 SEPA carried out a survey using sites upwind and downwind using the same type real time analysers at same sites. Analysis of recorded SO_2 levels in conjunction with wind direction data again indicated that the Caradale Brickworks was the source of the elevated SO_2 concentrations. The standard adopted was the NAQs standard of 100 ppb (266 µg/m^3) expressed as a 15-minute mean. The background concentrations at both sites were typically below 5 ppb (13 µg/m^3). However, a number of sporadic elevated concentrations were again detected at 4 Atlas Cottages. The period saw only one exceedence of the 100 ppb (266 µg/m^3) standard recorded on 23 May 1999 for 30 minutes before falling rapidly. It should be noted that the objective, when expressed as a 15 minute mean, specified in the Air Quality (Scotland) Regulations 2000 is 266 µg/m^3 (100ppb) or less, not to be exceeded more than 35 times a year by 31 December 2005. Following investigation of these sporadic elevated levels SEPA have concluded that the episodes have resulted from a variety of factors including: plant maintenance; process design; plant/equipment malfunction; management supervision and process operator training.

The multi-agency Caradale Environmental Liaison Group met on various occasions between November 1996 and February 1999. Local residents and Armadale Community Council were represented at the Group, as was Caradale Bricks Management. During the lifetime of the Group various air quality issues were highlighted by local residents and discussed in collaboration with SEPA and the Council. The works management responded to the issues raised. The operation of the works is authorised by SEPA as a Part B process and is discussed at 4 monthly West Lothian Council/SEPA Liaison Group meetings.

With continued improvement in these areas, both SEPA and West Lothian Council are satisfied that emissions from Caradale are unlikely to exceed the objectives in the Air Quality (Scotland) Regulations 2000.

The Stage One Review and Assessment identified no Part A processes and two Part B processes which are potentially significant sources of sulphur dioxide. One of these processes was the Caradale Brickworks discussed above.

Further consultation with SEPA has confirmed that emissions of sulphur dioxide from the other Part B process identified at the Stage 1 Review are not significant.

Therefore taking cognisance of the above information West Lothian Council believe that the objectives in the Air Quality (Scotland) Regulations 2000 are likely to be met, assuming present trends.

There is no need to proceed to a third stage review and assessment for sulphur dioxide.

10.0 Conclusions and Recommendations

10.1 Conclusions for Benzene

10.1.1 There is no significant industrial source of benzene located either within West Lothian or neighbouring areas which is likely to adversely affect air quality in West Lothian.

10.1.2 Monitoring has indicated that roadside levels of benzene within West Lothian comply with the standard.

10.1.3 There is no need to proceed to a second stage review for benzene.

10.2 Conclusions for 1,3 –Butadiene

10.2.1 There is no significant industrial source of 1,3 –Butadiene located either within West Lothian or neighbouring areas which is likely to adversely affect air quality on West Lothian.

10.2.2 Monitoring has indicated that roadside levels of 1,3 –Butadiene within West Lothian comply with the standard.

10.2.3 There is no need to proceed to a second stage review for 1,3 –Butadiene.

10.3 Conclusions for Carbon Monoxide

10.3.1 There is no significant carbon monoxide source, either from industry or road transport, located either within West Lothian or neighbouring areas which is likely to adversely affect air quality in West Lothian.

10.3.2 Real time monitoring has indicated that roadside levels of carbon monoxide within West Lothian are likely to comply with the objective.

10.3.3 There is no need to proceed to a third stage review for Carbon Monoxide.

10.4 Conclusions for Lead

10.4.1 There is no significant industrial source of lead located either within West Lothian or neighbouring areas which is likely to adversely affect air quality in West Lothian.

10.4.2 There is no need to proceed to a second stage review for lead.

10.5 Conclusions for Nitrogen Dioxide

10.5.1 Three part A processes, two part B processes and concerns regarding traffic problems in town centre areas were identified in the stage 1 report as requiring further review and assessment of Nitrogen Dioxide in West Lothian.

10.5.2 It was considered necessary to proceed to a Stage 2 review and assessment.

10.5.3 Ambient air quality monitoring for nitrogen dioxide in West Lothian and consultation with SEPA has indicated that there have been no exceedences of the standard due to industrial processes.

10.5.4 Real time monitoring and use of the Design Manual for Roads and Bridges spreadsheet has indicated that roadside levels of nitrogen dioxide within West Lothian are likely to comply with the objective.

10.5.5 There is no need to proceed to a third stage review for nitrogen dioxide.

10.6 Conclusions for PM_{10}

10.6.1 There is no significant industrial source of PM_{10} either within West Lothian or neighbouring areas with the potential for exposure of individuals in the relevant location as described in Section 1.17 of TG4(00).

10.6.2 The estimated annual average regional background level due to secondary particulates is less than 8µg/m^3.

10.6.3 Due to a lack of traffic information and monitoring data, it was considered necessary to proceed to a second stage review and assessment for PM_{10} using the High Street, Linlithgow as a worst case.

10.6.4 Real time monitoring and use of the Design Manual for Roads and Bridges spreadsheet has indicated that roadside levels of PM_{10} within West Lothian are likely to comply with the objective.

10.6.5 There is no need to proceed to a third stage review for PM_{10}.

10.7 Conclusions for Sulphur Dioxide

10.7.1 The formation of smoke control areas in Livingston has ensured low background levels of SO_2 in the most populated area in the District.

10.7.2 The extensive historical monitoring programme for SO_2 in West Lothian has covered every urban area. Results indicate the air quality standards have been met at Stage 1 with the exception of a historical localised problem at Caradale Brickworks in Armadale.

10.7.3 It was considered necessary to proceed to a second stage review and assessment for the localised SO_2 emission at Caradale Brickworks Armadale.

10.7.4 Further monitoring has indicated that emissions from Caradale are unlikely to result in exceedence of the objective.

10.7.5 There is no need to proceed to a third stage review and assessment for sulphur dioxide.

10.8 Conclusion for West Lothian's First and Second Stage Review and Assessment

In West Lothian the first and second stage review and assessment has found that the air quality objectives as prescribed by the Air Quality (Scotland) Regulations 2000 for the 7 specified pollutants namely benzene, 1,3 –butadiene, carbon monoxide, lead, nitrogen dioxide, PM_{10} and sulphur dioxide are all likely to be achieved.

Recommendations

1. Although a formal stage 3 review and assessment of air quality in terms of part IV of the Environment Act is not necessary it is recommended that the current air quality monitoring work in West Lothian be continued. This will provide data to indicate compliance with the objectives and will be essential for any further review and assessment of air quality.

2. It is recommend that the mobile air quality monitoring unit (Groundhog) be moved around West Lothian with the next most likely sites being the Steelyard, Bathgate and an area near Whitburn Cross (to be confirmed).

3. A web site will be established, which will allow the public to access Air Quality Data directly from the mobile air quality monitoring unit. Access to this data is currently available meanwhile via the air quality net web site on the Internet at www.air-quality.net. It is recommended that the public be made aware of the existence of this site and the Department of the Environment, Transport and the Regions own website www/environment.detr.gov.uk/airq/aqinfo.htm.

4. It is recommended that the Air Quality Forum and the West Lothian Council/SEPA Liaison Group continue to meet and exchange information.

5. It is recommended that an annual update report is presented to the Environmental and Protective Services Committee to keep members and the public up to date with the state of Air Quality in West Lothian.

6. It is recommended that in addition to making this report available to the statutory consultees that it is also made widely available to the public in West Lothian, including at Customer Information Points and Libraries.

11. References

1. Air Quality Meeting the Challenge. 1995 The Government's Strategic Policies for Air Quality Management.

2. The United Kingdom National Air Quality Strategy March 1997.

3. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. January 2000, The Department of Environment, Transport and The Regions, The Scottish Executive, The National Assembly for Wales and The Department of the Environment in Northern Ireland.

4. LAQM.G1(00) Framework for review and assessment of air quality.

5. LAQMG2(00) Developing local air quality strategies and action plans: the principal considerations.

6. LAQM.G3(00) Air quality and transport.

7. LAQM.G4(00) Air quality and land use planning.

8. LAQM.TG1(00) Review and assessment monitoring air quality.

9. LAQM.TG2(00) Review and assessment estimating emissions.

10. LAQM.TG3(00) Review and assessment selection and use of dispersion models.

11. LAQM.TG4(00) Review and assessment: pollutant specific guidance.

12. Air Quality (Scotland) Regulations 2000.

13. Department of the Environment, Transport and the Regions Environment Circular 15/97.

14. Environmental Protection Act 1990.

15. Pollution Prevention and Control Act 1999.

16. Department of the Environment, Transport and the Regions (1999), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality.

17. Netcen Website www.aeat.co.uk/netcen/airqual/.