

In partnership with



2009 Air Quality Updating and Screening Assessment for *Midlothian Council*

In fulfillment of Part IV of the Environment Act 1995
Local Air Quality Management

April 2009

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Executive Summary

Midlothian Council has carried out a review of air quality within Midlothian which fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents.

The report sets out the results of air quality monitoring carried out by Midlothian Council and considers the potential impacts from a range of sources such as road traffic and other transport emissions, industrial processes, commercial and domestic fuel use and fugitive emission sources.

It was found that there were no new issues except for potentially high concentrations of nitrogen dioxide due to a busy narrow congested street in Bonnyrigg. Some measurements of nitrogen dioxide were above the annual mean objective at locations adjacent to the A68 in Dalkeith. However, these locations were not representative of exposure locations. Concentrations are expected to decrease to below the objective value in 2009 due to the opening of the A68 Dalkeith Bypass. Midlothian Council has implemented some changes to the existing nitrogen dioxide diffusion tube monitoring survey for the 2009 monitoring period to take account of the above issues.

The next course of action for Midlothian Council in the Review and Assessment process is summarised as:

- Submit a Progress Report by 30 April 2010 which will include the revised diffusion tube monitoring survey results; and
- Submit a Detailed Assessment report by 30 April 2010 to assess annual mean concentrations of nitrogen dioxide in the High Street, Bonnyrigg due to the identification of a narrow congested street with more than 5,000 vehicles per day.

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1 Introduction

1.1 Description of Local Authority Area

Despite being relatively small in size, Midlothian occupies a key location on the southern boundary of Scotland's capital. All of Midlothian's main centres of population lie within 30 minutes drive from Edinburgh, while Dalkeith is only 6 miles from the city centre. Midlothian comprises a number of small and medium-sized towns, together with many villages and hamlets and it is not dominated by any single centre. Penicuik is the largest town with a population of around 17,000, followed in size by Bonnyrigg and Dalkeith with populations of about 14,000 and 11,000 respectively. Loanhead, Gorebridge, Mayfield and Newtongrange are smaller settlements. A schematic map of Midlothian showing villages, towns and roads within the district is shown in Figure 1.

Midlothian is largely a countryside setting. The area stretches from the Pentland Hills to the Moorfoots and Lammermuirs, and comprises a gently sloping plain, much of it intensively farmed, rising to moorland with upland country beyond. There are deeply incised river gorges of the Esk and Tyne with dense natural woodland. Much of this landscape is protected by policy designations such as the Green Belt.

There are no large industrial processes in Midlothian and the main issues with regards to air quality are due to road traffic emissions, particularly in the busy town and village centres where congestion occurs. Another main issue is domestic solid fuel combustion due to the rural setting of Midlothian and limited mains gas supply to many villages. There are also a number of open cast coal mining and landfill sites in Midlothian.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan setting out the measures it intends to put in place in pursuit of the objectives.

The Updating and Screening Assessment presented in this report was carried out in accordance with the recently issued technical guidance document, Local Air Quality Management Technical Guidance LAQM.TG(09) (Ref. 1).

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Scotland.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	3.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

1.4.1 First Round of Review and Assessment, 1998 – 2001

The assessment of local air quality was undertaken initially as a three stage process using increasingly detailed levels of assessment. Midlothian Council has previously completed Stages 1 to 3 of the first round of the Review and Assessment process.

The Stage 1 report concluded that further assessment of nitrogen dioxide, PM₁₀, sulphur dioxide and lead was required due to emissions from traffic, industrial and domestic sources. The Stage 2 report concluded that no further assessment was required for PM₁₀, sulphur dioxide and lead. A more detailed assessment of nitrogen dioxide was recommended at Stage 3 for road traffic emissions in the centre of Dalkeith. On the basis of continuous analyser monitoring and dispersion modelling results, the Stage 3 report concluded that the air quality objectives for nitrogen dioxide were not at risk of being exceeded at sensitive receptor locations in Dalkeith centre and therefore the declaration of an air quality management area was not required.

1.4.2 Second Round of Review and Assessment, 2003 – 2005

Updating and Screening Assessment 2003

Following completion of reports for the first phase of Review and Assessment, there were potentially a number of issues that needed to be addressed in terms of changes to the sources and emissions of pollutants that may have affected ambient air quality in local authority areas. Furthermore, new policy developments and revisions to published guidance required consideration within the on-going assessment of air quality.

The updating and screening assessment was based on a checklist approach, whereby sources identified in the first round of Review and Assessment and any new or altered emissions sources were reviewed with regard to their current significance and any requirement for further, more detailed, assessment.

The Updating and Screening Assessment completed in early 2004 concluded that a Detailed Assessment was required for nitrogen dioxide and PM₁₀ levels due to road traffic emissions in Dalkeith centre. The screening assessment indicated that a survey of domestic fuel use was required for two villages in Midlothian; Cousland and Pathhead.

Detailed Assessment 2004

The Detailed Assessment report completed in 2005 by Midlothian Council concluded that PM₁₀ levels in Dalkeith centre would comply with the air quality objectives for the target years of 2004 and 2010. Nitrogen dioxide levels were also predicted not to exceed the relevant air quality objectives. However, further monitoring was recommended to provide more data of improved reliability. The updated results of this survey are set out in this report.

The survey of domestic fuel use in Cousland and Pathhead indicated a more detailed assessment of PM₁₀ and sulphur dioxide levels was required in Pathhead. Midlothian Council committed to carry out the monitoring in the winter period of September 2005 to March 2006. The results of the monitoring were incorporated into the next round (the third round) of the review and assessment process (i.e. the Updating and Screening Assessment 2006).

Progress Report 2005

The Progress Report submitted in 2005, and updated in 2006, provided an update on local air quality issues in Midlothian and focused on the latest monitoring results and updates to industrial processes and developments. The report concluded that there were no areas of immediate concern. The proposed Dalkeith by-pass was anticipated to lead to a considerable decrease in pollution levels in the centre of Dalkeith. It was recommended that additional monitoring be undertaken to reinforce these findings in Dalkeith and also at the village of Pathhead following the recommendations in the Detailed Assessment 2004 report.

1.4.3 Third Round of Review and Assessment, 2006 – 2008

Updating and Screening Assessment 2006

The Updating and Screening Assessment completed in 2006 concluded that measured concentrations of PM₁₀ at Pathhead were above the 2010 annual mean objective value. As the monitoring period was less than one year, it was concluded that further monitoring be carried out and the results reported in a Detailed Assessment in 2007. Although it was concluded that there had been no significant changes with regards to emissions and measurements of all other substances, it was recommended that the existing monitoring programme be continued to confirm the trend in pollution levels.

Detailed Assessment 2007

The Detailed Assessment completed in 2007 focused on PM₁₀ levels in Pathhead due to domestic coal burning and road traffic emissions. The results of the monitoring campaign indicated that the levels of PM₁₀ are predicted to exceed the annual mean air quality objective by the target date of

2010. Further analysis was undertaken using dispersion modelling which confirmed the monitoring results. On this basis, Midlothian Council committed to declaring an AQMA in Pathhead.

The AQMA in Pathhead came into force on 30 April 2008 and covers the entire village as shown in Figure 2. Midlothian Council aims to carry out a Further Assessment in 2009 to confirm the original assessment, calculate the improvement required and refine its knowledge of the sources of pollution. Midlothian Council is also committed to preparing an Air Quality Action Plan in 2009.

Progress Report 2008

The Progress Report submitted in 2008, provided an update on local air quality issues in Midlothian and focused on the latest monitoring results and updates to industrial processes and developments. The monitoring data confirmed the declaration of the AQMA at Pathhead. Some diffusion tube measurements at locations in Dalkeith were above the annual mean nitrogen dioxide objective. However, these locations were not representative of long term human exposure locations. Midlothian Council committed to reviewing the diffusion tube monitoring locations and considering whether the survey also needs to be expanded to cover Loanhead and Bonnyrigg, where increased traffic congestion has occurred. Some minor changes to industrial processes and plans for developments such as Park and Rides, a new town and re-opening of a rail link were identified. It was concluded that a Detailed Assessment was not required.

Copies of the previous LAQM reports are available on request to Midlothian Council.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Midlothian Council operates two automatic monitoring stations. One station is located in Dalkeith town centre and the other station is located in the centre of Pathhead village. Further details of the monitoring stations are provided in Table 2.1. The location of the Dalkeith Centre and Pathhead monitoring stations are shown in Figure 3 and 4, respectively.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case location?
Dalkeith Centre	Roadside	X 333153 Y 667298	NO ₂ , PM ₁₀ , SO ₂	N	N (>25m)	3m	N/A
Pathhead	Roadside	X 339585 Y 664203	PM ₁₀ , SO ₂	Y *	Y (4m)	1m	Y

* AQMA declared for PM₁₀

The maintenance of the two monitoring stations at Dalkeith and Pathhead is carried out by Casella ETI. This involves two routine services per year and also provision for emergency callouts. Casella ETI also has the data management contract and collects all the raw data from each of the monitoring stations. The data are checked to ensure that the data is being recorded correctly, the analysers are stable and there are no faults with the analysers. The data is then re-scaled by Casella ETI using the results of calibration and span checks which are carried out by the analyser automatically or carried out manually by Midlothian Council every two weeks. The manual checks carried out by Midlothian Council include a span check in which a gas of known concentration is passed through the analysers and the measured concentrations, and other operating parameters, are recorded by the operator and sent to Casella ETI. The raw and re-scaled data are sent by Casella ETI to Midlothian Council at regular periods.

Further work has also been carried out by AEA Energy and Environment with regards to the QA/QC procedures for the Dalkeith and Pathhead monitoring stations to satisfy the requirements in LAQM.TG(09) and include the stations on the Air Quality in Scotland website (www.scottishairquality.co.uk). The work included 6-monthly audits and servicing, and data ratification. Audits of the monitoring site consisted of a number of performance checks to identify any faults with the equipment. The calibration cylinder was also checked against another gas standard in order to confirm the gas concentration. Any identified faults were forwarded on to the service unit for repair. The final stage of the QA/QC process was to ratify the data. During ratification, all calibration, audit and service data are collated and the data is appropriately scaled. Any suspect data identified are deleted therefore ensuring that the data are of a high quality.

PM₁₀ is measured at both monitoring stations using Tapered Element Oscillating Microbalance (TEOM) units. The concentrations recorded during 2008 from these analysers were corrected by AEA Energy and Environment using the revised Volatile Correction Model (VCM) (Ref. 2) provided by Defra. The model allows TEOM measurements to be corrected for the loss of volatile components that occur due to the high sampling temperatures employed by the TEOM instrument. The corrected measurements are considered to be equivalent to the gravimetric reference equivalent for PM₁₀ measurements. Further details of the correction are provided in Appendix A.

For TEOM measurements carried out before 2008 at Dalkeith and Pathhead, correction factors of 1.14 and 1.3 were utilised to modify the measured concentrations following Scottish Executive guidance. This method was not considered to be equivalent to the gravimetric reference equivalent.

2.1.2 Non-Automatic Monitoring

Monitoring of nitrogen dioxide using passive diffusion tubes was undertaken at 14 separate locations in Midlothian during 2008. The diffusion tube locations are shown in Figures 3, 4 and 5. The diffusion tube locations are described in Table 2.2.

Table 2.2 Details of Nitrogen Dioxide Diffusion Tube Monitoring Locations

Site Name	Location	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA ?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location ?
J1 (1, 2 and 3) *	Dalkeith	Roadside	X 333153 Y 667298	NO ₂	N	N (>25m)	3m	N/A
J2	Dalkeith	Roadside	X 333176 Y 667295	NO ₂	N	N (>10m)	1m	N/A
E1 *	Dalkeith	Urban Background	X 333385 Y 667188	NO ₂	N	Y (5m)	N/A	N/A
BD1	Dalkeith	Roadside	X 333079 Y 667176	NO ₂	N	Y (1m)	1m	Y
ED1	Dalkeith	Roadside	X 333170 Y 667410	NO ₂	N	N (>10m)	1m	N/A
ED2	Dalkeith	Roadside	X 332995 Y 667118	NO ₂	N	Y (1m)	2m	Y
X1	Dalkeith	Roadside	X 333009 Y 667214	NO ₂	N	N (>10m)	1m	N/A
HD1	Dalkeith	Roadside	X 333324 Y 667515	NO ₂	N	Y (2m)	2m	Y
ND1	Dalkeith	Roadside	X 333415 Y 667058	NO ₂	N	Y (2m)	1m	Y
P1 *	Penicuik	Urban Background	X 323161 Y 659847	NO ₂	N	Y (10m)	N/A	N/A
P2 *	Penicuik	Roadside	X 323680 Y 661021	NO ₂	N	Y (10m)	1m	Y
P3	Penicuik	Roadside	X 323555 Y 659801	NO ₂	N	Y (1m)	1m	Y
PD1	Pathhead	Roadside	X 339634 Y 664135	NO ₂	N	Y (1m)	2m	Y
PD2	Pathhead	Roadside	X 339451 Y 664311	NO ₂	N	Y (2m)	2m	Y

* tube results sent monthly to Netcen as part of the Nitrogen Dioxide Diffusion Tube Network reporting

The nitrogen dioxide diffusion tubes are placed at each location by Midlothian Council for a period of approximately one month, based on a pre-arranged timetable provided by Netcen. At the end of each monitoring period, the exposed tubes are replaced with new tubes and the exposed tubes are sent to the laboratory for analysis. The analysis is carried out by Edinburgh Scientific Services (ESS), part of the City of Edinburgh Council. ESS has confirmed that the procedures set out in the Harmonisation Practical Guidance are followed during the analysis. The laboratory is UKAS accredited for the analysis and also participates in the Workplace Analysis Scheme for Proficiency (WASP) scheme. ESS has reported that the results from the WASP scheme confirm that the laboratory is performing satisfactorily and the bias has been close to zero for several years. The laboratory uses the 50% v/v triethanolamine (TEA) in acetone method where the adsorbent pads are dipped into this solution, dried and then inserted into the acrylic diffusion tubes. All exposure times and dates are recorded by Midlothian Council and sent to the laboratory with the exposed tubes. Midlothian Council also sends one unexposed tube with each batch to check that there has been no contamination during the analysis.

2.2 Comparison of Monitoring Results with Air Quality Objectives

This section sets out the results of all the monitoring carried out by Midlothian Council in 2008 and where relevant, provides results from previous years to identify any trends.

2.2.1 Nitrogen Dioxide

The results of the nitrogen dioxide monitoring at the automatic station in Dalkeith and diffusion tube locations across Midlothian are presented below.

Automatic Monitoring Data

The results of the automatic monitoring are set out in Table 2.3a and Table 2.3b.

Table 2.3a Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data capture	Annual mean concentration 2008 ($\mu\text{g}/\text{m}^3$)
Dalkeith Centre	Dalkeith	N	97.2%	28

Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Data capture	Number of exceedences of hourly mean 2008 ($200 \mu\text{g}/\text{m}^3$)
Dalkeith Centre	Dalkeith	N	97.2%	0

The results indicate that the air quality objectives for nitrogen dioxide were met at the location of the monitoring station in Dalkeith town centre in 2008. The annual mean concentrations recorded by the continuous monitoring station from 2003 – 2008 are shown in Table 2.3c.

Table 2.3c Results of Automatic Monitoring for Nitrogen Dioxide 2003 – 2008

Site ID	Location	Annual mean concentration ($\mu\text{g}/\text{m}^3$) Adjusted for bias					
		2003	2004	2005	2006	2007	2008
Dalkeith Centre	Dalkeith	-	24	26	26	26	28

The results presented in Table 2.3c indicate that at the monitoring station, the annual mean concentrations of nitrogen dioxide show an increasing trend since 2004. This is consistent with the trend recorded at the Edinburgh St Leonards monitoring station (the closest station with available data) over the same period.

Diffusion Tube Monitoring Data

The diffusion tube method is open to a degree of uncertainty inherent in the method and as such the results of the survey should be treated with some caution and used as indicators of nitrogen dioxide levels only. Bias correction methods have been developed to reduce the error in the results of the

diffusion tube survey. The most robust of these methods is co-location of diffusion tubes with a continuous monitor to calculate the tube bias. For this purpose, Midlothian Council has co-located triplicate diffusion tubes at the Dalkeith Centre continuous monitoring station since 2005. The results of the co-location study in 2008 are shown in Appendix A. The study resulted in a bias adjustment factor of 0.91. This means that the diffusion tube results are slightly higher than the continuous monitoring results. The bias adjustment data and calculations are shown in Appendix A. The bias adjustment factor reported in the Spreadsheet of Bias Adjustment Factors (version 03/09) produced by Defra and the Devolved Administrations (Ref. 3) for this laboratory and analysis method is 0.92 (based on 1 kerbside study), similar to the local bias adjustment factor. It was decided to use the local bias adjustment factor.

The bias adjustment factor was applied to the diffusion tube results situated at roadside locations only as the co-location study is based on roadside measurements. Diffusion tubes located at urban background locations were not adjusted.

Table 2.4a Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA?	Data Capture	Annual mean concentration 2008 ($\mu\text{g}/\text{m}^3$) Adjusted for bias *
J2	Dalkeith	N	100%	43.6
E1	Dalkeith	N	100%	14.0
BD1	Dalkeith	N	100%	37.6
ED1	Dalkeith	N	100%	40.8
ED2	Dalkeith	N	100%	28.5
X1	Dalkeith	N	100%	28.0
HD1	Dalkeith	N	92%	18.2
ND1	Dalkeith	N	92%	48.3
P1	Penicuik	N	100%	6.1
P2	Penicuik	N	100%	23.8
P3	Penicuik	N	100%	14.8
PD1	Pathhead	N	92%	19.7
PD2	Pathhead	N	100%	17.1

* Bias adjustment factor of 0.91 applied to Roadside measurements

The measured nitrogen dioxide concentrations at several diffusion tube locations were above the annual mean air quality objective of $40\mu\text{g}/\text{m}^3$. All these tube locations are located adjacent to the A68 in Dalkeith and have generally measured increasing concentrations since 2005 (see Table 2.4b). As reported in the Progress Report 2008, during this period there have been several developments and major road works in the centre of Dalkeith which have caused increased levels of congestion, especially during peak hours. The Dalkeith Bypass opened in September 2008 and this is likely to have reduced the number of vehicles travelling through Dalkeith town centre. Consequently, concentrations of nitrogen dioxide are expected to decrease in Dalkeith town centre in future years.

The highest concentration was measured at diffusion tube location ND1. The relevant exposure is a house situated approximately a further 2m back from the monitoring location. It is not possible to locate the diffusion tube at the façade due to limited access. The concentration at the house was estimated using the Nitrogen Dioxide Fall off with Distance Calculator provided by Defra and the Devolved Administrations (Ref. 4). Using the distance from the kerb to the measurement location and house and the background concentration based on the diffusion tube measurement E1, the estimated annual mean concentration at the nearby residential property was $40.7\mu\text{g}/\text{m}^3$, just over the annual mean objective. As the Bypass is expected to reduce the number of vehicles travelling through Dalkeith town centre, it is likely that the levels at the house close to ND1 will be less than the objective value in future years.

Concentrations above the annual mean objective were also recorded at diffusion tube locations J2 and ED1. As stated in the Progress Report 2008, these locations are not directly representative of

relevant exposure locations. Midlothian Council committed to reviewing these monitoring locations by the end of 2008 and it is confirmed that these were moved as a result of the review. The concentrations for 2009 and onwards for the updated locations will be reported in future LAQM reports.

Based on the above, Midlothian Council does not propose to carry out a Detailed Assessment of nitrogen dioxide levels adjacent to the A68 in Dalkeith at this time. Measurements of nitrogen dioxide will continue as normal to evaluate the effects of the Dalkeith Bypass, the new locations and wider trends in nitrogen dioxide concentrations. The annual mean concentrations will be assessed through the LAQM process. Further details on the trends and likely impact of the Dalkeith Bypass are provided below.

Table 2.4b Results of Nitrogen Dioxide Diffusion Tubes 2003 – 2008

Site ID	Location	Annual mean concentration ($\mu\text{g}/\text{m}^3$)					
		Roadside measurements adjusted for bias					
		2003	2004	2005	2006	2007	2008
J2	Dalkeith	41.6	40.6	34.3	38.6	43.4	43.6
E1	Dalkeith	12.5	12.8	11.5	12.3	14.4	14.0
BD1	Dalkeith	40.0	38.1	30.3	41.0	40.8	37.6
ED1	Dalkeith	33.4	33.1	35.8	40.4	43.0	40.8
ED2	Dalkeith	27.5	27.0	27.5	27.9	29.8	28.5
X1	Dalkeith	32.3	29.7	25.1	30.5	29.7	28.0
HD1	Dalkeith	17.4	18.2	16.4	17.9	19.8	18.2
ND1	Dalkeith	36.5	46.7	39.6	48.8	52.5	48.3
P1	Penicuik	6.1	9.0	7.1	5.8	7.4	6.1
P2	Penicuik	29.0	22.3	22.6	28.6	27.0	23.8
P3	Penicuik	-	13.3	15.5	16.2	17.1	14.8
PD1	Pathhead	14.6	19.0	17.1	16.1	19.4	19.7
PD2	Pathhead	15.7	21.9	14.5	17.9	19.3	17.1

The results presented in Table 2.4b are presented graphically in Figure 6 to illustrate any trends. The results indicate that concentrations of nitrogen dioxide measured across Midlothian are either relatively constant or slightly increasing up to 2007 with a decrease in 2008 at most diffusion tube locations. No overall decreasing trends were observed. To attempt to determine the likely impact on nitrogen dioxide levels in Dalkeith due to the Dalkeith Bypass, the average concentration recorded during October 2008 – December 2008 (i.e. subsequent to the Dalkeith Bypass opening) were compared to the average concentrations for the same period in previous years at diffusion tube location ND1 (where the highest concentrations have been recorded). This comparison is shown in Table 2.4d.

Table 2.4d Results of Nitrogen Dioxide Diffusion Tube ND1 for October – December 2003 – 2008

Site ID	Location	Average concentration for October to December ($\mu\text{g}/\text{m}^3$)					
		Adjusted for bias					
		2003	2004	2005	2006	2007	2008
ND1	Dalkeith	46.0	46.7	50.0	52.7	53.7	42.7

The results in Table 2.4d indicate that the average concentration for the October to December period in 2008 was the lowest out of 6 years of measured data. This provides a further indication that annual mean concentrations at the house adjacent to ND1 will comply with the annual mean objective in future years and that a Detailed Assessment for nitrogen dioxide at locations adjacent to the A68 in Dalkeith is not required at this stage. As stated above, measurements of nitrogen dioxide will continue as normal and the annual mean concentrations will be assessed through the LAQM process.

2.2.2 PM₁₀

The results of the automatic monitoring are set out in Table 2.5a and Table 2.5b. The TEOM measurements were corrected using the Volatile Correction Method and provided by AEA Energy and Environment. The summary for each location is provided in Appendix A.

Table 2.5a Results of PM₁₀ Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data capture	Annual mean concentration (µg/m ³)	
				2008	2010 ⁺
Dalkeith Centre	Dalkeith	N	82.7%	15.0	14.4
Pathhead	Pathhead	Y	95.2%	19.6	18.4
+ Predicted from 2008 data using the methodology in Box 2.2 of LAQM.TG(09)					

Table 2.5b Results of PM₁₀ Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	Data capture	Number of exceedences of 24-hour mean (50 µg/m ³)
				2008
Dalkeith Centre	Dalkeith	N	82.7%	0 (39.3) *
Pathhead	Pathhead	Y	95.2%	2

* 98th percentile of 24-hour means provided in brackets as data capture <90%.

The results indicate that the measured concentrations of PM₁₀ at Dalkeith comply with the annual mean and 24-hour mean air quality objectives for 2004 and 2010.

At Pathhead, the measured annual mean concentration of 19.6 µg/m³ in 2008 is above the 2010 annual mean objective value. When factored using the approach set out in Box 2.2 of LAQM.TG(09), the predicted concentration for 2010 is 18.4 µg/m³, slightly higher than the annual mean objective value. The number of exceedences of the 24-hour mean objective complies with the number of exceedences permitted by the 2004 and 2010 objectives. On the above basis, the results indicate that the annual mean air quality objective for PM₁₀ is forecast to be exceeded by a small margin in 2010. Following the declaration of the AQMA in April 2008, a Partisol gravimetric analyser was installed at Pathhead in early 2009. The results from the Partisol, and further measurements from the TEOM unit, will feed into the Further Assessment and will inform the decision making process for the Air Quality Action Plan. The gravimetric results will be utilised to confirm if the 2010 annual mean objective will be exceeded at Pathhead. If the results are less than 18 µg/m³, the AQMA may need to be revoked.

2.2.3 Sulphur Dioxide

The results of the automatic monitoring are set out in Table 2.6a, Table 2.6b and Table 2.6c.

Table 2.6a Results of SO₂ Automatic Monitoring: Comparison with 15-minute Mean Objective

Site ID	Location	Within AQMA?	Data capture	Number of exceedences of 15-minute mean (266 µg/m ³)
				2008
Dalkeith Centre	Dalkeith	N	95.3%	0
Pathhead	Pathhead	N	90.5%	0

Table 2.6b Results of SO₂ Automatic Monitoring: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Data capture	Number of exceedences of 1-hour mean (350 µg/m ³)
				2008
Dalkeith Centre	Dalkeith	N	95.3%	0
Pathhead	Pathhead	N	90.5%	0

Table 2.6c Results of SO₂ Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	Data capture	Number of exceedences of 24-hour mean (125 µg/m ³)
				2008
Dalkeith Centre	Dalkeith	N	95.3%	0
Pathhead	Pathhead	N	90.5%	0

The results indicate that the air quality objectives for sulphur dioxide are complied with at both monitoring locations.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

In order to provide an assessment of road traffic sources for this report, the most up to date information on traffic flows on several roads within Midlothian was obtained from the Roads and Transport Department at Midlothian Council and Transport Scotland. The updated traffic information is shown in Appendix B.

The towns of Dalkeith, Penicuik and Bonnyrigg were identified as areas where there are narrow congested streets with residential properties within 5m of the kerb in previous rounds of assessment. Dalkeith and Penicuik were assessed and do not require further consideration. However, Bonnyrigg was not assessed as there were no traffic data available. To determine the need for further assessment of narrow congested streets, the approach set out in Section A.1 of Box 5.3 in LAQM.TG(09) was followed using the traffic data now available. The relevant criteria and the description of the circumstances at Bonnyrigg High Street are shown below:

- *The daily traffic flow (AADT) is greater than 5,000 vehicles per day.* The AADT on Bonnyrigg High Street (B704) is 9,177 vehicles per day based on a survey carried out in May 2007 (see Appendix B);
- *There is slow moving traffic that is frequently stopping and starting due to pedestrian crossings, parked vehicles etc. Typical average speeds are likely to be 15mph or less.* There are traffic lights, parked vehicles and a busy junction. The average speed on Bonnyrigg High Street approximately 150m north of the junction with the B704 was approximately 20mph;
- *There needs to be residential properties within 2m of the kerb and buildings on both sides of the road.* There are buildings on both sides of Bonnyrigg High Street and there are residential properties within 2m of the kerb, largely on the 1st floor of the buildings fronting the street.

Although the average speed is slightly higher than the criteria, Midlothian Council consider that a more detailed assessment is required in Bonnyrigg High Street and as of January 2009, commenced diffusion tube monitoring at two locations in the centre of Bonnyrigg to determine the annual mean concentrations of nitrogen dioxide. The results of the monitoring will be reported in a Detailed Assessment in 2010 and in future LAQM assessment reports.

Midlothian Council has identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, not adequately considered in previous rounds of Review and Assessment, and **will need to proceed to a Detailed Assessment.**

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

The busy streets in the centre of Dalkeith and Penicuik were assessed in previous rounds. Locations not assessed where people may potentially spend some time outdoors on busy streets close to traffic are Bonnyrigg High Street and Clerk Street in Loanhead. The approach set out in Section A.2 of Box 5.3 of LAQM.TG(09) was followed to determine if a screening assessment of these locations was required. A busy street is defined in Section A.2 as one with more than 10,000 vehicles where people typically spend 1-hour or more, for example, streets with many shops and streets with outdoor cafes and bars.

High Street, Bonnyrigg: Although there are a number of shops on the High Street and it is possible people may spend one hour or more close to traffic, the vehicle flows on the High Street are less than 10,000 vehicles per day and therefore no further assessment is required.

Clerk Street, Loanhead: Although the vehicles flows are estimated to be higher than 10,000 vehicles per day, Clerk Street is relatively small, with only a few shops, and it is unlikely that people will spend one hour or more at or close to the kerbside. There are no outdoor cafes or bars. To confirm the concentrations of nitrogen dioxide at Clerk Street, diffusion tube measurements at one location close to a shop commenced in January 2009. The measured concentrations will be reported in the Detailed Assessment in 2010 and future LAQM assessment reports.

Midlothian Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HDVs.

Midlothian Council confirms that there are no new/newly identified roads with high flows of buses/Heavy Duty Vehicles (HDVs).

3.4 Junctions and Busy Roads

Busy roads in Midlothian were assessed in previous rounds. The main busy junctions that were not assessed previously due to lack of appropriate data are the junctions in Bonnyrigg (junction of the A6094 and B704) and Loanhead (junction of the A768 and B702).

The approach set out in Section A.4 of Box 5.3 of LAQM.TG(09) was followed to determine if a screening assessment of these locations was required and to then determine the need for a more detailed assessment. A screening assessment for nitrogen dioxide and PM₁₀ is required if the combined traffic flows at the junctions are in excess of 10,000 vehicles per day. As monitoring of nitrogen dioxide has already commenced in 2009 at Bonnyrigg and Loanhead in close proximity to the junctions (see Sections 3.1 and 3.2), the assessment of junctions and busy roads focuses on PM₁₀ only, and specifically the most demanding annual mean 2010 objective. Furthermore, Section A.4 of Box 5.3 of LAQM.TG(09) states that the results of nitrogen dioxide diffusion tube monitoring are preferred to Design Manual for Roads and Bridges (DMRB) (Ref. 5) screening assessment results.

The part of LAQM.TG(09) Section A.4 relating to assessment of busy roads and junctions in Scotland was followed. The background annual mean concentration of PM₁₀ at each junction was determined from the background maps provided by Defra and the devolved administrations. The background concentrations in 2010 are estimated to be 11.4 – 11.6 µg/m³ at the town centre locations. Based on the relevant guidance, a screening assessment will only be required if the combined traffic flows at these junctions are in excess of 10,000 vehicles per day and there is relevant exposure within 10m of the kerb.

Based on the traffic flow data and local knowledge of the junctions, Midlothian Council confirms that there is relevant exposure within 10m of the busy roads and junctions at each location. The traffic flow data in Appendix B indicates that the combined flows at each junction are in excess of 10,000 vehicles per day. Therefore, a DMRB screening assessment was carried out. The results are shown in detail in Appendix C.

The predicted concentrations are below the 2010 annual mean PM₁₀ objective and no further assessment is required at this stage.

Concentrations of nitrogen dioxide recorded by the diffusion tube measurements at these busy junctions will be reported in future LAQM assessment reports.

Midlothian Council has assessed new/newly identified junctions meeting the criteria in Section A.4 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

The new Dalkeith Bypass opened in September 2008. No information on previous air quality studies for the new road is available. The Approach 2 set out in Section A.5 of Box 5.3 in LAQM.TG(09) was followed to determine if further assessment of the new road was required.

Traffic count data for Nov 2008 – Feb 2009 at two locations on the A68 Dalkeith Bypass were provided by Transport Scotland. The average traffic flows during this period were approximately 7500 – 11000 vehicles per day depending on the count point location. However, the nearest residential property is in excess of 50m from the road. Therefore, there is no need to proceed further in assessing emissions of nitrogen dioxide and PM₁₀ from the A68 Dalkeith Bypass.

Midlothian Council has assessed new/newly identified roads meeting the criteria in Section A.5 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.6 Roads with Significantly Changed Traffic Flows

Midlothian Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Midlothian Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Midlothian Council confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

Midlothian Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Midlothian Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

Midlothian Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

Information on installations regulated under the Pollution Prevention and Control (Scotland) Regulations 2000 as either Part A or Part B processes was obtained from SEPA. The list of authorised processes is set out in Appendix D.

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Information on any new or proposed installations for which an air quality assessment has been carried out was obtained from SEPA. There is one facility operated by Moredun Group at the Pentland Science Park which has submitted an application for a Part A permit under the PPC Regulations to operate a relatively small hazardous waste incinerator. This application is currently being determined by SEPA. The facility is not located close to any areas where there are existing high concentrations of any of the relevant pollutants (such as nitrogen dioxide or PM₁₀). Consideration of the potential impacts will be incorporated into future LAQM assessments if the operator demonstrates to SEPA that the appropriate control techniques will be utilised through application of Best Available Techniques (BAT) and the permit application is successful.

Midlothian Council confirms that there are no new or proposed industrial installations for which planning and permitting approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

Information on any installations where emissions have increased substantially was obtained from SEPA. Midlothian Council confirms there is no new relevant exposure at existing industrial installations.

Midlothian Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Information on any new installations or installations which have changed significantly was obtained from SEPA.

Midlothian Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

Midlothian Council confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Information on any poultry farms which meet the criteria specified in Section C4 of LAQM.TG(09) was obtained from SEPA.

Midlothian Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

There is one biomass plant currently in operation in Midlothian. The plant is located at Pentland Plants near Loanhead and has a thermal input capacity of 2MW. The plant is a modern wood pellet fuelled boiler produced by Reka and includes a cyclone to reduce particulate emissions. Information on the parameters of the plant (stack height, stack diameter, nearby building height) were obtained and assessed following the approach set out in Section D.1a of LAQM.TG(09). Emissions were estimated from the data provided in the Technical Guidance: Screening Assessment for Biomass Boilers document (Ref. 6). The emissions for the plant were estimated as:

Oxides of nitrogen (NO_x) = 0.3 g/s (based on 150g/Gj for a wood pellet boiler)
PM₁₀ = 0.13 g/s (based on 66g/Gj for a wood pellet boiler)

The biomass plant screening tool available at www.airquality.co.uk was used to determine the maximum emission rate. The data on stack height, stack diameter, building height and background concentrations for each pollutant were entered into the screening tool. The results indicated that no further assessment would be required if the emissions from the plant were not higher than 0.64 g/s for oxides of nitrogen or 0.13 g/s for PM₁₀.

Therefore, the results indicate that no further assessment is required with regards to the biomass plant at Pentland Plants.

Midlothian Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

An assessment of domestic solid fuel burning (principally coal burning) was carried out in previous LAQM assessments by Midlothian Council. The assessments, and monitoring data, led to the declaration of the AQMA at Pathhead due to a forecast exceedence of the annual mean PM₁₀ objective for 2010. As the biomass plant near Loanhead is not in an area of significant domestic solid fuel use, there is no need to carry out an assessment of the combined impacts of biomass combustion at this time.

Midlothian Council confirms that there are no new combined biomass combustion impacts in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

As stated in section 6.2, an assessment of domestic solid fuel burning was carried out in previous LAQM assessments by Midlothian Council. No issues with regards to sulphur dioxide were identified and monitoring at Pathhead (and Dalkeith) has confirmed that there is no risk of exceeding the sulphur dioxide air quality objectives in Midlothian.

Midlothian Council confirms that there are no areas of significant domestic fuel use in the Local Authority area (except at Pathhead, see section 6.2).

7 Fugitive or Uncontrolled Sources

The Progress Report 2008 included information on the following new fugitive sources since the previous Updating and Screening Assessment in 2006. This information is reproduced below together with consideration of these sources following the approach set out in Box E of Chapter 5 of LAQM.TG(09):

- Scottish Coal Company Ltd, new opencast coal site at Shewington, nr Rosewell;

The site at Shewington is an extension to the existing Newbigging open cast coal site and has not been assessed previously. Using the background maps of air quality produced by Defra and the Devolved Administrations, the background PM₁₀ concentration in 2010 at the location of the site is estimated to be 9.9 µg/m³. For a background concentration of 9.9 µg/m³, the LAQM.TG(09) guidance requires that all residential properties within 200m of the potentially dusty sources to be identified. There is relevant exposure within 200m of the worked area at the site (Broachrigg Farmhouse and two other cottages). No complaints have been received in respect of dust and there have not been any complaints or evidence of dust tracked out onto the public highway. Coal extraction from this worked area is now completed and reinstatement works are underway. Once these are complete, the worked areas on the site will be further than 200m from Broachrigg Farm and the cottages.

- Scottish Coal Company Ltd, planning application soon to be submitted for a new opencast coal mining site at Airfield Farm, nr Cousland. This will include an air quality assessment.

The opencast site is situated in Midlothian but very close to the boundary of East Lothian. The planning application for the new opencast coal site at Airfield Farm has not yet been submitted and on this basis, no further assessment is required at this time.

Other potential sources of fugitive emissions of PM₁₀ are landfills. There are no new landfills in Midlothian and all existing landfill sites were assessed previously in the Updating and Screening Assessment 2003. There have been no complaints relating to dust emissions from the existing landfills.

Midlothian Council confirms that there are no potentially significant sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

The conclusions and proposed actions from this Updating and Screening Assessment are set out below.

8.1 Conclusions from New Monitoring Data

Monitoring inside the Pathhead AQMA (PM₁₀)

Monitoring of PM₁₀ was carried out in 2008 by the Pathhead automatic monitoring station. The results indicate that the forecast concentrations in 2010 are slightly above the 2010 annual mean objective value. This is based on TEOM measurements corrected using the VCM method. Midlothian Council, as part of the Further Assessment work being carried out subsequent to the declaration of the AQMA, installed a Partisol gravimetric analyser in early 2009 at Pathhead to enable a direct comparison of the measured concentrations to the 2010 objective. These results will enable Midlothian Council to confirm in the Further Assessment if the AQMA at Pathhead will be revoked or retained.

Monitoring outside the Pathhead AQMA

Monitoring of nitrogen dioxide, PM₁₀ and sulphur dioxide was carried out at the Dalkeith Centre automatic monitoring station. The results were all within the relevant air quality objectives. Monitoring of sulphur dioxide was also carried out by the Pathhead automatic monitoring station. The results are well below the air quality objective values. However, the measured concentrations were higher than those recorded in Dalkeith, indicating that domestic solid fuel combustion is contributing to sulphur dioxide (and PM₁₀) concentrations at the monitoring station location. On this basis, measurements of sulphur dioxide will continue to input into the LAQM assessment process although no detailed assessment is required.

Monitoring of nitrogen dioxide was carried out at several locations across Midlothian using diffusion tubes. The results indicated that concentrations measured adjacent to busy roads in Penicuik and Pathhead were within the annual mean air quality objective. The results at some of the locations within Dalkeith adjacent to the old A68 were above the annual mean objective. This was at diffusion tube locations ND1, J2 and ED1. The diffusion tube locations J2 and ED1 were not representative of human exposure locations and were moved at the end of the 2008 monitoring period. Some other changes to the existing nitrogen dioxide diffusion tube monitoring survey have been implemented by Midlothian Council for the commencement of the 2009 monitoring period. Details of these changes and the monitoring results will be set out in the Progress Report in 2010.

As discussed in Chapter 2, the predicted concentration at the house near to location ND1 was just above the annual mean objective value. The opening of the A68 Dalkeith Bypass in late 2008 will lead to a reduction in nitrogen dioxide concentrations at locations adjacent to the old A68 in Dalkeith. The analysis of monitoring results set out in Table 2.4d indicates that the measured concentrations for the period since the bypass opened (October – December 2008) is the lowest recorded for the same period in the previous 5 years. Traffic data set out in Appendix C indicates that the traffic flows on the A68 to the south of Dalkeith town centre have decreased by approximately 6000 vehicles per day in the first few months of the Dalkeith Bypass opening. On this basis, it is likely that the concentrations of nitrogen dioxide will be below the annual mean objective value at the house adjacent to ND1 and this will be confirmed in the Progress Report 2010 which will set out the diffusion tube monitoring results for 2009. Midlothian Council does not propose to carry out a Detailed Assessment of nitrogen dioxide levels in the vicinity of the old A68 in Dalkeith centre at this time.

8.2 Conclusions from Assessment of Sources

Road Traffic Sources

The Updating and Screening Assessment has identified that a Detailed Assessment is required for nitrogen dioxide due to potentially high levels in the narrow congested High Street, Bonnyrigg. The air quality objective of interest is the annual mean objective of $40 \mu\text{g}/\text{m}^3$. Nitrogen dioxide diffusion tube monitoring has commenced in 2009 at locations on the High Street and Lothian Street and the results of these measurements will form the basis of the Detailed Assessment in 2010.

Consideration of the other road sources indicates that a Detailed Assessment is not required for these elements.

Other Transport Sources

No issues were identified in relation to the other transport sources.

Industrial Sources

No issues were identified in relation to industrial sources. Assessment of the proposed hazardous waste facility at the Pentlands Science Park will be carried out in future LAQM assessments if the operator obtains authorisation to operate the plant.

Commercial and Domestic Sources

The biomass plant at Pentland Plants was assessed and it was concluded that emissions from the plant were not significant. No other issues were identified in relation to commercial and domestic sources.

Fugitive and Uncontrolled Sources

No issues were identified in relation to fugitive and uncontrolled sources.

8.3 Proposed Actions

The Further Assessment currently being produced by Midlothian Council will confirm if the AQMA at Pathhead will be revoked or retained, based on the gravimetric monitoring results.

The next course of action for Midlothian Council in the Review and Assessment process is summarised as:

- Submit the Progress Report by 30 April 2010; and
- Submit the Detailed Assessment report by 30 April 2010 to assess annual mean concentrations of nitrogen dioxide in the High Street, Bonnyrigg due to the identification of a narrow congested street with more than 5,000 vehicles per day.

9 References

1. Defra and the Devolved Administrations, Local Air Quality Management, Technical Guidance LAQM.TG(09), February 2009.
2. Defra and the Devolved Administrations, Volatile Correction Model, July 2008, accessed at <http://www.volatile-correction-model.info/> April 2009.
3. Defra and the Devolved Administrations, Spreadsheet of Bias Adjustment Factors, version 03/09, accessed at www.uwe.ac.uk/aqm, April 2009.
4. Defra and the Devolved Administrations, NO2 Fall off With Distance Calculator, Issue 2 16/3/09, accessed at www.airquality.co.uk/laqm, April 2009.
5. Department for Transport, Design Manual for Roads and Bridges, version 1.03c, July 2007.
6. AEA Energy & Environment on behalf of Defra and the Devolved Administrations, Technical Guidance: Screening Assessment for Biomass Boilers, ED48673005/R2655, Issue Number 1, July 2008, accessed at www.airquality.co.uk/laqm, April 2009.

Appendices

Appendix A: QA/QC Data

Appendix B: Traffic Flow Data

Appendix C: DMRB Calculations

Appendix D: List of Industrial Processes

Appendix A: QA:QC Data

Diffusion Tube Bias Adjustment Factors

The diffusion tubes are analysed by Edinburgh Scientific Services using the 50% triethanolamine (TEA) in acetone method. The bias adjustment factor for this laboratory and method for the year 2008 listed in the Spreadsheet of Bias Adjustment Factors v.03/09 (Ref. 3) is 0.92. This is based on one co-location study at a Kerbside site carried out for the AEA Technology Intercomparison study.

Factor from Local Co-location Studies (if available)

A local co-location study is carried out by Midlothian Council. Three diffusion tubes are located adjacent to the inlet of the Dalkeith Centre automatic monitoring station – tubes J1 (1, 2 and 3) as detailed in Table 2.2. The bias adjustment factor for 2008 was calculated as 0.91 using this study. The bias adjustment calculations are shown below.

Checking Precision and Accuracy of Triplicate Tubes										AEA Energy & Environment From the AEA group	
Diffusion Tubes Measurements										Automatic Method	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)
1	02/01/2008	30/01/2008	30.0	26.0	40.0	32	7.2	23	17.9	26.5	96
2	30/01/2008	27/02/2008	27.0	19.0	37.0	28	9.0	33	22.4	32.3	100
3	27/02/2008	02/04/2008	18.0	19.0	24.0	20	3.2	16	8.0	25.3	100
4	02/04/2008	30/04/2008	38.0	36.0	44.0	39	4.2	11	10.3	32.1	100
5	30/04/2008	28/05/2008	40.0	36.0	35.0	37	2.6	7	6.6	29.7	100
6	28/05/2008	02/07/2008	24.0	26.6	24.0	25	1.5	6	3.7	24.9	77
7	02/07/2008	30/07/2008	26.0	28.0	22.0	25	3.1	12	7.6	22.8	100
8	30/07/2008	03/09/2008	25.5	30.9	34.7	30	4.6	15	11.6	23.7	100
9	03/09/2008	01/10/2008	30.0	28.0	29.0	29	1.0	3	2.5	24.0	100
10	01/10/2008	29/10/2008	24.0	22.0	24.0	23	1.2	5	2.9	20.0	99
11	29/10/2008	03/12/2008	38.0	34.0	31.0	34	3.5	10	8.7	31.5	100
12	03/12/2008	07/01/2009	34.0	35.0	41.0	37	3.8	10	9.4	34.8	99
13											

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Site Name/ ID:	Dalkeith Monitoring Station
Accuracy (with 95% confidence interval) without periods with CV larger than 20%	Precision 10 out of 12 periods have a CV smaller than 20%
Bias calculated using 10 periods of data Bias factor A 0.89 (0.82 - 0.98) Bias B 12% (2% - 22%)	Accuracy (with 95% confidence interval) WITH ALL DATA Bias calculated using 12 periods of data Bias factor A 0.91 (0.83 - 1) Bias B 10% (0% - 20%)
Diffusion Tubes Mean: 30 μgm^{-3} Mean CV (Precision): 10 Automatic Mean: 27 μgm^{-3} Data Capture for periods used: 98%	Diffusion Tubes Mean: 30 μgm^{-3} Mean CV (Precision): 13 caution Automatic Mean: 27 μgm^{-3} Data Capture for periods used: 98%
Adjusted Tubes Mean: 27 (25 - 29) μgm^{-3}	Adjusted Tubes Mean: 27 (25 - 30) μgm^{-3}

Overall survey --> Good precision Good Overall DC

(Check average CV & DC from Accuracy calculations)

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Version 03 - November 2006

Discussion of Choice of Factor to Use

The results of the diffusion tube measurements were adjusted using the bias adjustment factor derived from the local co-location study (the factor of 0.91). This was chosen as only one study was available in the bias adjustment spreadsheet and this was at a Kerbside location with significantly higher measured concentrations than the local study Roadside location and measured typical concentrations across Midlothian. In any case, the factors from both studies are very similar and there is no impact from using the slightly lower locally derived bias adjustment factor.

PM Monitoring Adjustment

The TEOM PM₁₀ measurements for the Dalkeith Centre and Pathhead automatic monitoring stations were adjusted using the Volatile Correction Method (VCM) as recommended in LAQM.TG(09). The VCM corrections were carried by AEA Energy and Environment using the web portal available through the national air quality archive (Ref. 2). The method used by AEA Energy and Environment is summarised below (this is an excerpt from the information provided to Midlothian Council by AEA Energy and Environment).

Midlothian Council - Scotland

Introduction

AEA has been funded by The Scottish Government to provide VCM corrected TEOM (Tapered Element Oscillating Microbalance) data to Local Authorities under the Scottish Air Quality Archive Website project. This is a short summary outlining the method used by AEA for correcting the Scottish Archive TEOM data.

Method

The following data are required as inputs to the VCM:

- Daily average temperatures
- Daily average pressures
- Daily average TEOM concentrations ($\mu\text{g}/\text{m}^3$)
- Daily average FDMS (Filter Dynamic Measurement System) purge measurements ($\mu\text{g}/\text{m}^3$)

The VCM can also use hourly average inputs, however, it was found that the model has difficulty in coping with hourly data and therefore daily average data was used.

Daily average temperatures and pressure measurements from the Edinburgh St Leonards AURN site were used in the model. This site was selected as a good representation of the weather in the central belt of Scotland and the data showed good correlation with Leuchars Meteorological Station data.

The VCM uses inputs from up to three FDMS sites in the correction of TEOM data. However, it was found that the results varied depending on which three FDMS sites were used. Therefore, daily average purge measurements from 9 Scottish FDMS sites were used for the correction. The 9 sites used are:

- East Dunbartonshire Kirkintilloch
- Edinburgh St Leonards
- Fife Rosyth
- Glasgow Abercromby
- Glasgow Broomhill
- Glasgow Nithsdale Road
- Paisley Gordon Street
- West Lothian Broxburn
- West Lothian Linlithgow

The average of the daily purge measurements from the 9 sites was then calculated with any outliers identified during the ratification process being removed from the data-set. This average purge measurement was then used in the VCM.

VCM Spreadsheet

A template VCM spreadsheet was produced using the meteorological and purge measurement data describe above. All TEOM data was then inputted into this template and the results recorded.

The attached VCM spreadsheet displays all the data inputs used by AEA for the correction of your TEOM data. The final tab named "Analyses" displays the VCM corrected annual average PM_{10} concentrations and the number of daily exceedences.

Short-term to Long-term Data adjustment

No adjustment for short-term to long-term measured concentrations was required for this study as all measurements covered the full period of 2008.

QA/QC of automatic monitoring

Details of the QA/QC of automatic monitoring are provided in Chapter 2.

QA/QC of diffusion tube monitoring

Details of the QA/QC of diffusion tube monitoring are provided in Chapter 2.

Appendix B: Traffic Flow Data

Table of traffic data

Ref.	Town / Village	Road	Location	AADT	Year of count	HDV%	Average Speed (km/h)	Notes
1	N/A	A720	Edinburgh City Bypass (East of Gilmerton Junction)	39751	2008	-	-	
2	N/A	A720	Edinburgh City Bypass (East of Sheriffhall junction)	37177	2008/9	-	-	
3	N/A	A68 (old)	Old Dalkeith Road (south of City Bypass Sheriffhall junction)	12858	2008	-	-	
4	N/A	A68 (new)	Dalkeith Bypass (north section)	7558	2008/9	-	-	Opened during September 2008
5	N/A	A68 (new)	Dalkeith Bypass (south section)	10997	2008/9	-	-	Opened during September 2008
6	Dalkeith	A68 (old)	Lauder Road (north of Junction with B6482 Easthouses Road)	14003	2008	-	-	Dalkeith Bypass opened during September 2008. Flow data for Oct 08 – Dec 08 indicates AADT of 9750 compared with approximately 15500 for same period in 2006 and 2007.
7	Dalkeith	A6094	Musselburgh Road (north east of Dalkeith town centre)	8464	2008	-	-	
8	Pathhead	A68	Main Street (south end of village)	8888	2008	8.0%	-	
9	N/A	A68	(East of Fala Tunnel)	8334	2008	8.0%	-	
10	N/A	A7	(North of junction with Gilmerton Road)	11608	2008	-	-	
11	N/A	A7	(North of junction with A6094)	22145	2007	-	-	
12	N/A	A7	(South of junction with A6094 Road)	19683	2007	-	-	
13	Bonnyrigg	A6094	Polton Street (at Hopefield Primary School)	13162	2007	12.1%	44	
14		B704	High Street (south of Park Road)	9177	2007	9.3%	32	
15		B704	Cockpen Road	9213	2008	-	-	

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Table of traffic data (continued)

Ref.	Town / Village	Road	Location	AADT	Year of count	HDV%	Average Speed (km/h)	Notes
16	Loanhead	A768	The Loan	10285	2008	-	-	1200m west of junction with B702
17		B702	Loanhead Road	10404	2006	-	-	Just south of junction with A710 at Straiton. Likely to include large portion of traffic travelling to Straiton Retail Park
18	Straiton	A701	Straiton Road	23380	2008	-	-	Based on southbound traffic flows (assumes same volume of traffic northbound)
19	N/A	A703	Seafield Moor Road	6988	2006	-	-	
20	New Milton	A701	Edinburgh Road	19354	2008	-	-	North of junction with B7026 The Brae
21	Penicuik	A701	Edinburgh Road	16926	2007	9.5%	39	Between junctions of The Quadrant and Cuiken Avenue
22		A766	Carlops Road	2903	2008	-	-	
23	Fulford	A702	Biggar Road	11870	2008	-	-	
24	Easter Howgate	A702	Biggar Road	10627	2008	-	-	
25	N/A	A702	Biggar Road	6076	2008	-	-	North of Silverburn

Appendix C: DMRB Calculations

Input Data

Location/ Receptor	Grid Ref	Background Concentration	
		Year	PM ₁₀
A	330900, 665200	2008	11.7
		2010	11.4
B	328250, 665600	2008	11.9
		2010	11.6

A = residential property close to junction of High Street (B704) (Link 1) and Polton Street/Lothian Street (A6094) (Link 2), Bonnyrigg

B = residential property close to junction of Clerk Street (B702) (Link 1) and The Loan/High Street (A768) (Link 2), Loanhead

Location/ Receptor	Link number	Distance from link centre to receptor (m)	Traffic flow & speed		Traffic composition		
			AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B,C,D)	Total % LDV (<3.5t GVW)	Total % HDV (>3.5t GVW)
A	1	7	9177	15	B	90.7	9.3
	2	12	13162	15	B	87.9	12.1
B	1	6	10404	15	B	89.3 *	10.7 *
	2	18	10285	15	B	89.3 *	10.7 *

* No LDV/HDV data available for Loanhead. The LDV and HDV % estimated from average of LDV/HDV split recorded at Bonnyrigg approximately 2km to the east.

Verification

No model verification was carried out as there are no measurements of PM₁₀ in the vicinity of the assessment locations.

Results

The results of the DMRB assessment are shown in the table below.

Location/ Receptor	Name	Year	PM ₁₀	
			Annual mean µg/m ³	Days >50µg/m ³
A	Property close to junction of High Street and Polton Street/Lothian Street, Bonnyrigg	2010	16.4	0
B	Property close to Clerk Street and The Loan/High Street, Loanhead	2010	16.0	0

Appendix D: List of Industrial Processes

Table of industrial processes

License Number	Operator	Site	Regulation Category	Schedule 1 Activity	Section
PPC/E/0020007	Waste Recycling Group Ltd	Drummond Moor (No2) Landfill Site, Penicuik	Part A	Chapter 5: Waste Management	5.2.a
PPC/E/0020034	Interflex Ltd	Peggy's Mill, Edinburgh	Part A	Chapter 6: Other Activities	6.4.b
PPC/E/0020057	Waste Recycling Group Ltd	Oatslie Sandpit Landfill Site, Roslin	Part A	Chapter 5: Waste Management	5.2.a
PPC/E/0020082	Deans Foods	Loanhead Processing Plant	Part A	Chapter 6: Other Activities	6.8.d.(i)
PPC/B/1003133	N.C.R.C Heggie (Edinburgh) Ltd	Unit C, Pentland Industrial Estate	Part B	Chapter 6: Other Activities	6.4.b
PPC/B/1003236	Brand and Rae Ltd	Bonnyrigg Ready Mix Concrete Plant, Bonnyrigg	Part B	Chapter 3: Mineral Industries	3.1.a.(ii)
PPC/B/1004347		Millerhill Disposal Point, Edinburgh	Part B	Chapter 3: Mineral Industries	3.5.b.(i)
PPC/B/1004359	Hanson Premix	Nivensknowe Rd, Loanhead	Part B	Chapter 3: Mineral Industries	3.1.a.(ii)
PPC/B/1009121	Tarmac Northern	Old Pentland, Midlothian	Part B	Chapter 3: Mineral Industries	3.5.e
PPC/B/1010425	W & J Short	Dalkeith	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/B/1010428	Sainsbury's	Petrol filling station	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/B/1010582	Esso	Fordel Service Station, Lauder Road, Dalkeith	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/B/1010585	Hay's of Penicuik	Penicuik	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/B/1012932	Johnsons	Sainsburys Loanhead	Part B	Chapter 7: SED Activities	Chapter 7: SED Activities
PPC/B/1013309	Shell	Newtonloan	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/B/1014758	Crawford Drycleaning Services	Bonnyrigg	Part B	Chapter 7: SED Activities	Chapter 7: SED Activities
PPC/B/1014928	Drycleaning & Laundry Services	Dalkeith	Part B	Chapter 7: SED Activities	Chapter 7: SED Activities
PPC/B/1015551	RFA-em Co. Ltd	Bilston Glen, Loanhead	Part B	Chapter 7: SED Activities	Chapter 7: SED Activities
PPC/B/1016238	Leiths (Scotland) Ltd		Part B	Chapter 3: Mineral Industries	3.5.e
PPC/B/1016238	Leiths (Scotland) Ltd		Part B	Chapter 3: Mineral Industries	3.1.a.(ii)
PPC/B/1018366	Q4 Drycleaning	Penicuik	Part B	Chapter 7: SED Activities	Chapter 7: SED Activities

Table of industrial processes (continued)

License Number	Operator	Site	Regulation Category	Activity	Section
PPC/E/0030016	Esso	Lothianburn Service Station	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/E/0030019	Shell	Easthouses	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/E/0030068	Tarmac Northern Ltd	Catewell Quarry - Dalkeith	Part B	Chapter 3: Mineral Industries	3.1.a.(ii)
PPC/E/0030073	Howie Minerals Ltd	Middleton Limeworks	Part B	Chapter 3: Mineral Industries	3.5.a
PPC/E/0030122	Scottish Coal Company Ltd	Newbigging OCCS - Rosewell	Part B	Chapter 3: Mineral Industries	3.5.b.(ii)
PPC/E/0030122	Scottish Coal Company Ltd	Newbigging OCCS - Rosewell	Part B	Chapter 3: Mineral Industries	3.5.b.(i)
PPC/E/0030122	Scottish Coal Company Ltd	Newbigging OCCS - Rosewell	Part B	Chapter 3: Mineral Industries	3.5.b.(iii)
PPC/E/0030147	Tesco	Tesco Filling Station	Part B	Chapter 1: Energy Industries	1.2.c.(ii)
PPC/E/0030154	The Moredun Foundation	Pentlands Science Park, Penicuik	Part B	Chapter 5: Waste Management	5.1.a
PPC/E/0030156	<i>The Edinburgh Crystal Glass Company Ltd *</i>	<i>Loanhead</i>	<i>Part B</i>	<i>Chapter 3: Mineral Industries</i>	<i>3.3.d</i>

* permit likely to be revoked as company ceased trading

Figures

- Figure 1 Schematic showing boundary of Midlothian, towns, villages and significant roads
- Figure 2 Air Quality Management Area, Pathhead
- Figure 3 Location of automatic monitoring station and passive diffusion tubes in Dalkeith
- Figure 4 Location of automatic monitoring station and passive diffusion tubes in Pathhead
- Figure 5 Location of passive diffusion tubes in Penicuik
- Figure 6 Annual mean nitrogen dioxide diffusion tube concentrations in Midlothian 2003 – 2008

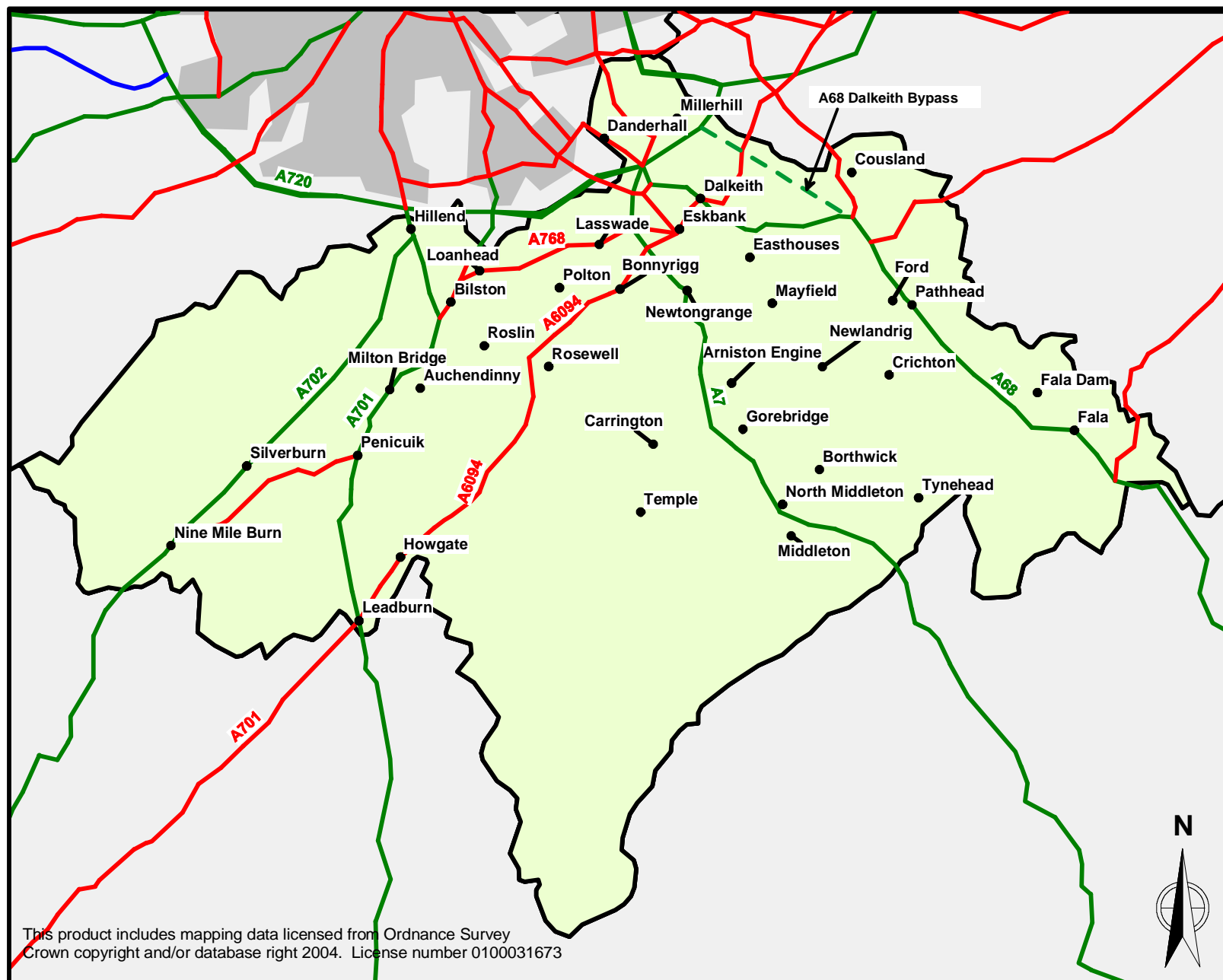
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FIGURE 1

Schematic showing boundary of Midlothian, towns, villages and significant roads

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DRAWN:	SBY
CHECKED:	DMB
CAN:	MD0080027
DATE:	APR 2009

KEY:

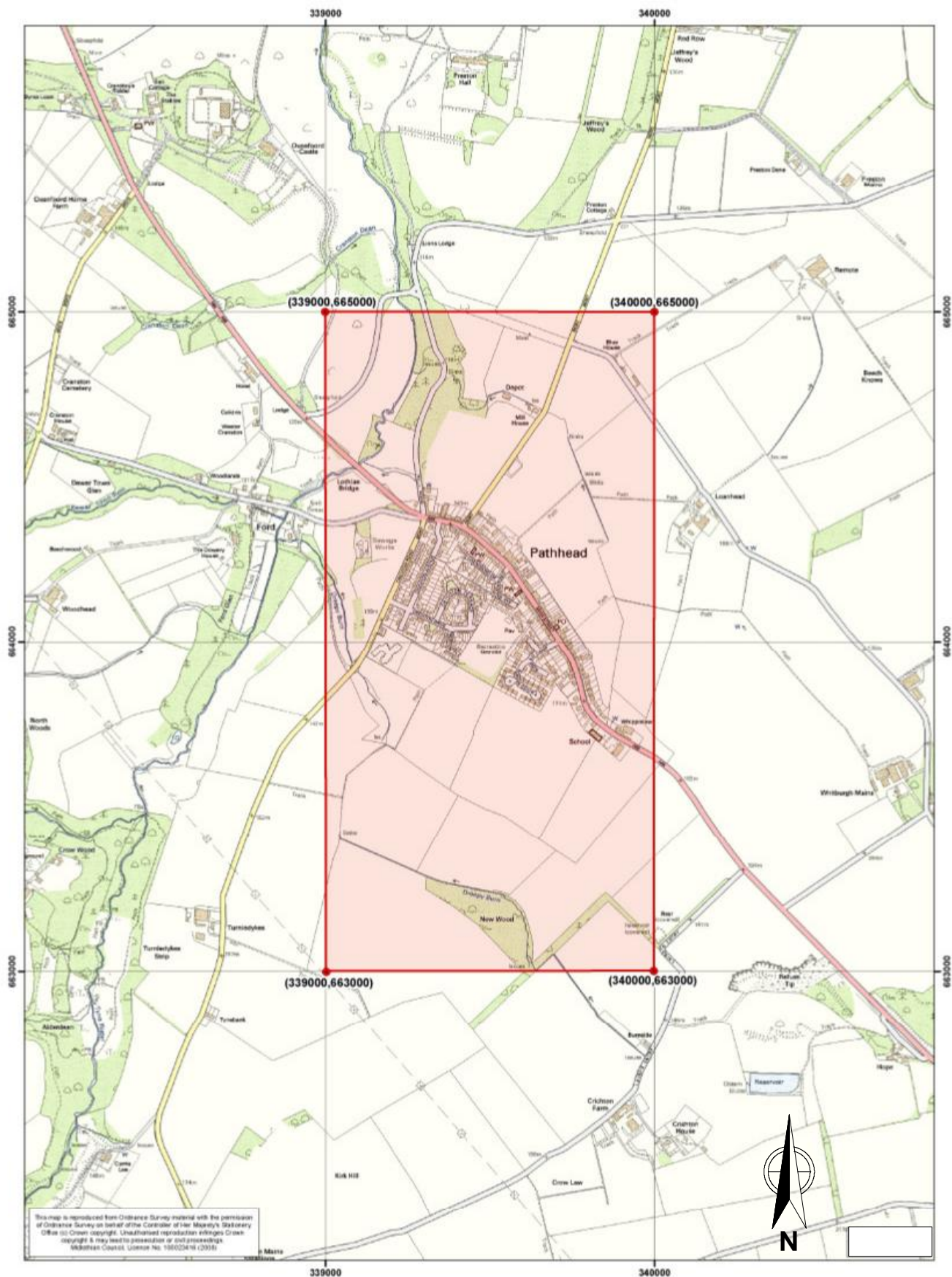


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FIGURE 2

Air Quality Management Area for PM10, Pathhead

SCALE: N/A

CONTENT: SBY

CHECKED: DMB

CAN: MD0080027

DRAWN: SBY

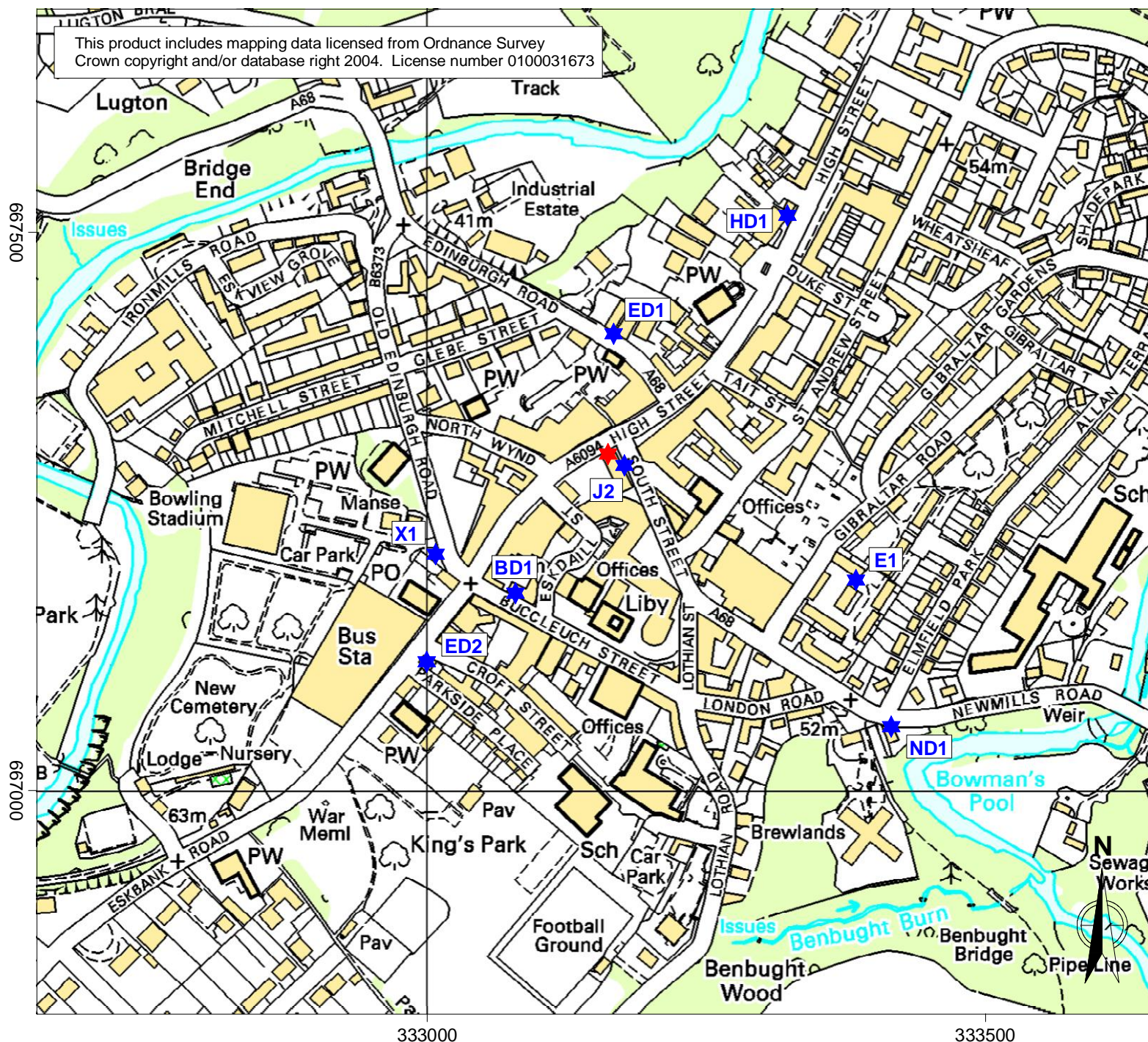
DATE: APR 2009

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FIGURE 3

Location of automatic monitoring station and passive diffusion tubes in Dalkeith

SCALE: N/A
CONTENT: SBY
DRAWN: SBY
CHECKED: DMB
CAN: MD0080027
DATE: APR 2009

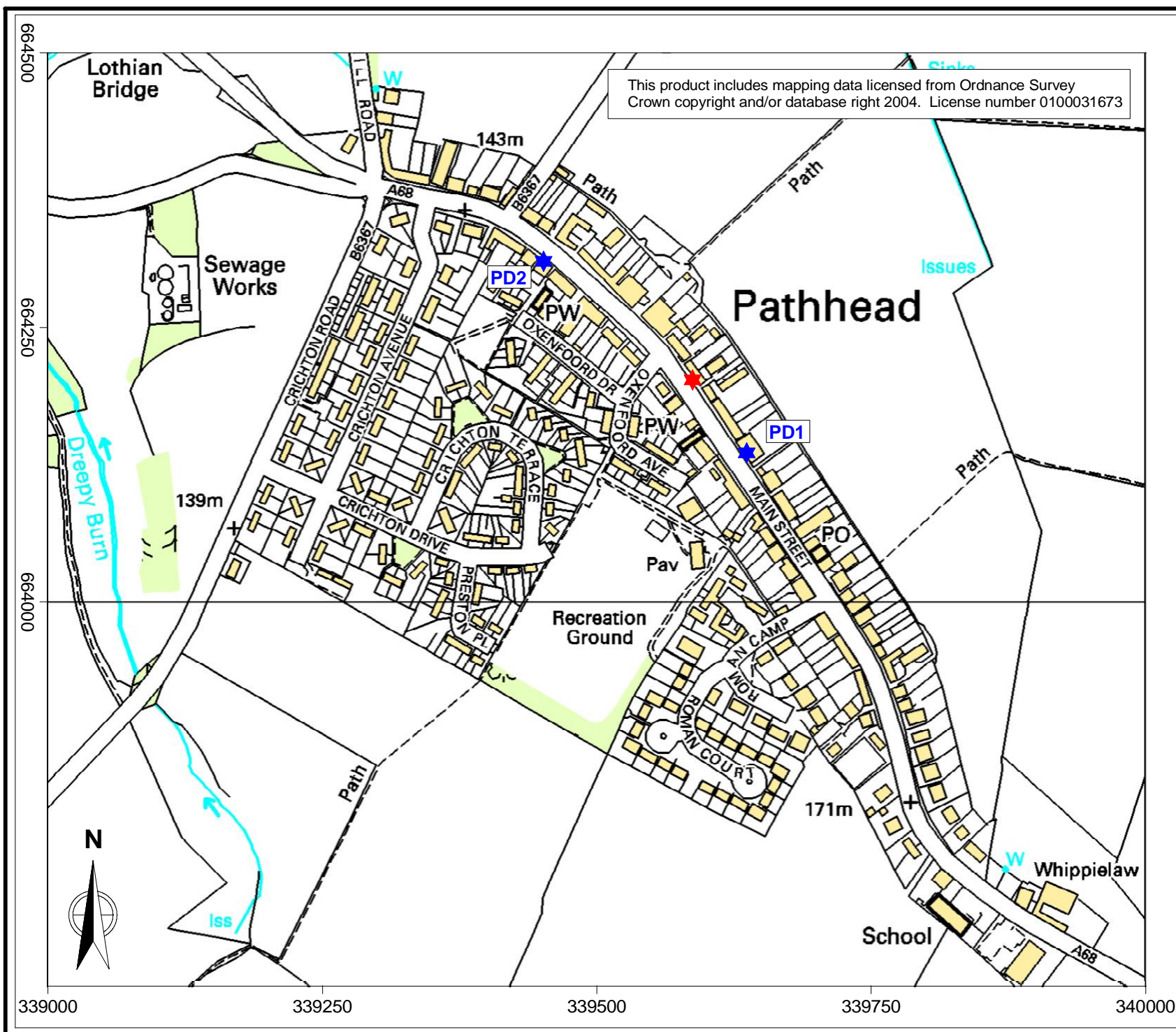
KEY:

- ★ Automatic monitoring station location
- ★ Diffusion tube location

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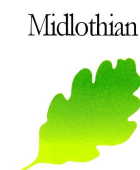
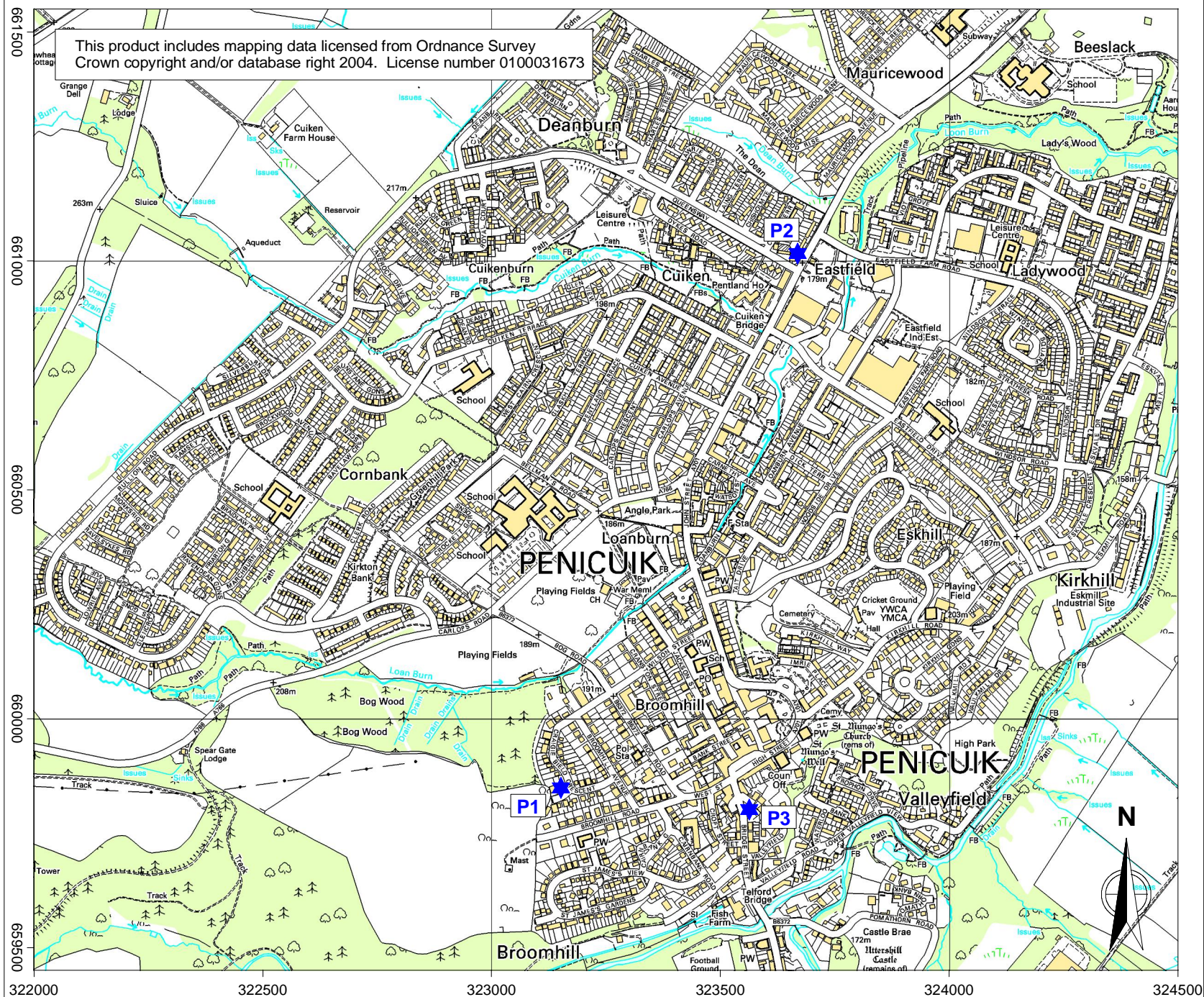
FIGURE 5

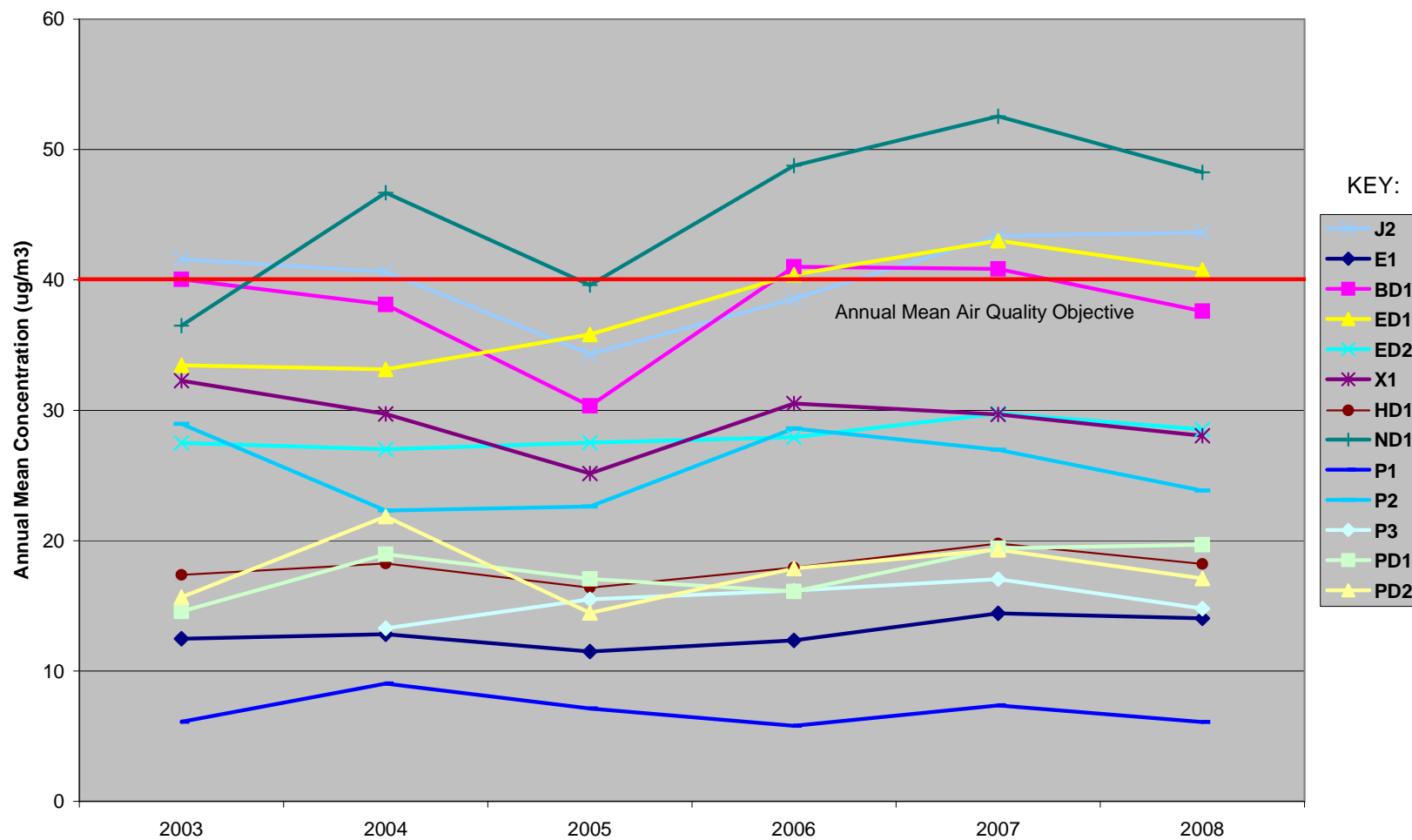
Location of passive diffusion tubes in Penicuik

SCALE: N/A
 CONTENT: SBY
 DRAWN: SBY
 CHECKED: DMB
 CAN: MD0080027
 DATE: APR 2009

KEY:

★ Diffusion tube location





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FIGURE 6

Annual mean nitrogen dioxide diffusion tube concentrations in Midlothian 2003 - 2008

SCALE: N/A

CONTENT: SBY

DRAWN: SBY

CHECKED: DMB

CAN: MD0080027

DATE: APR 2009

Midlothian

