Air Quality
Progress Report

City of Edinburgh Council
Environmental and Consumer Services Department

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Executive Summary

Local authorities are required under Part IV of the Environment Act to periodically review and assess air quality within their areas. A number of pollutants require to be assessed against prescribed air quality objectives (targets).

The review and assessment timetable is based on a three year cycle, Updating and Screening Assessments are required every three years, 2003, 2006 and 2009. If an air quality objective is likely to be exceeded, further work is required in the form of a Detailed Assessment. In the intervening years between subsequent rounds of reviews and assessments local authorities must prepare a Progress Report. For local authorities which undertook a Detailed Assessment in 2004 such as Edinburgh, the first Progress Report is required in 2005.

The Progress Report for the City of Edinburgh Council contains the latest monitoring results, an assessment of data trends and an outline of developments which may effect future air quality in the city. This document has been produced in accordance with published government guidance, Progress Report Guidance LAQM. PRG (03) and Technical Guidance LAQM TG (03).

The monitoring results show that benzene, carbon monoxide, sulphur dioxide and particles (PM_{10}) meet with their respective air quality objectives. The objective for the annual mean concentration of nitrogen dioxide continues to be exceeded at a number of hotspots within the Air Quality Management Area (AQMA) and at St Johns Road/Clermiston Road junction. The existing AQMA will require to be extended to cover this area of concern as discussed in the Council's earlier Detailed Assessment Report. Diffusion tube monitoring outside the AQMA indicates possible exceedences of the nitrogen dioxide annual mean at Great Junction Street and West Port. The report recommends that the Council proceed to a Detailed Assessment at these two locations. All other diffusion tube-monitoring sites meet with the objectives.

The monitoring locations which are outside the AQMA show a downward trend for nitrogen dioxide apart from Dundas Street where there is no change. Monitoring locations within the AQMA show varying trends. An upward trend is observed at West Maitland Street and Princes Street whereas the trend is downward at Queen Street and Leith Walk indicating that nitrogen dioxide concentrations within the AQMA have increased at some locations and decreased at others. Four out of the eleven sites show an increase in levels, four a decrease and three remain the same.

It is uncertain that the downward trend of nitrogen dioxide concentrations in Edinburgh will mirror the national trend, due to the proposed number of large-scale residential and commercial developments in the city.

Leith Dock Development Framework (LDDF) together with the committed development along the Forth Estuary (Waterfront) may result in the worsening of air quality in the Leith area and the possible designation of further AQMAs. The problem areas are likely to be in the canyon type streets which are typical of 'Old Leith'. The scale of the development may adversely effect the existing AQMA.

1.0 Introduction

Part IV of the Environment Act 1995 requires local authorities to periodically review and assess air quality within their areas. The following pollutants require to be assessed against air quality objectives, which have been prescribed in regulations and set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland. [1]

1,3-butadiene	Sulphur dioxide
Benzene	Nitrogen dioxide
Carbon monoxide	Particles PM_{10}
Lead	

At locations where a pollutant is likely to exceed an air quality objective, local authorities must declare an Air Quality Management Area. (AQMA) and produce an Action Plan. The Action Plan should contain measures that are required to improve local air quality. This process is known as Local Air Quality Management (LAQM).

Most local authorities have completed the first and second round of review and assessment work. The second round and future review and assessment rounds is a two-stage process. Initially, local authorities are required to undertake an Updating and Screening Assessment (U&SA) with respect to the aforementioned pollutants; where potential exceedences are identified they must proceed to a Detailed Assessment (DA). This assessment involves undertaking further work to provide assurance that an exceedence will definitely occur and ultimately whether or not an AQMA or amendments to existing AQMAs are required.

The evaluation of the first round of LAQM recommended that local authorities should prepare an annual air quality Progress Report in the intervening years between subsequent rounds of review and assessment work. Updating and Screening Assessments are required every three years, 2003, 2006 and 2009. Those local authorities that carried out a Detailed Assessment in 2004 are required to produce their first Progress Report in 2005.

The overall objective of a Progress Report is to ensure continuity of the LAQM process and maintain its profile within the local authority. Progress Reports should focus on the following key areas:

- report on new monitoring data
- assessment of data trends
- identify any developments that may effect air quality.

This report has been produced in accordance with government guidance documents Progress report Guidance LAQM. PRG (03) and Technical Guidance LAQM. TG(03).

1 Air Quality (Scotland) Regulations 2000 and the Air Quality (Scotland) Amendment Regulations 2002

1.1 LAQM Summary for City of Edinburgh Council

Round 1

- The pollutants Particles (PM_{10}), 1,3-butadiene, benzene, lead, carbon dioxide and sulphur dioxide meet with their respective air quality objectives.

- The annual average nitrogen dioxide air quality objective is likely to be exceeded at a number of city centre locations, Queen Street, Princes Street, West Maitland Street, George Street, Leith Walk, North Bridge, Roseburn Terrace and Gorgie Road.

- Areas where exceedences occur are due to road traffic emissions and the majority are at or close to busy junctions.

- A single AQMA was declared for the city centre in 2000 as detailed in appendix 8 map 1.

- Further work undertaken for Stage 4 identified that buses are responsible for the majority of NO_X emissions within the AQMA.

- The Council's Air Quality Action Plan was produced and approved in July 2003.

Round 2

- The U&SA report was completed in July 2003 and concluded that a DA was necessary city-wide for Particles (PM_{10}) due to high background levels and a significant tightening of the air quality objectives for Scotland. The annual average nitrogen dioxide objective is also likely to be exceeded at St Johns Road Corstorphine, due to traffic emissions.

- The pollutants, 1,3-butadiene, benzene, lead, carbon dioxide and sulphur dioxide meet with the air quality objectives.

- The DA report was completed in December 2004 and concluded that Edinburgh is likely to meet with the more onerous air quality objectives for $PM_{10.}$ The additional assessment work at St Johns Road/Clermiston Road, Corstorphine has shown that there is likely to be a risk of exceeding the annual average nitrogen dioxide target on the westbound side of the road. Therefore the existing AQMA will require to be extended to cover this area of concern.

- The proposed extension of the existing AQMA is shown in appendix 8 map 2.

The findings of the DA report have been accepted by the University of West of England, Scottish Executive (SE) and the Scottish Environment Protection Agency (SEPA).

Details of the Council's air quality reviews and assessments are contained in the following reports:

Round 1 LAQM

Review and Assessment of Air Quality in the City of Edinburgh Stage1 and 2 (1999)

City of Edinburgh Council Review and Assessment of Air Quality Stage 3 (2000)

City of Edinburgh Council Review and Assessment of Air Quality Stage 4 (2002)

Round 2 LAQM

City of Edinburgh Council Updating and Screening Assessment
Local Air Quality Management Phase 2 (2003)

City of Edinburgh Council Action Plan (2003)

City of Edinburgh Council Detailed Assessment Report (2004)

Stage 3 and 4, the Updating and Screening Assessment and The Action Plan can be viewed on the Council's web page:

www.edinburgh.gov.uk/airquality

2.0 Monitoring

This section contains a summary of new data gathered since the U&SA and the DA reports were completed. Monitoring is undertaken throughout the city using automated continuous real time analysers and nitrogen dioxide passive diffusion tubes. At locations where sufficient annual data has been collected (minimum 6 years) data trends have been assessed. The trend plots are shown in section 3.0 of this report.

2.1 Description and location of automated monitoring sites

Edinburgh currently operates five automated (real-time) monitoring stations which measure nitrogen dioxide and PM_{10} and one station which measures nitrogen dioxide. One of the locations is a background site located on the outskirts of the city. Four of the sites are roadside locations and one an urban centre. The latter is part of the national network and also monitors carbon monoxide, sulphur dioxide and ozone. The background site also measures carbon monoxide, sulphur dioxide and ozone.

The monitoring station which measures benzene and 1-3 butadiene is part of the hydrocarbon national network. Monitoring of the latter pollutant ceased in 2001, due to the concentrations being well below the objective.

West Richmond Street Gardens (Edinburgh St Leonards)

A new location for the national network site was established at West Richmond Street Gardens (Edinburgh St Leonards). Department for Environment, Food and Rural Affairs (Defra) commissioned the site in January 2004. It is south of the city centre, located in a small car park of a Medical Centre (GP surgery) surrounded by residential properties and 45 metres from a busy road. It is described as an urban centre.
The following pollutants are monitored:
Nitrogen dioxide, PM_{10}, sulphur dioxide, carbon monoxide and ozone.

OS Reference 326265 : 673129

Haymarket Terrace

The air quality monitoring station at Haymarket Terrace is located in a car parking area of Haymarket Station. The unit is line with the façade of adjacent residential tenement property and is 5.5 metres from the main road. Haymarket Terrace has an Annual Average Daily Traffic Flow (AADT) of approximately 26,000 and a high percentage of bus movements. The total percentage of HGVs is 15%. The site is described as a roadside location and monitoring commenced in 1999.
The following pollutants are monitored:
Nitrogen dioxide and PM_{10}

OS Reference 323880 : 673203

Queen Street / North Castle Street

The air quality-monitoring unit is situated at North Castle Street at the junction of Queen Street. It is line with the façade of adjacent residential tenement property and is

5.8 metres from the road. At the time of monitoring there was no vehicle access from North Castle Street to Queen Street. Queen Street is the busiest main traffic route through the city centre. The AADT is in excess of 37,000 vehicles and the total percentage of HGVs is 2%. This site is described as a roadside location and monitoring commenced in 1999.

This monitoring station was relocated at the end of March 2005 to the northbound carriageway of Queen Street at the junction of Wemyss Place, to facilitate the Central Edinburgh Traffic Management scheme in the city centre.
The following pollutants are monitored:
Nitrogen dioxide and PM_{10}

OS Reference 324195 : 674052

Roseburn Terrace

This site was established in July 2003. The air quality-monitoring unit is 7.7 metres from the road and is located in a residential area on a footbridge over the Water of Leith close to traffic lights and residential tenement property. The road (A8) is one of the main traffic routes to the west of the city. The site is described as a roadside location. The AADT is 25,838 and percentage of HGVs is 11.6%. Monitoring commenced in July 2003. The TEOM instrument was removed in January 2004 and installed in the monitoring unit at Currie to enable PM_{10} background data to be assembled. The TEOM instrument was reinstalled in December 2004, following the purchase and installation of a new TEOM for the mobile unit located at Currie.
The following pollutants are monitored:
Nitrogen dioxide and PM_{10}

OS Reference 322939 : 673233

Gorgie Road

The monitoring unit is located in a redundant Police Box which is 2.5 metres from the kerbside and close to a children's play area. The road currently has an AADT in excess of 17,500 and 11% of HGVs. Adjacent buildings are all tenement type properties, and there are a significant numbers of dwellings at ground to fourth storey level.
The following pollutant is monitored:
Nitrogen dioxide.

OS Reference 323121 : 672314

Currie High School

This site was established in 2004 to monitor background PM_{10} concentrations for the Detailed Assessment report. It is situated in an open location at the rear of Currie High School close to residential property on the outskirts of the city. It is described as a suburban background location.
The following pollutants are monitored:
Nitrogen dioxide, PM_{10}, carbon monoxide, sulphur dioxide and ozone.

OS reference 317595 : 667908

Middle Meadow Walk

This site was established in 1993 to monitor the hydrocarbons, benzene and 1,3-butadiene. The monitoring station is situated opposite Middle Meadow Walk, 147 metres from Forest Road/Lauriston Place junction. It is described as an urban background site and is part of the Hydrocarbon National Network. Due to low concentrations obtained at this location, 1,3- butadiene monitoring was discontinued in 2002. The method of monitoring for benzene changed to a pumped tube system in 2002.

OS reference 325717 : 673036

For the purpose of this report, monitoring data has only been reported for those pollutants which local authorities are required to review and assess. Ozone measurements have not been included, as this pollutant is dealt with nationally

All real time monitoring locations are shown in appendix 8 map 3.

2.2 Passive diffusion tube monitoring locations

Edinburgh has a well-established network of passive diffusion tube sites located throughout the city, which measure nitrogen dioxide. Monitoring is currently undertaken at 51 locations, four of the sites are operated as part of the UK national survey. Historically, Edinburgh has focused its monitoring regime in narrow congested streets flanked by tenement type residential properties. Therefore the majority of the passive diffusion tubes have been located to provide the worst-case scenario:

- Close to or at the building facades of residential property.
- Within street canyons.
- At busy road junctions which are close to residential property.
- Locations which have a high percentage of HGVs ie. Buses.

Additional monitoring sites were established for round 2 of the review and assessment process in areas of concern where monitoring had not being previously carried out.

Additional passive diffusion tubes were located at St Johns Road/Clermiston Road junction Corstorphine for the DA. Appendix 8 map 8.

All other passive diffusion tube-monitoring locations are shown in appendix 8 maps, 4, 5, 6, and 7.

2.3 Automated monitoring results

Real-time monitoring results and their respective air quality objectives are reported for each of the pollutants that are measured. Tables 2.1 to 2.5.

All QA/QC procedures and data capture relating to the tabulated data is detailed in appendices 1A and 2 respectively.

2.3.1 Benzene:

Air Quality Objective:

Running annual mean concentration of 3.25 μg/m^3 to be achieved by 31.12.2010 (Scotland and Northern Ireland)

Table 2.1 Benzene concentrations μg/m^3 1999 to 2004

Site	1999	2000	2001	2002	2003	2004
Middle Meadow Walk B Running annual mean μg/m^3	1.98	1.72	1.38	0.91*	0.95*	0.83*
B = background *** Method changed to a pumped tube system. Values reported as an annual mean.**						

Data gathered for 2003 and 2004 continues to meet with the air quality objectives. The concentrations show a continuing decrease over the monitoring years. The values from the year 2002 appear to be of a magnitude lower which may be attributed to a change in methodology.

2.3.2 Sulphur dioxide:

Air Quality Objectives:

15-minute means of 266 μg/m^3 not to be exceeded for more than 35 times a year by 31.12.2005

1-hr mean of 350 μg/m^3 not to be exceeded for more than 24 times a year by 31.12.2004

24- hr mean of 125 μg/m^3 not to be exceeded more than 3 times a year by 31.12.2004

Table 2.2 Sulphur dioxide exceedences for 2004

Site	Monitoring Year	Number of exceedences 15 minute mean	Number of exceedences 1-hr mean	Number of exceedences 24-hr mean
St Leonards **UC**	2004	2	0	0
Currie **B**	2004	0	0	0
UC = Urban centre B= Background				

Data gathered for 2004 continues to meet with the air quality objectives.

2.3.3 Carbon monoxide:

Air Quality Objective:

Maximum running 8-hr mean concentration of 10.0 mg/m^3 to be achieved by 31.12.2003

Table 2.3 Carbon monoxide concentrations mg/m^3 and exceedences for 2004.

Site	Monitoring year	Max running 8-hr mean Number exceedences
St Leonards UC	2004	1.6 (0) (Max annual mean)
Currie B	2004	1.4 (0)
UC = Urban centre B = Background		

Data gathered for 2004 at the above monitoring locations continues to meet with the air quality objective.

2.3.4 PM_{10}

Air Quality Obectives:
(Scotland only)

An annual mean of 18 μg/m^3 (gravimetric) to be achieved by 31.12. 2010

A 24-hour mean of 50 μg/m^3 (gravimetric) not to be exceeed more than 7 times per year by 31.12.2010

All authorities

An annual mean of 40 μg/m^3 (gravimetric) to be achieved by 31.12.2004

A 24- hour mean of 50 μg/m^3 (gravimetric) not to be exceeded more than 35 times by 31.12.2004

The objectives which are to be achieved by 2004 are based on EU Stage 1-limit values. The objectives to be achieved by 2010 are based on indicative EU Stage 2 limits. The 2010 objectives have been incorporated into Scottish regulations and therefore it is only Scottish Local Authorities who are required to consider them for review and assessment purposes.

Additional study work was undertaken for the DA to determine whether or not Edinburgh would meet with the more onerous air quality objectives. This work involved colocating a TEOM monitor with a gravimetric (partisol) monitor at a roadside location for six months. This study resulted in a gravimetric conversion factor of 1.14 compared to the standard 1.3 factor as advised in LAQM TG (03). Using the locally derived gravimetric equivalence factor of 1.14 for the annual average and the 1.3 standard factor for the 24 hour mean, (as advised by the SE) all monitoring sites are likely to meet with both objectives. SE, SEPA and the University of West of England have accepted the findings of the colocated study.

Further monitoring data gathered since the DA report was completed continues to meet with the objectives. PM_{10} concentrations are shown in the table below for each of the monitoring locations. TEOM data has been corrected using both the 1.14 and 1.3 gravimetric equivalence factors (TEOM x 1.14 or 1.3). All data is ratified unless stated. Table 2.4.

Table 2.4 PM_{10} concentrations ($\mu g/m^3$) estimated to 2010.

Location	Monitoring Period	Teom $\mu g/m^3$	Teom x1.14 (grav)	Teom x1.3 (grav)	No Exceedences Teom x 1.3	2010 (grav) 1.14	1.3
Haymarket Roadside	01.08.03 to 31.07.04	14.6	16.6	18.9	2	15.7	17.8
	01.01.04 to 31.07.04	14.4	16.4	18.7	1	15.6	17.6
	01.01.04 to 31.12.04	14.0	16.0	18.2	1	15.2	17.2
	01.01.05 to 31.03.05	14.1**	16.1**	18.3**	1	15.3	17.3
Queen St Roadside	01.08.03 to 31.07.04	15.5	17.7	20.1	3	16.7	18.8
	01.01.04 to 31.07.04	15.2	17.3	19.8	2	16.4	18.5
	01.01.04 to 31.12.04	15.6*	17.8*	20.2*	2	17.0	19.0
	01.01.05 to 14.03.05	14.5**	16.5**	18.9**	0	15.7	17.8
Roseburn Roadside	18.07.03 to 31.12.03	15.2	17.3	19.8	1	16.4	18.5
	01.01.05 to 31.03.05	14.4**	16.4**	18.7**	1	15.6	17.6
St Leonards Urban centre	01.01.04 to 31.07.04	14.5	16.5	18.9	0	15.7	17.8
	01.01.04 to 31.12.04	14.6	16.6	19.0	0	15.8	17.9
	01.01.05 to 31.03.05	13.3**	15.2**	17.2**	1	14.6	16.3
Currie Background	16.01.04 to 31.07.04	9.3	10.6	12.0	0		
	16.01.04 to 31.12.04	9.1	10.4	11.8	0		
	01.01.05 to 31.03.05	9.2**	10.5**	12.0**	0		

Data in Blue is data which has not been previously reported on.
* Construction works adjacent to monitoring station commenced October 2004 to December 2004
** Data unratified January to March 2005
Note exceedences for 2005 occurred on the 30.03.05

Particle emissions from road transport and industry are expected to decline in future years as a result of EU legislation and National policies. Therefore levels of PM_{10} are likely to be lower by 2010. To estimate future concentrations, current monitoring data requires to be adjusted to the target year of 2010 for both secondary and primary combustion PM_{10}, using guidance in Box 8.6 and the relevant factors in Box 8.7 of LAQM TG (03). The Review and Assessment help desk have advised that this methodology has been developed for use with the equivalence gravimetric factor of 1.3 and therefore cannot be applied for the factor 1.14. However, it is considered that if this method is used for TEOM x 1.14 it will provide more pessimistic estimated 2010 concentration values. An example of the calculation and factors used are detailed in appendix 3.

2.3.5 Nitrogen dioxide

AirQuality Objectives:

Annual mean concentration of 40 μg/m^3 to be achieved by the end of 2005

1 hour mean concentration of 200 μg/m^3 not to be exceeded more than 18 times per year to be achieved by the end of 2005

Table 2.5 Nitrogen dioxide concentrations (μg/m^3) automated sites 1999 to 2005

Location	1999	2000	2001	2002	2003	2004	2005
Gorgie R							
Mean μ/m^3	42	38	40	38	39	37	40**
Number of exceedences	0	0	0*	0	0	0	0
Haymarket R							
Mean μ/m^3	38	37	42	42	41	37	41**
Number of exceedences	0	0	10	0	0	0	0
Queen Street R							
Mean μ/m^3	42	38	39	44	41	37	35**
Number of exceedences	0	0	6	0	0	0	0
Roseburn R	**Site started 18.07.03**						
Mean μ/m^3					32	33	36**
Number of exceedences					0	0	0
St Leonards UC	**Site started 24.11.03**						
Mean μ/m^3						25	28**
Number of exceedences						0	0
Currie B	**Site started 16.01.04**						
Mean μ/m^3						10	15**
Number of exceedences						0	0

Data in Blue is data which has not been previously reported on.
* Analyser fault during December 2001 when exceedences occurred
** Data unratified January to March
R = roadside , UC = Urban Centre , B = Background

The roadside automated monitoring locations are all within the AQMA. Data which has been gathered for each of the sites meets with the short-term hourly objective for all monitoring years. Data gathered for 2004 currently meets with both air quality objectives.

Annual data gathered for Queen Street in 2002 and 2003 did not meet with the standard concentration of 40 $\mu g/m^3$. Roadworks were undertaken during 2002, which may have resulted in higher levels. Haymarket did not meet the standard in 2001, 2002, and 2003. Current data gathered for 2005 exceeds the annual standard at Gorgie and Haymarket. However, this data is unratified and comprises of a 3-month monitoring period, January to March 2005. Data for this current year will be fully reported on in the Updating and Screening Assessment Round 3 (2006).

2.4 Passive diffusion tube nitrogen dioxide monitoring results

The Environment Act does not place an absolute obligation on local authorities to meet the prescribed air quality targets, only to 'act in the pursuit of achieving them'. However, the EU requires Scottish Ministers to meet the air quality standards for all the specific pollutants by their EU limit target dates. As nitrogen dioxide is the pollutant of concern with respect to the AQMA, passive diffusion tube data for 2004 has also been projected to 2010 in order to make comparisons with the EU limit value.

All passive diffusion tube monitoring data shown in this report has been corrected for diffusion tube bias in accordance with Box 6.4 LAQM TG (03). The monthly exposed passive diffusion tubes in Edinburgh over read real time analysers by factors of 0.9 to 0.88 (8.7% to 12.7%). Appendix 4.

Passive diffusion tubes have been corrected to the façades of adjacent residential property where appropriate. Correction factors which have been used are shown in appendix 6.

The correction factors for roadside and background locations contained in LQAM TG (03) Box 6.6 and Box 6.7 have been used to estimate the annual average NO_2 concentration to 2005 and 2010 from measured 2004 data. Appendix 7.

QC/QA passive diffusion tube procedures are shown in appendix 1b.
Raw passive diffusion tube data including % data capture and corrected values are tabulated in appendix 5.

2.4.1 Nitrogen dioxide (pdt) monitoring data outside the AQMA

Monitoring of nitrogen dioxide is undertaken at 37 locations in the city, which are not within the AQMA. New monitoring data, together with projected concentrations for 2005 and 2010 is shown in table 2.6.

Table 2.6 Passive diffusion tubenitrogen dioxide concentrations (μg/m^3) outside the AQMA

Location	ID	Site Description	2003	2004	2005 estimated	2010 estimated
West Port	**28**	Roadside Canyon	46	43	42	35
Easter Road	**25**	Roadside Canyon	43	40	39	32
Bernard St Leith	**29**	Roadside Canyon	42	40	39	32
Bernard St Leith	**29a**	Roadside Canyon	-	36	35	29
Bernard St Leith	**29b**	Roadside Canyon	-	40	39	32
Gt Junction St	**30**	Roadside Canyon	40	43	42	34
Broughton Road	**43**	Roadside	-	35	34	28
Broughton St	**44**	Roadside Canyon	-	31	30	25
Pier Place	**12**	Roadside	32	31	30	25
Trinity Crescent	**14**	Roadside	36	32	31	25
Commercial St 11	**7**	Roadside	32	34	33	27
Commercial St 78	**9**	Roadside	39	34	33	27
Glasgow Rd 9	**15**	Kerbside	39	34	33	27
Glasgow Rd 68	**16**	Roadside	36	32	31	26
Grassmarket	**37**	Kerbside	29	33	32	27
Morningside Rd	**8**	Kerbside Canyon	37	34	33	27
Home St Tollcross	**10**	Roadside Canyon	34	33	32	26
Deanhaugh St	**13**	Roadside	32	32	31	26
Calder Rd	**4**	Kerbside	28	22	22	18
Hope Park Terr	**17**	Roadside Canyon	32	29	28	23
Dalkeith Rd	**31**	Roadside Canyon	31	30	29	24
Dundas St	**35**	Kerbside	31	30	29	24
Niddrie Mains Rd	**32**	Kerbside	23	23	22	18
Lanark Rd	**11**	Kerbside	23	22	21	18
Baileyfield Rd Portobello	**19**	Roadside	22	21	21	17

Melville Dr	**38**	Roadside	23	22	22	18
India St	**34**	Kerbside	20	20	19	16
Hillhouse Rd*	**40**	Roadside	33	37	36	30
Hillview Terr*	**41**	Urban Background	18	16	15	13
MidmarDrive*	**42**	Urban Background	17	15	14	13

Air Quality Objective = 40 μg/m^3
*** National network site**
Locations highlighted in purple are new monitoring sites
Values shown in red indicate that an exceedence is likely

All monitoring locations**,** apart from West Port and Great Junction Street continue to meet with the annual average objective. Both West Port and Great Junction Street are estimated to meet the EU limit value by the target year 2010.

Additional new sites were established at St John's Road/Clermiston Road junction for the DA of nitrogen dioxide. Sites 1 and 39 (ID) were existing. Data for 2003 and 2004 is shown below, together with projected concentrations to 2005 and 2010 in table 2.7.

Table 2.7 Passive diffusion tube nitrogen dioxide concentrations (μg/m^3) St Johns Road/ Clermiston Road junction

Site	Tube No	ID	2003	2004	2005	2010
St Johns Rd (East bound)	**1/1x**	**1**	44	43	42	35
St Johns Rd (East bound)	**1A****	**39**	34	32	31	26
St Johns Rd (East bound)	**1b**	**1b**	37*	41	40	33
St Johns Rd (Westbound)	**1c/1d**	**1c**	67*	69	67	55
St Johns Rd (Westbound)	**1e**	**1e**	67*	71	69	57
St Johns Rd (Westbound)	**32**	**1d**	69*	76	74	61
St Johns Rd (Westbound)	**35/35a**	**1f**		68	65	54

AIR QUALITY OBJECTIVE = 40 μg/m^3
* Data 2003/2004 reported in DA
** National network tube
Locations highlighted in purple are new monitoring sites
Values shown in red indicate that an exceedence in likely

Annual exceedences of nitrogen dioxide occur where the residential properties are closer to traffic emission sources at St Johns Road/Clermiston Road junction. The concentrations of nitrogen dioxide are much higher on the westbound side than those on the eastbound carriageway. This is possibly due to local topography and slower moving traffic. Values on the westbound carriageway are likely to exceed the EU limit value by 2010.

2.4.2 Monitoring data within the AQMA

Passive diffusion tube monitoring is carried out at 14 locations within the AQMA. The new data for 2003 and 2004, together with estimated concentrations for 2005 and 2010 is shown below in table 2.8.

Table 2.8 Passive diffusion tube nitrogen dioxide concentrations (μg/m^3) within the AQMA

Location	ID	Site Description	2003	2004	2005	2010
West Maitland St/ Palmerston Pl	**2**	Kerbside/jun canyon	70	69	68	56
Princes St	**24**	Kerbside	63	64	63	51
Torphichen Pl*	**3**	Kerbside/jun canyon	60	68*	66	55
Roseburn Terr/St	**22**	Kerbside/jun canyon	58	73	71	58
North Bridge (N bound)	**27**	Roadside	58	54	53	43
North Bridge (S bound)	**26**	Roadside	54	48	47	38
Gorgie Rd/ Murieston Rd	**5**	Kerbside/jun	50	42	41	34
Gorgie Rd	**18**	Roadside	46	43	42	35
Roseburn Terr	**23**	Kerbside	44	38	37	31
Leith Walk/ MacDonald Rd	**20**	Kerbside/jun	36	38	37	30
Leith Walk/Brunswick Rd	**21**	Kerbside/jun	39	38	37	30
Queen St/Fredrick St	**33**	Kerbside/jun	39	40	39	32
York Pl	**36**	Kerbside	39	38	37	30
Ardmillian Terr	**6**	Kerbside	32	35	34	28

AIR QUALITY OBJECTIVE = 40 μg/m^3
Location highlighted in purple is a new monitoring site
Values shown in red indicate that an exceedence is likely
*** Scaffolding erected at monitoring location**

The annual average nitrogen dioxide objective is likely to be exceeded at the following monitoring locations in the AQMA:

West Maitland Street/ Princes Street
Torphichen Place
Roseburn Terrace/Street
North Bridge (North bound)
North Bridge (South bound)
Gorgie/Murieston Road
Gorgie Road

Locations which are marked in red are also likely to exceed the annual average by 2010.

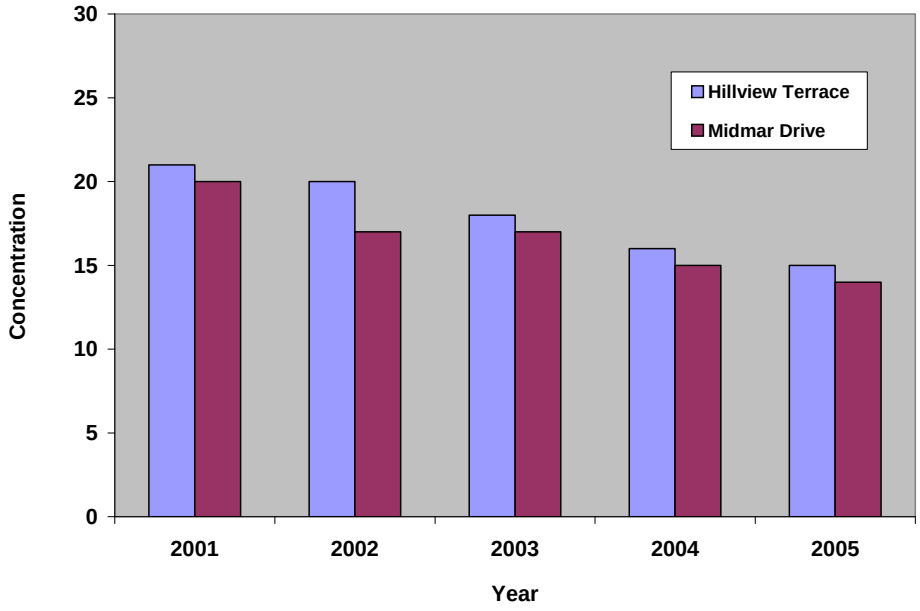
3.0 Data trends and discussion.

3.1 Nitrogen dioxide

At established locations (where a minimum of 6 years monitoring data has been collected) annual mean nitrogen dioxide concentrations have been plotted for successive years. Trend lines for each of the locations have been drawn using the simple regression statistical program in excel.

The passive diffusion monitoring data from the two background sites which are part of the UK National Diffusion Tube network show a downward trend over the monitoring years 2001 to 2004. Concentrations have been projected to 2005 using 2004 data 2.4. Fig1.

Fig 1 Nitrigen dioxide concentrations (μg/m^3) at background locations from 2001 to 2005 (projected estimate)



3.1.1 Nitrogen dioxide trends from automated (real time) monitoring sites

The annual average nitrogen dioxide values from the real time automated monitoring stations in the AQMA tend to decrease, then increase then decrease. This may be a result of weather conditions and local factors relating to roadworks in the city centre. Queen Street was resurfaced in 2002 reducing the traffic to one lane, which lead to congestion. The Western Approach road was closed for a period of time 2003/4 due to repair work. This may have lead to changes in the traffic patterns at Gorgie /Dalry. Also gas mains repair work in this area is ongoing.

The trend for Queen Street and Gorgie locations appears to be downward. Although, the Queen Street trend is less marked. The trend for Haymarket appears to be upward bordering on no change. Figs 2 to 4.

Fig 2 Annual mean nitrogen dioxide trend Queen Street (real-time data µg/m^3)

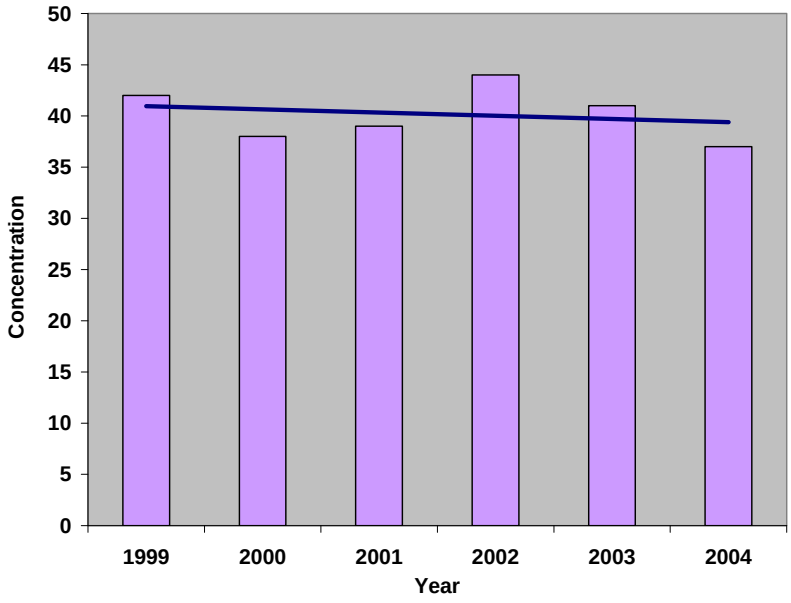


Fig 3 Annual mean nitrogen dioxide trend Haymarket (real-time data µg/m^3)

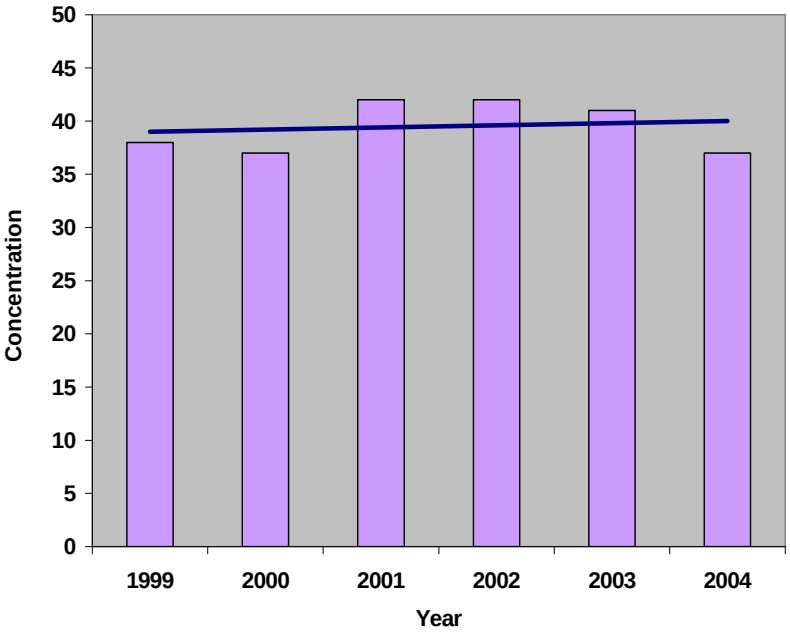
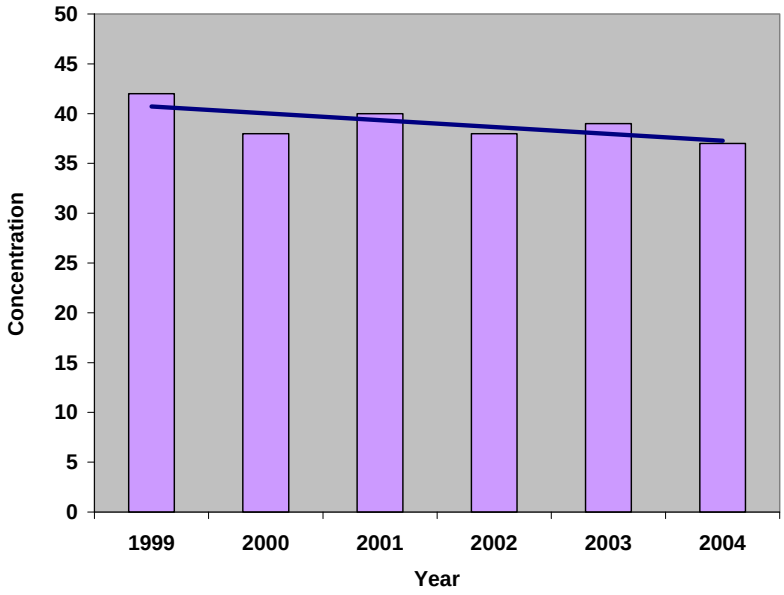


Fig 4 Annual mean nitrogen dioxide trend Gorgie (real-time data μg/m^3)



3.1.2 Nitrogen dioxide trends from passive diffusion tube data

Nitrogen dioxide passive diffusion tube trends within AQMA

Annual mean nitrogen dioxide passive diffusion concentrations measured within the AQMA appear to be increasing at West Maitland Street, Princes Street and Roseburn Terrace. Thus depicting an upward trend. The locations at Gorgie/ Murieston junction, York Place and North Bridge have remained the same. A decrease in concentrations is apparent at Queen Street and Leith Walk, which demonstrates a downward trend. Trends are shown in figures 5 to 12.

Fig 5 Annual mean nitrogen dioxide trend West Maitland Street (passive diffusion tube data μg/m^3)

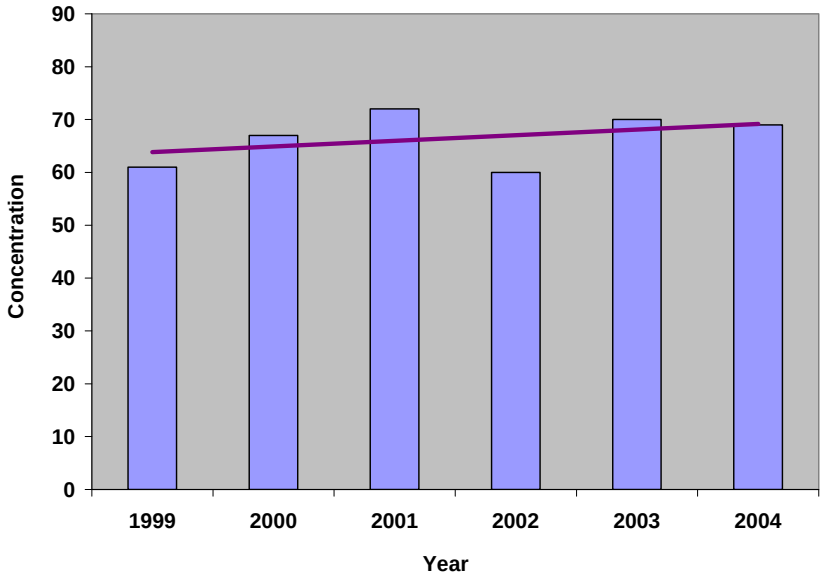


Fig 6 Annual mean nitrogen dioxide trend Princes Street (passive diffusion tube data μg/m^3)

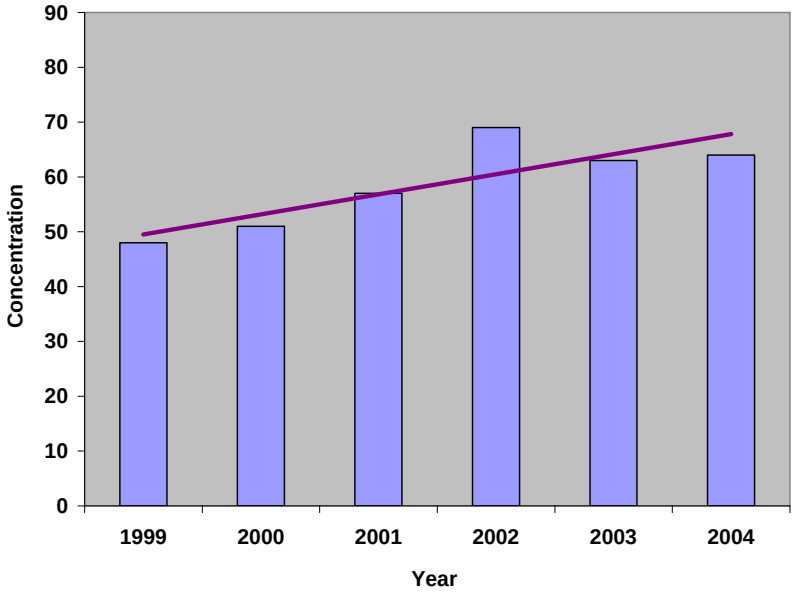


Fig 7 Annual mean nitrogen dioxide trend Roseburn (passive diffusion tube data μg/m^3)

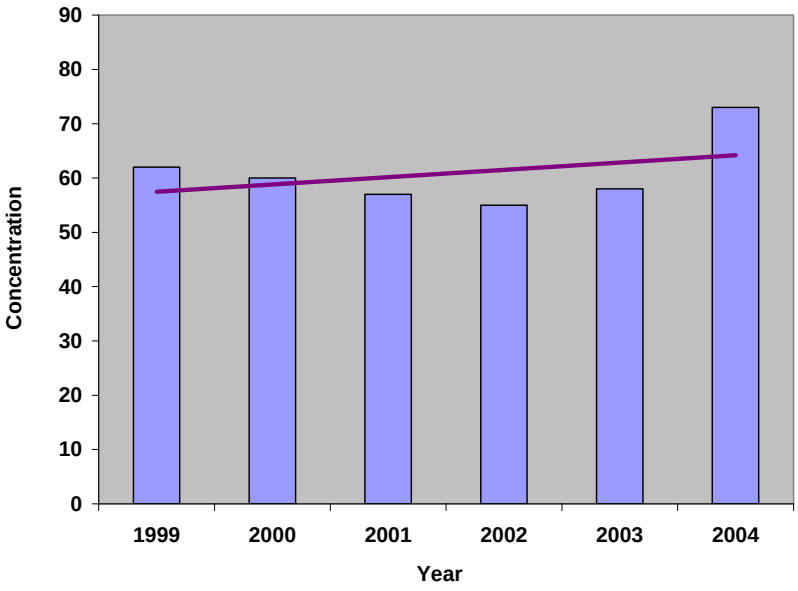


Fig 8 Annual mean nitrogen dioxide trend Gorgie/ Murieston (passive diffusion tube data μg/m^3)

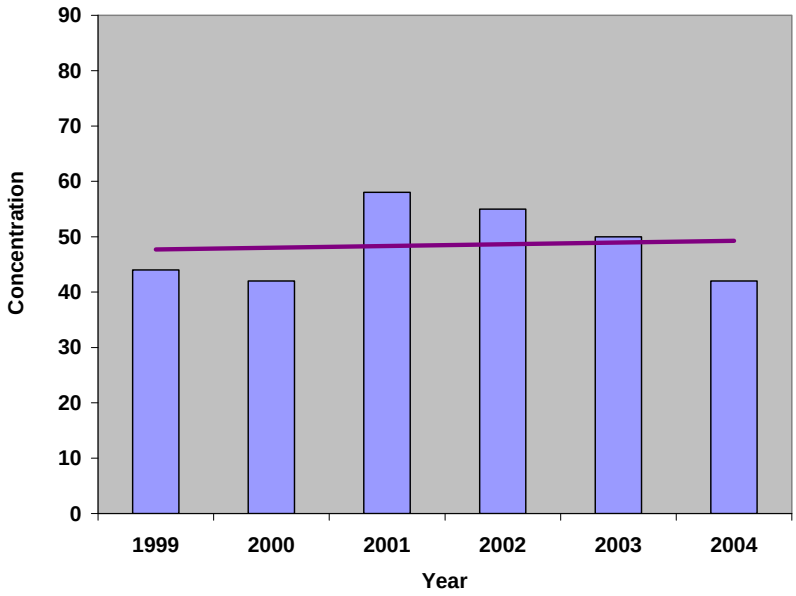


Fig 9 Annual mean nitrogen dioxide trend York Place (passive diffusion tube data μg/m^3)

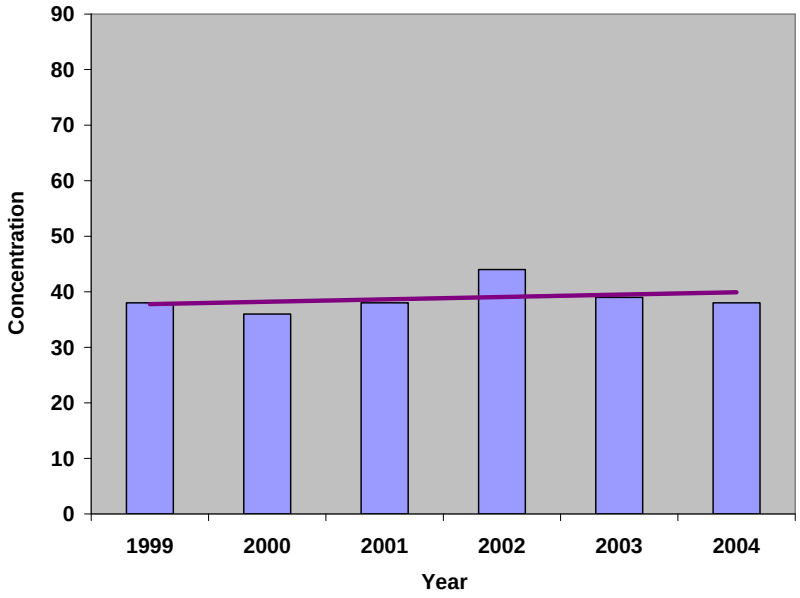


Fig 10 Annual mean nitrogen dioxide trend North Bridge (passive diffusion tube data μg/m^3)

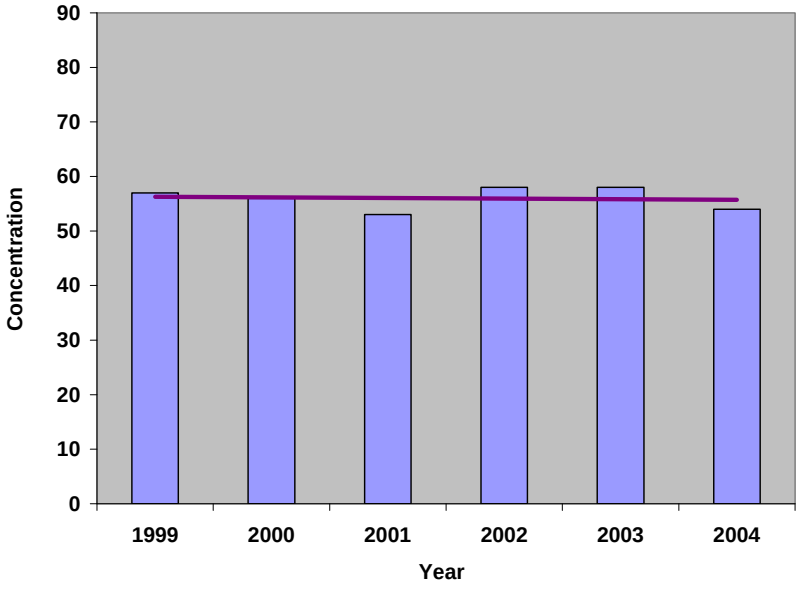


Fig 11 Annual mean nitrogen dioxide trend Queen Street (passive diffusion tube data µg/m^3)

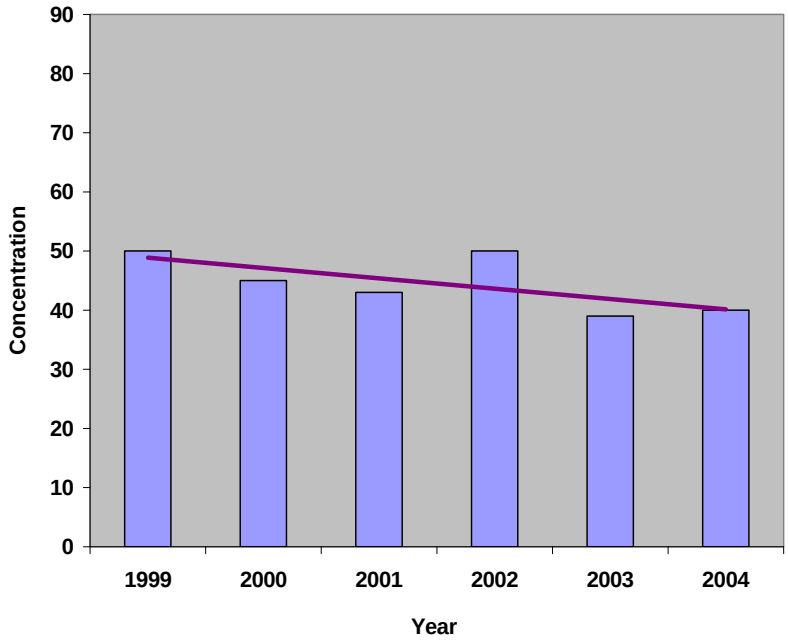
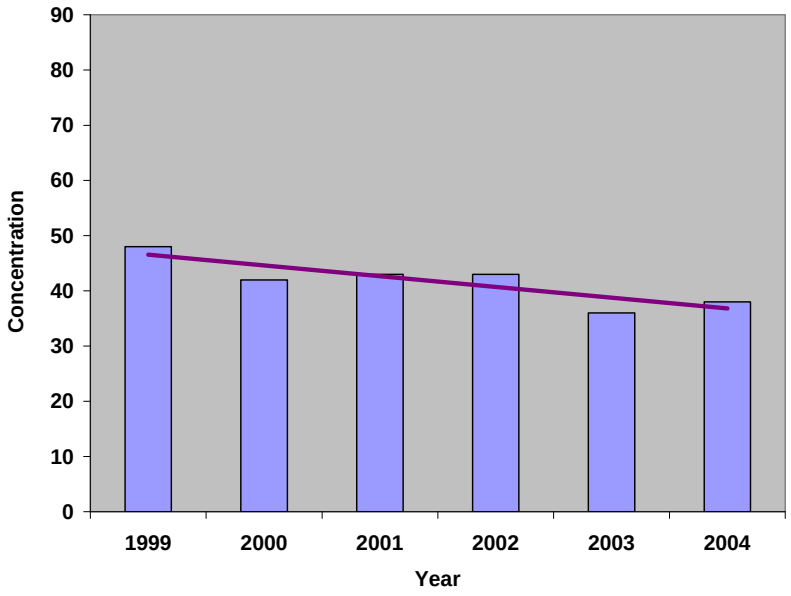


Fig 12 Annual mean nitrogen dioxide trend Leith Walk (passive diffusion tube data µg/m^3)



Nitrogen passive diffusion tube locations outside the AQMA

All monitoring locations appear to demonstrate a downward trend in annual mean nitrogen dioxide concentrations over the six years of monitoring, apart from the city

centre location Dundas Street which has remained the same. Trends are shown in figures 13 to 20.

Fig 13 Annual mean nitrogen dioxide trend Calder Road (passive diffusion tube data µg/m^3)

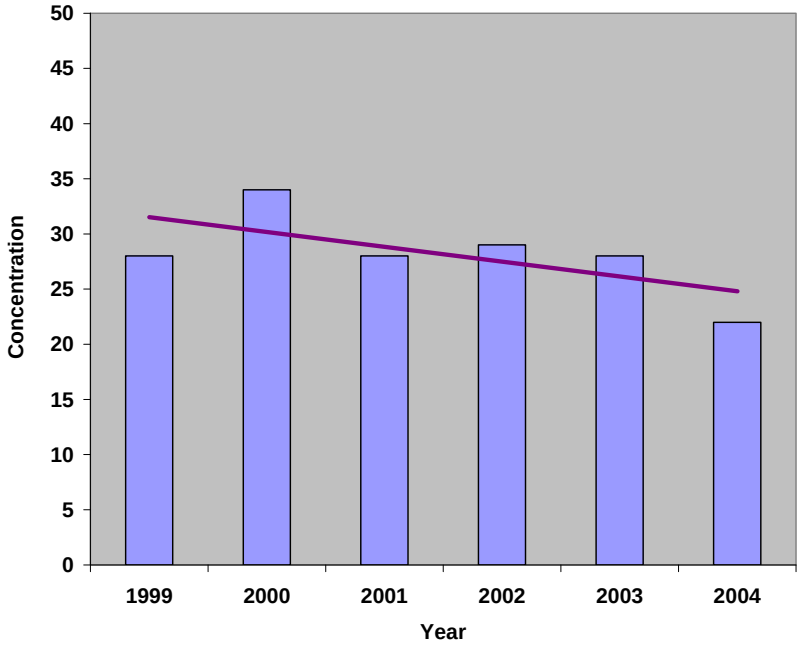


Fig 14 Annual mean nitrogen dioxide trend Grassmarket (passive diffusion tube data µg/m^3)

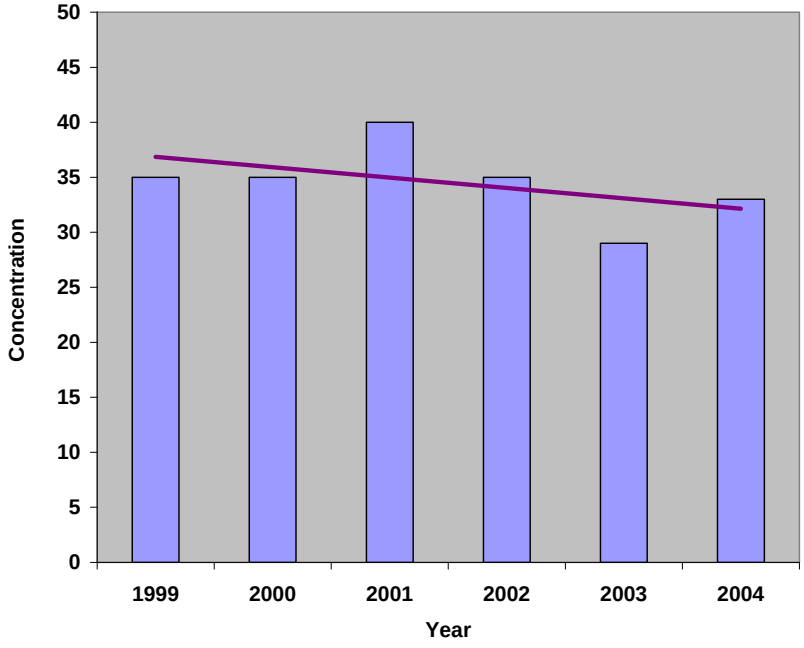


Fig 15 Annual mean nitrogen dioxide trend Morningside Road (passive diffusion tube data μg/m^3)

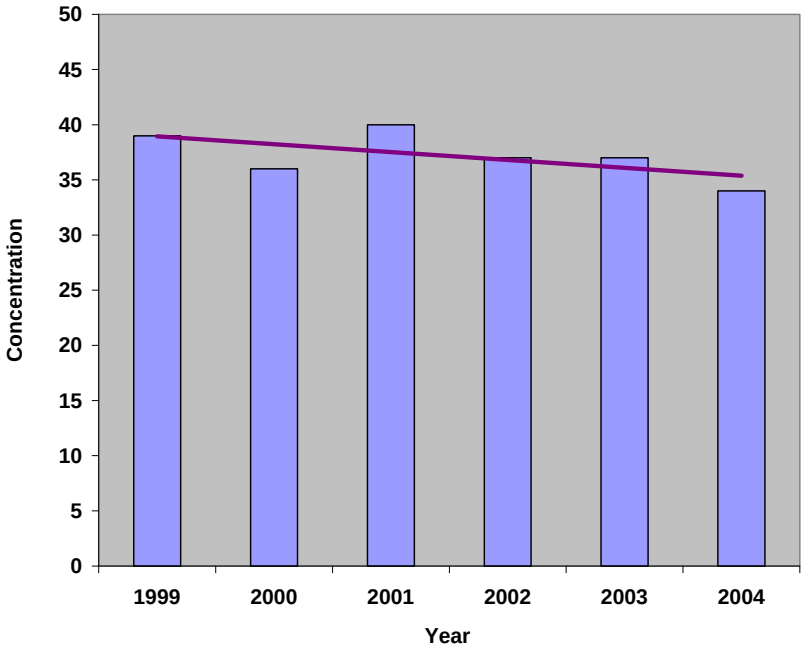


Fig 16 Annual mean nitrogen dioxide trend Home Street (passive diffusion tube data μg/m^3)

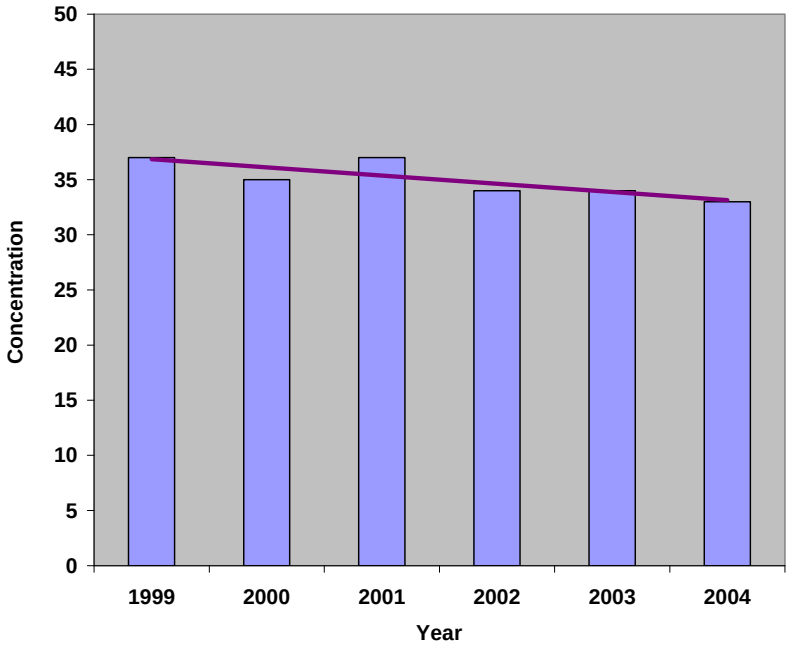


Fig 17 Annual mean nitrogen dioxide trend Deanhaugh Street (Stockbridge) (passive diffusion tube data μg/m^3)

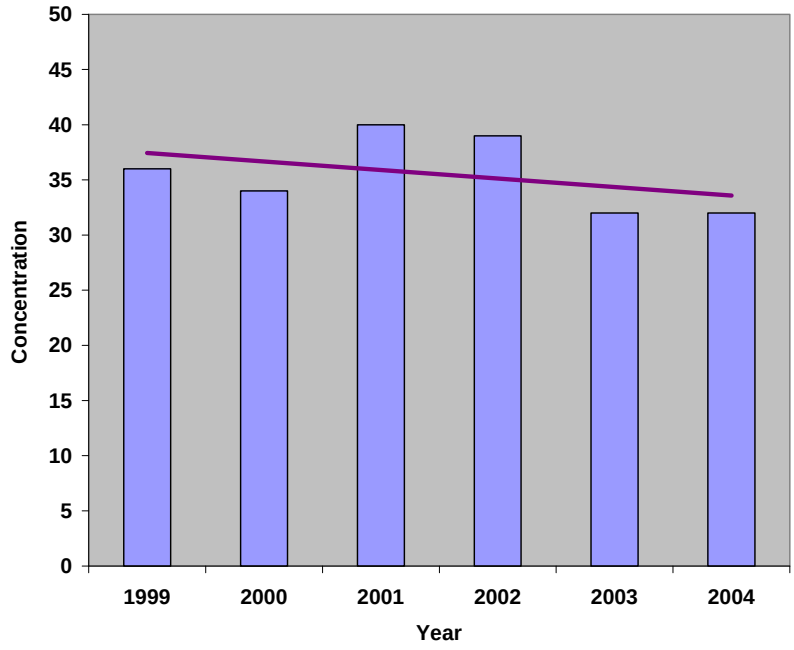


Fig 18 Annual mean nitrogen dioxide trend Hope Park Terrace (passive diffusion tube data μg/m^3)

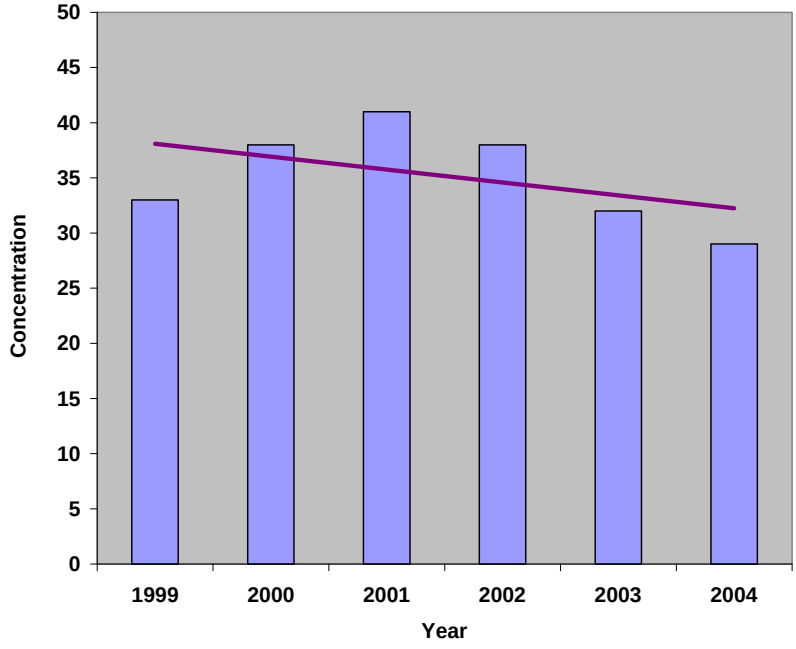


Fig 19 Annual mean nitrogen dioxide trend India Street (passive diffusion tube data μg/m^3)

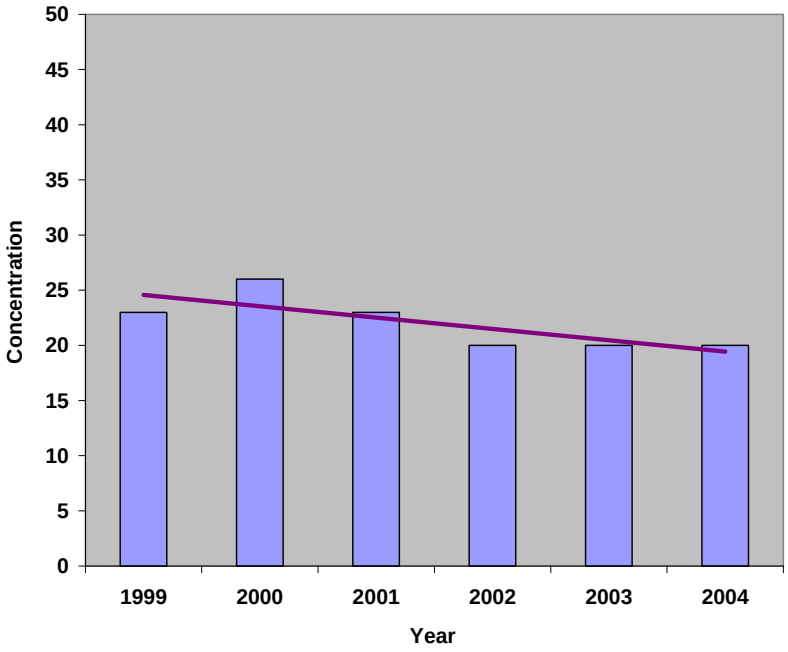
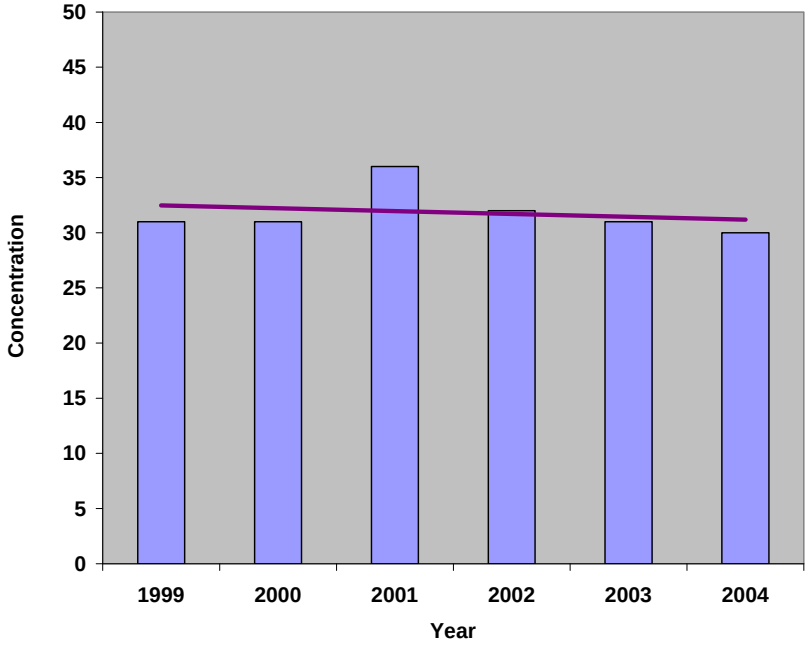


Fig 20 Annual mean nitrogen dioxide trend Dundas Street (passive diffusion tube data μg/m^3)



3.2 PM_{10} trends

The data which has been used to assess PM_{10} trends has not been corrected for gravimetric equivalence. The trend plots are shown in figure 21 and 22.

Fig 21 Annual mean PM_{10} trend Haymarket (TEOM μg/m^3)

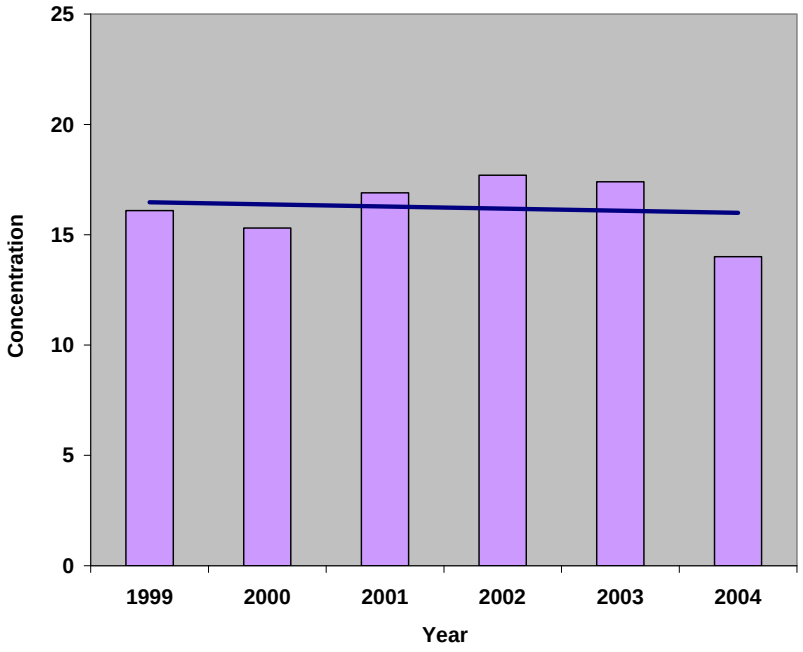
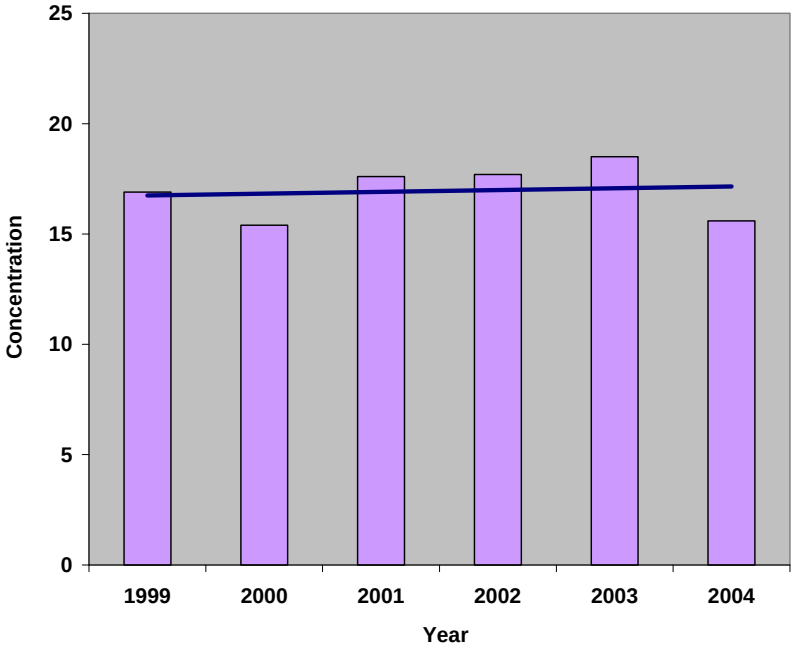


Fig 22 Annual mean PM_{10} trend Queen Street (TEOM μg/m^3)



The PM_{10} trend at both Queen Street/North Castle Street junction and Haymarket show no change. However, these trends require to be tempered with the caveat, that construction work was taking place during the years 2001 to 2003 in the vicinity of the monitoring stations.

4.0 New Local Developments

4.1 Industrial Processes/ Landfill Quarrying

No new PartA, 2A or B processes have been authorised in Edinburgh since the last Updating and Screening Assessment in July 2003. Similarly no new quarrying or landfill processes have been established.

4.2 Transport

No new roads have been constructed since the last Updating and Screening Assessment in July 2003.

Major road layout changes are currently being undertaken in Edinburgh as a result of phase 2 of the Central Edinburgh Traffic Management (CETM) scheme. The scheme was approved in September 2003 and will affect the majority of the AQMA. Whilst these proposals are predicted to improve air quality in George Street. They are likely to have a neutral or adverse effect at other locations within the AQMA.

The main traffic changes will involve:

- Removal of all vehicles from the westbound side of Princes Street with the exception of buses, taxis, emergency vehicles and cycles between the hours of 7 am and 8 pm Therefore, all other vehicles are likely to be diverted on to Queen Street and North Bridge.

- Opening of the junction at Queensferry Street and Princes Street in order to redirect buses from Charlotte Square and George Street on to Princes Street.

Peak traffic flows are expected to increase on Queen Street and more buses will be directed on Princes Street. Nitrogen dioxide concentrations in these two key areas are likely to increase as a result of these proposals.

A further traffic diversion scheme at Haymarket Interchange was implemented towards the end of 2004 for road safety reasons. The scheme does not permit traffic travelling from Dalry Road to turn left on to Haymarket Terrace. All westbound traffic is diverted to West Maitland Street. Where it either loops around Torphichen Place, Morrison Street and on to Haymarket Terrace or turns left at Palmerston Place. Therefore traffic flows are likely to increase at West Maitland Street, Palmerston Place, Torphichen Street and Morrison Street.

In March 2004 the Council adopted a new Local Transport Strategy (LTS 2004-2007). The LTS reiterates many of the actions listed in the Air Quality Action Plan and includes a number of new actions. One of the actions was to develop a congestion-charging scheme by the target date 2006. The scheme was subject to a public enquiry and a referendum. The citizens of Edinburgh voted against congestion charging. A proportion of the revenue procured (£8 million) would have been used to establish a Council initiative grant scheme for reducing vehicle emissions. The target groups would have included operators of public transport (buses), taxis and goods vehicles with diesel engines. These vehicle groups have been identified as being the

most polluting within the AQMA. This grant would have been additional to the one provided by the Energy Trust Program.

Expansion of Edinburgh Airport

A draft masterplan for the expansion of Edinburgh Airport has been published by BAA. A new parallel runway to the North by 2030, a new M8 link road and eastern access road are being proposed. Earlier modelling studies with respect to air quality issues concluded that there would not be any exceedences of the air quality objectives from the aircraft emissions and associated increased volumes of traffic.[2] However, major road congestion and traffic flow problems were anticipated at Edinburgh under the Regional Air Services Case Studies (RASCO). Additional air quality impact assessment work will be required.

The Air Quality Action Plan Annual Report, details the progress which has been made with respect to traffic related measures contained within the Council's Action Plan. This report is currently in draft form and will be submitted to the SE and SEPA as a separate document.

4.3 New mixed use developments (residential /commercial)

The Waterfront of Edinburgh is currently being developed. This comprises of the land adjacent to the Forth estuary and stretches from Silverknowes (western boundary) to the sewage works at Seafield Road (eastern boundary).

Various sites within this area are proposed for residential and commercial use and are committed developments.

The area to the east encompasses Leith Docks. A framework (Leith Dock Development Framework LDDF) has been prepared for future development in this area. The Planning Committee approved this as supplementary planning guidance on 10th February 2005.

The various ' Waterfront' committed development sites are listed in table 4.1.

A total of 29,176 new homes are being proposed for the Waterfront. In addition, 271,750 m^2 of land is available for retail, business, industry and other uses for the areas where outline consent has been granted. The LLDF site is larger than the combined committed areas of development; it will include up to 18,000 residential units and 295,917 m^2 of land for retail etc.

2 Edinburgh and Glasgow Airport Study Regional Air Services- (Study 3 Part B – Air Quality Modelling for Scotland contained in Appendix E Air Quality Report) Arup Transport Planning.
Produced for the Department for Transport, Local Government and the Regions (DTLR)

Table 4.1 Waterfront development sites and proposed uses.

Site	Residential	Commercial/ Retail /other
Secondsite (Granton Gas Works)	2,000 units	8,900 m^2 retail 75,000 m^2 business Primary school
Granton Harbour (Forth Ports)	3,396 units	23,190 m^2 business 7,650 m^2 public amenty Marina
Central Development Area (Waterfront)	1,930 units	3,200 m^2 industrial 35,000 m^2 exhibition 75,000 m^2 business
North Shore Gateway (Waterfront)	850 units 22 units (minded to grant)	11,540 m^2 business 23,680 m^2 business 1,090 m^2 library and learning centre
Western Harbour (Forth Ports)	3,000 units	7,500 m^2 retail Primary school Open space.
Leith Docks Development Framework* **Outline application yet to be submitted**	18,000 units	Potential for: Primary schools 1 denominational school Secondary school Industrial Business uses Community/cultural

It is anticipated that an outline planning application will be submitted to the Planning Department regarding Leith Docks within the few next months. An Environmental Statement Report is currently being prepared which will include transport and air quality impact assessments.

The Transport Assessment (Draft 3)[3] indicates that traffic associated with the committed development for the Waterfront and Leith area (base condition) results in significant congestion of the local network. The introduction of the development traffic (LDDF) causes further congestion. The roads which will be affected are:

Portland Place
Constitution Street/Bernard Street
Ferry Road/Bonnington Road/Newhaven Road/ Gt Junction Street
Seafield Road
Leith Walk

3 Leith Docks Development Framework Transport Assessment Draft

The Transport Assessment also indicates that city-bound traffic will back up through the development site itself.

Environmental and Consumer Services Department have advised that the proposals are likely to have a detrimental impact on air quality in the surrounding areas, which may lead to the creation of an AQMA. Air quality in the existing city centre AQMA could also worsen. The LDDF Transport Assessment does not cover the city centre area and the existing AQMA.

In Edinburgh, air quality objectives for nitrogen dioxide are likely to be exceeded where street canyons occur, at busy junctions where traffic is slow moving, where there is a high percentage of HGVs (buses) and where tenement type residential property is close to the road. Constitution Street, Great Junction Street, Bernard Street fit the aforementioned criteria. Bernard Street is considered to be borderline with respect to meeting the annual average target for nitrogen dioxide. This Council will need to proceed to a Detailed Assessment at Great Junction Street.

Various mitigation measures and sensitivity tests have been outlined in the Transport Assessment document which has lead to a predicted reduction of the LDDF development traffic:

- Assumption that 20% of the future population will live and work on site
- Reduced parking for affordable housing
- Modal shift from car to tram to bus and cycling
- Green travel plans
- Introduction of city centre parking restraints

Many of the above measures can be viewed as being ‘optimistic assumptions’. Environmental and Consumer Services have stipulated that the air quality impact assessment must be undertaken to demonstrate the worst case traffic scenario. The fact that traffic from the ‘committed development’ without the LDDF proposal is considered to lead to significant congestion raises concern.

NOTE Tramline 1 and 2

The Environmental Impact Assessment for tramline 1 has not taken account of the LDDF proposals. Two Consultants were employed by Transport Integrated Enterprise (T.I.E) each used a different approach for the assessment studies for Tramline 1 and 2. It was agreed that one study would be carried out for all three lines, to ensure a consistent approach with respect to air quality. This has not being undertaken as yet. The study would need to include the LDDF proposals and any other committed development which was not previously considered.

Although there is likely to be modal shift from car to tram, the tram will also take up road space and traffic queuing problems may be exacerbated because of this[3].

5.0 Discussion and conclusions

The new monitoring data (2003 and 2004) contained in this report has shown that benzene, carbon monoxide, sulphur dioxide and PM_{10} meet the air quality objectives. The PM_{10} annual concentrations are based on the Edinburgh derived local gravimetric equivalence factor (1.14), which was approved by the SE, SEPA and University of West of England.

Nitrogen dioxide concentrations continue to exceed the air quality objectives at various hotspots within the AQMA; and the following sites are likely to fail the EU limit value by 2010 should the measures contained in the Action Plan fail to be implemented:

West Maitland Street/Palmerston Place
Roseburn Terrace/ Street junction
North Bridge (Northbound)
Torphichen Place
Princes Street

New monitoring data from locations outside the AQMA show that concentrations of nitrogen dioxide continue to meet the objectives, apart from West Port and Great Junction Street. This Council will require to progress to a Detailed Assessment at these locations.

New monitoring data at St Johns Road/Clermiston Road junction continues to exceed the annual average nitrogen dioxide objective and in due course an AQMA will be declared to cover this area of concern. This was discussed in the Detailed Assessment report December 2004.

The 2004 annual average concentration of nitrogen dioxide at Roseburn Terrace/Street junction has increased by 25% compared with the previous monitoring year. This percentage of increase has not been observed at any of the other passive diffusion monitoring locations and any possible contributory local factors have not been identified.

The annual average roadside nitrogen dioxide trends vary within the AQMA. Four out of the eleven monitoring locations show an upward trend, indicating an increase in concentration. Four show a downward trend, indicating a decrease in concentration and three remain the same.

Roadside nitrogen dioxide monitoring locations outside the AQMA demonstrate a downward trend apart from Dundas Street where there is no change.

The annual average roadside nitrogen dioxide trends are summarised in table 5.1 and 5.2 below.

Table 5.1 Annual average nitrogen dioxide trends at locations within the AQMA.

Location	Monitoring Method	Trend
Westmaitland St/Palmerston Place	Pdt	Upward
Princes St	Pdt	Upward
Roseburn Terrace/Street junction	Pdt	Upward
Gorgie Rd/Murieston Rd junction	Pdt	Same
York Place	Pdt	Same
North Bridge	Pdt	Same
Queen St/Fredrick St junction	Pdt	Downward
Leith Walk	Pdt	Downward
Haymarket Terrace	Real-time	Upward
Queen Street/North Castle St	Real time	Downward
Gorgie/WhitePark	Real-time	Downward

Table 5.2 Annual average nitrogen dioxide trends at locations outside the AQMA.

Location	Monitoring method	Trend
Calder Road	Pdt	Downward
Grassmarket	Pdt	Downward
Morningside Road	Pdt	Downward
Home Street	Pdt	Downward
Deanhaugh St	Pdt	Downward
Hope Park Terrace	Pdt	Downward
India Street	Pdt	Downward
Dundas Street	Pdt	Same

The trend for PM_{10} has remained the same at Haymarket and Queen Street/North Castle Street. However, construction activities in the vicinity of both monitoring stations between 2001 and 2003 may have effected the trend.

Nationally, the contribution of road transport to nitrogen dioxide emissions has declined in recent years due to various policy measures and improvements in vehicle technology. Emissions of nitrogen oxides are estimated to fall by 46% between 2000 and 2010[4]. It is uncertain as to whether or not this decrease will be mirrored in Edinburgh due to large scale mixed use developments within the city. Although the factors, which were used to estimate roadside nitrogen dioxide concentrations to 2010 and beyond, take account of traffic volume increases, they might not be in keeping with future traffic increases in Edinburgh. Therefore, future predicted concentrations of nitrogen dioxide might be underestimated.

4 Stedmen JR, Bush T J, Murrells T P and King K (2001). Baseline PM_{10} and NO_x projections for PM_{10} objective analysis. AEAT/ENV/R/0726.

The Review and Assessment of Air Quality Stage 4 report and The Council's Action Plan identified that the most significant improvements regarding the reduction in emissions of nitrogen oxides (NOx) would be achieved through the clean up of public transport. Buses were considered to be the most polluting vehicles in the AQMA. Additional funding from congestion charging, over and above the Government Energy Trust grant programme was to be specifically targeted towards operators of public transport, taxis and goods vehicles. It was estimated that 8 million pounds would be set aside for the council operated scheme Combined with funding from the Energy Trust programme a total of 11 million pounds would have been available to provide cleaner vehicles. Therefore, as a result of congestion charging not being implemented, less money is available to ensure the degree of vehicle emission improvement necessary to meet the EU nitrogen dioxide limits by 2010.

Appendix 1A QA /QC procedures real time analysers

Staff competence

Two officers are trained as local site operators in relation to the management of the Defra National Network site and undertake the necessary calibrations and basic maintenance at all the automated sites. Both operators have been trained to fulfil the requirements associated with passive diffusion tube samplers.

Real-Time Analysers

Calibration procedures

The three ML 9841 B NO_x analysers perform an autocalibration each day with zero air and NO gas. Warning limits are set at +/- 5 % on the software program All sites are visited weekly, apart from the National Network site, which is visited fortnightly and manual calibration checks are carried out using certified NO gas at approximately 500ppb plus a zero check. All cylinders are replaced at 12 - 18 month intervals. NO cylinders are supplied by Air Liquide UK for the mobile monitor and British Oxygen Company (BOC) for the Rollalongs

Servicing

All instruments are serviced and recalibrated every six months by the appropriate supplier

The service contracts include a support package for software and replacement parts, plus any necessary call outs to the sites.

The TEOM heads on the automatic PM_{10} units are cleaned monthly and filters are changed regularly (approximately every 2 weeks).

All visits to the monitoring stations, actions which are taken and activities adjacent to the site are recorded in the site logbook.

Data validation and ratification

All data, including calibration data is scrutinised on a daily basis (Monday to Friday) by visual examination, to see if they contain unusual measurements. Any data which is considered to be suspicious i.e large spikes, is flagged to undergo further checks. Data sets which are considered to require further investigation are checked with respect to the following:

- Assessment of calibration records for drift precision /accuracy of analyser
- Negative values ie during /after TEOM filter change
- Spikes generated by analysers.
- Time/date of manual calibration no out of service switch Mobile AQ unit
- Examination of data gathered from other sites to ascertain if high values are caused by pollution episodes.
- Assessment of local activity construction/ roadworks.

- Data capture rates distribution of missing or suspect data.

Any data which is considered to be erroneous is deleted.

The monitoring station located at St Leonards since 2004, is part of the Automated Urban and Rural Network, (AURN). All AURN sites are subject to an independent audit and stringent QA/QC procedures which are undertaken by Casella Stanger and A.E.A Technology on behalf of DEFRA.

Details of manual calibration checks, precision and accuracy of instruments are available on request either in electronic or paper format.

Site details and type of equipment used for the Council automated analysers table 1

Table 1 Council's automated monitoring equipment used for the Progress report

Site	**NO_x analyser Model**	**PM_{10}**	**Supplier**	**Software**
Queen St Nrth Castle St Rollalong	ML 9841B	TEOM Operated at 50 ^{oc}	Casella ETI (E.M.C)	Enview Data collected daily via modem
Haymarket Terrace Rollalong	ML 9841B	TEOM Operated at 50 ^{oc}	Casella ETI (E.M.C)	Enview Data collected daily via modem
Currie Mobile Trailer	AP1 M200A	TEOM Operated at 50 ^{oc}	Casella ETI (E.M.C) E.T NOx	Enview Data collected daily via modem
Roseburn Terrace Rollalong	ML 9841B	TEOM Operated at 50 ^{oc}	Casella ETI (E.M.C)	Enview Data collected daily via modem
Gorgie Road Housing Police Box	Model 42 Model 142 (auto cal)	-	Thermo Onix	ESC E- Das Ambient Data downloaded Weekly via lab top

Additional analysers located within mobile trailer:

Analyser	**Model**
Carbon monoxide	AP1 M300 Series Gas Filter Correlation CO analyser
Sulphur dioxide	AP1 100A series Fluorescent SO_2 analyser

Appendix 1B QC/QA procedures passive diffusion tubes

Passive diffusion tubes were supplied and analysed by Analytical and Scientific Services, City of Edinburgh Council. The laboratory is UKAS accredited for this task and participates in the Workshop Analysis Scheme for Proficiency (WASP) inter laboratory QC/QA.The laboratories performance was considered to be satisfactory over the monitoring periods 2000, 2001, 2002, 2003 and 2004

The laboratory uses 50% v/v Triethanolanine (TEA) in acetone for the adsorbent; the grids are dipped into this solution and allowed to dry before insertion into the tube. The method has remained unchanged during the monitoring periods. Acrylic diffusion tubes were used for the exposure periods.

NO_2 diffusion tube monitoring has been conducted in accordance with the quality requirements contained in the UK NO_2 Survey Instruction Manual for local/unitary authorities and government guidance document LAQM.TG (03). The diffusion tubes are located within 1 metre of the edge of the kerb or close to the façade of residential property. The tubes are attached to sign posts/lampposts, at a height of 2.0m above ground level. All exposure times and dates are recorded and retained as paper documents. Copies of which are sent with the exposed diffusion tubes to the laboratory.

Three diffusion tubes from each monthly batch are used as blanks. These tubes are not exposed and are stored in the refridgerator during the exposure period. They are analysed along with the appropriate batch of exposed tubes. The purpose of blanks is to determine whether or not NO_2 contamination occurred during tube preparation.

Appendix 2 % Data capture real time analysers 2003 and 2004

Site	Pollutant	2003	2004
Gorgie	NO_2	99%	86%
Haymarket	NO_2 PM_{10}	96% 93%	93% 92%
Queen Street	NO_2 PM_{10}	95% 97%	95% 93%
Roseburn	NO_2 PM_{10}	85% 99%	95% -
Currie	NO_2 PM_{10} SO_2 CO	- - - -	92% 91% 82% 90%
St Leonards	NO_2 PM_{10} SO_2 CO	- - - -	90% 93% 93% 93%

Appendix 3 Calculation of estimated 2010 PM_{10} concentrations from 2003/04 data.

Example of calculation to estimate PM_{10} concentrations to 2010 using measured data from 2003/4 (Haymarket)		
Correction factors used from Box 8.7 to project to year 2010	2003/4 measured data (1.3)	2003/4 measured data (1.14)
secondary	0.795 / 0.932 = 0.853	0.795 / 0.932 = 0.853
primary	0.815 / 0.930 = 0.876	0.815 / 0.930 = 0.876
Correction of secondary 2001 to 2003/4	x 0.932	x 0.932
TEOM measured data corrected to gravimetric (1.3) and (1.14)	14.6 $\mu g/m^3$ x 1.3 = 18.9 $\mu g/m^3$	14.6$\mu g/m^3$x 1.14 = 16.6 $\mu g/m^3$
Secondary PM_{10} 2001 from UK background maps	4 x 0.932 =3.73$\mu g/m^3$	4 x 0.932 =3.73$\mu g/m^3$
Estimated secondary PM_{10} to 2010	3.73 x 0.853 =3.18$\mu g/m^3$	3.73 x 0.853 =3.18$\mu g/m^3$
Coarse fraction (remains unchanged)	= 10.5$\mu g/m^3$	= 10.5$\mu g/m^3$
Primary fraction of PM_{10} Total –secondary - coarse	18.9- 3.73-10.5 = 4.67 $\mu g/m^3$	16.6- 3.73-10.5 = 2.37$\mu g/m^3$
Primary fraction of PM_{10} to 2010	4.67 x 0.876 = 4.09$\mu g/m^3$	2.37 x 0.876 = 2.08$\mu g/m^3$
Total estimated PM_{10} at 2010	4.09 + 3.18 +10.5 = 17.8$\mu g/m^3$	2.08 + 3.18+10.5 = 15.8 $\mu g/m^3$

Measurement year	Secondary to year of measurement	Secondary to 2010	Primary to 2010
2004	4 x 0.932 = 3.73	0.795/0.932 = 0.853	0.815/0.930 = 0.876

Appendix 4 Passive diffusion tube bias corrections

Passive diffusion tubes are exposed in triplicate on the sampler head cage of the air quality monitoring stations on the side closest to the road. The data from the triplicate sets which show the best agreement are used to calculate the passive diffusion tube mean. Passive diffusion tube bias has been calculated according to Box 6.4 Approach to bias correction of nitrogen dioxide diffusion tube data LAQMA. TG(03).

Queen St/ North Castle Street
2003

Start	End	analyser	Mean pdt
31.12.03	05.02.03	38.7	38.0
05.02.03	05.03.03	54.4	47.7
05.03.03	02.04.03	54.8	61.0
02.04.03	30.04.03	45.5	57.0
30.04.03	04.06.03	36.3	41.0
04.06.03	03.07.03	31.5	38.5
03.07.03	30.07.03	29.9	35.0
30.07.03	03.09.03	37.4	34.7
03.09.03	01.10.03	34.6	40.5
01.10.03	05.11.03	40.8	49.0
05.11.03	03.12.03	43.4	45.0
03.12.03	31.12.03	46.4	54.0
mean		41.1	45.1
% Bias	9.70%	overread	
Factor	0.911		

Queen Street Site 1
2004

	Start	End	analyser	Mean pdt
Jan	31.12.03	04.02.04	40	40.6
Feb	04.02.04	03.03.04	47	45.3
Mar	03.03.04	31.03.04	43	42
Apr	31.03.04	05.05.04	34	36.5
May	05.05.04	02.06.04	35	34
Jun	02.06.04	30.06.04	33	32
Jul	30.06.04	04.08.04	32	45.6
Aug	04.08.04	01.09.04	42	49.3
Sept	01.09.04	29.09.04	28	38.3
Oct	29.09.04	03.11.04	41	51.3
Nov	03.11.04	01.12.04	39	40
Dec	01.12.04	06.01.05	33	39.5
Mean			**37.2**	**41.2**
% Difference			**10.7%**	**overead**
Bias			**0.9**	

Haymarket Site 2
2004

	Start	End	analyser	Mean pdt
Jan	30.12.03	03.01.04	39	47.5
Feb	03.01.04	02.03.04	41	47
Mar	02.03.04	30.03.04	40	44.5
Apr	30.03.04	04.05.04	36	37
May	04.05.04	01.06.04	36	32.5
Jun	01.06.04	29.06.04	34	43
Jul	29.06.04	03.08.04	32	39
Aug	03.08.04	31.08.04	39	50
Sep	31.08.04	28.09.04	28	35.6
Oct	28.09.04	02.11.04	41	48
Nov	02.11.04	30.11.04	41	39
Dec	30.11.04	05.11.05	35	35.5
mean			**36.9**	**41.5**
%bias				**12.5%**
bias				**0.88**

Currie School 3
2004

	Start	End	analyser	Pdt mean
Jan				
Feb	04.02.04	03.03.04	12.8	15
Mar	03.03.04	31.03.04	8.0	11.3
Apr	31.03.04	05.05.04	3.4	7
May	05.05.04	02.06.04	8.4	8.6
Jun	02.06.04	30.06.04	5.2	8
Jul	30.06.04	04.08.04	10.5	10.3
Aug	04.08.04	01.09.04	14.1	16.3
Sep	01.09.04	29.09.04	11.1	11.6
Oct	29.09.04	03.11.04	14.1	14.3
Nov	03.11.04	01.12.04	15.5	14
Dec	01.12.04	06.01.05	12.6	9.6
mean			**10.5**	**11.5**
%bias				**8.7**
bias				**0.91**

Mean Bias 2004
0.9
0.88
0.91
=0.89 over read

Appendix 5 NO_2 passive diffusion tube raw and corrected data /data capture

Location	Tube No	Raw Data	% Capture	Bias corr	Kerbside corr
St Johns Rd	1	50.5	92%	44.9	42.7
St Johns Rd	1x	51.6	92%	45.9	43.6
St Johns Rd	1b	46.3	67%	41.2	41.2
West Maitland St	2	85.5	92%	76.1	68.4
West Maitland St	2b	87.8	75%	78.1	70.3
Torphican Pl	2x	80.3	100%	71.5	67.9
Calder Rd	3	33.6	83%	29.9	22.4
Gorgie Rd/Murieston Rd	4	52.5	92%	46.7	42
Admillan Terr	4x	41	92%	36.5	34.7
Commercial St	5	38	83%	33.8	33.8
Morningside Rd	6	40.1	83%	35.7	33.9
Morningside Rd	6x	40.5	92%	36.0	34.2
Commercial St	7	38	92%	33.8	33.8
Home St	8	36.8	83%	32.8	32.8
Lanark Rd	9	25.7	92%	22.9	21.8
Pier Pl	10	36.3	100%	32.3	30.7
Deanhaugh St	11	37.7	83%	33.6	31.9
Trinity Cres	12	35.4	100%	31.5	31.5
Newbridge/Glasgow Rd	13	41.8	100%	37.2	33.5
Newbridge/Glasgow Rd	14	40.3	92%	35.9	32.2
Hope Pk Terr	15	36	75%	32.0	28.8
Gorgie Rd	16x	50	100%	44.5	44.5
Gorgie Rd	16	47	100%	41.8	41.8
Baileyfield Rd	17	25.3	100%	22.5	21.4
McDonald Rd	19	47.1	100%	41.9	37.7
McDonald Rd	19x	43.8	100%	39.0	37
Roseburn Terr/St	20	86	67%	76.5	72.7
Roseburn Terr	20x	45.2	83%	40.2	38.2
Princes St	21	96	83%	85.4	64
Easter Rd	23	44.9	92%	40.0	40
Westport	25	48.7	75%	43.3	43.3
Bernard St	26	45	92%	40.1	40.1
Gt Junction St	27	47.9	83%	42.6	42.6
Dalkeith Rd	28	30	92%	26.7	24
Niddrie Mains Rd	29	28.2	83%	25.1	22.6
Broughton Rd	30	40.2	92%	35.8	35.8
Broughton Rd	30x	38.4	92%	34.2	34.2
Broughton St	40	34.4	92%	30.6	30.6
North Bridge 1	24	60.4	100%	53.8	53.8
North Bridge 2	24x	53.8	100%	47.9	47.9
Queen St	33	49.8	92%	44.3	39.9
Queen St	33x	49.7	83%	44.2	39.8
India St	34	24.8	100%	22.1	19.9
Dundas St	37	38.3	100%	34.1	30.1
York Pl	39	47.3	92%	42.1	37.9
Melville Dr	44	36.4	83%	32.4	24.3
Melville Dr	46	31.4	100%	27.9	20.9
Melville Dr	47	31.9	92%	28.4	21.3
Grassmarket	45	49.1	66%	43.7	32.8

Grassmarket	45x	50.3	66%	44.8	33.6
St Johns Rd	1A	40	100%	35.6	32
Hillhouse Rd	2A	41.9	75%	37.3	37.3
St Johns Rd	1c	79.7	83%	70.9	70.9
St Johns Rd	1d	74.3	67%	66.1	66.1
St Johns Rd	1e	79.3	83%	70.6	70.6
St Johns Rd	32	84.8	75%	75.5	75.5
St Johns Rd	35	83	83%	73.9	73.9
St Johns Rd	35a	85.3	75%	75.9	75.9
Bernard St	26a	40.7	100%	36.2	36.2
Bernard St	26b	44.9	100%	40.0	40

Background

Hillview Terr	3A	17.6	100	15.7	15.7
Midmar Dr	4A	16.3	100	14.5	14.5

Appendix 6 Passive diffusion tube kerb to façade distance corrections

Kerbside to façade corrections

Site number	Code	Location	Distance pdt from kerb (m)	Distance from pdt to façade (m)	Factor used
1	1	St Johns Rd	0.54	1.9	0.95
1	1x	St Johns Rd (Duplicate)	0.54	1.9	0.95
2	2	West Maitland St Palmerston Pl	0.65	4.2	0.90
3	2x	West Maitland St	0.30	2.7	0.95
4	3	Calder Rd	1.75	> 20	0.75
5	4	Gorgie Rd/Ardmillan Terr	0.3	4.9	0.90
6	4x	Ardmillan Terr /Gorgie- Dalry	0.6	3.8	0.95
7	5	Commercial St no 11	2.47	at façade 0.4	
8	6	Morningside Rd	0.45	2.6	0.95
8	6x	Morningside Rd Duplicate	0.45	2.6	0.95
9	7	Commercial St at no 78	2.6	at facade	
10	8	Home St / Toll Cross	2.8	at facade 0.4	
11	9	Lanark Rd at no 610	1.0	3.6	0.95
12	10	Pier Place at Alien Rock	2.15	2.7	0.95
13	11	Deanhaugh St	0.6	3.6	0.95
14	12	Trinity Crescent	4.0	4.3	
15	13	Glasgow Rd at no 9 (East bound)	1.1	4.4	0.90
16	14	Glasgow Rd at no 68	1.8	4.4	0.90
17	15	Hope Park Terrace	0.3	4.5	0.90
18	16	Gorgie Rd close to facade	2.4	1.0	
19	17	Baileyfield Rd (Portobello)	2.0	3.5	0.95
20	19	Mc Donald Rd /Leith Wlk	1.0	4.6	0.90
21	19x	Leith Wlk / Brunswick Rd	1.0	3.3	0.95
22	20	Roseburn Terr/ St	0.57	1.54	0.95
23	20x	Roseburn Terr	0.35	2.14	0.95
24	21	Princes St	0.47	10.5	0.75
25	23	Easter Rd	2.32	at facade	
26	24	North Bridge Pizza Hut	3.5	at facade	
27	24x	North Bridge Clydesdale Bank	3.5	at facade	
28	25	West Port opposite no38	1.7	at facade	
29	26	Bernard St	2.35	at facade	
29a	26a		2.10	at facade	
29b	26b		2.18	at facade	
30	27	Gt Junction St	2.82	at facade	
31	28	Dalkeith Rd 187	1.8	4.9	0.90
32	29	Niddrie Mains Rd / Craigmillar Castle	1.2	4.3	0.90
33	33	Queen St/Frederick St	1.0	4.4	0.90
33	33x	Queen St/Frederick St Duplicate	1.0	4.4	0.90
34	34	India St	0.4	6.55	0.90
35	37	Dundas St	0.4	7.12	0.90
36	39	York Place at no 49	0.75	8.2	0.90
37	45	Grass Market	1.2	18	0.75
38	44	Melville Drive	2.83	> 20	0.75
38	46	Melville Drive	2.83	> 20	0.75
38	47	Melville Drive	2.83	> 20	0.75
39	1A	St Johns Rd /Victor Park Terr	1.7	9.0	0.90
40	2A	Queensferry Rd	2.0	at façade 0.4	
41	3A	Hillview Terrace at no 10	1.0	9.0	

42	4A	Midmar Drive 28-30	1.45	9.4	
43		Broughton Rd	2.03	at facade	
44		Broughton St	2.03	at facade	

The factors used are based on advice provided for the Stage 3 Review and Assessment report from Duncan Laxen (Air Quality Consultants Ltd) personal communication:

0 - 2m x 0.95

2 - 5m x 0.90

> 5m x 0.75

However, more conservative factors have since been advised which are :

2 - 5m x 0.95

5 - 10m x 0.90

10- 20m x 0.75

For the purpose of this report the following factors were used:

0 - 4m x 0.95

4 - 10m x 0.90

10 - 20m x 0.75

Note In all cases the factors err on the side of caution

Appendix 7 Calculation used for the estimation of NO_2 concentrations in 2005 and 2010.

Site Type	Projection to 2005	Projection to 2010
Background 2004	0.908/0.927 = 0.975	0.778/0.927 = 0.839
Roadside 2004	0.892/0.915 = 0.974	0.734/0.915 = 0.802
Example measured data for 2004 = 48μg/m^3 roadside Projection to 2005 48 x 0.974 = 47μg/m^3		

Factors for the annual roadside and background locations were derived from (Box 6.6 LAQMA TG (03)) and (Box 6.7 LAQM TG(03)) respectively.