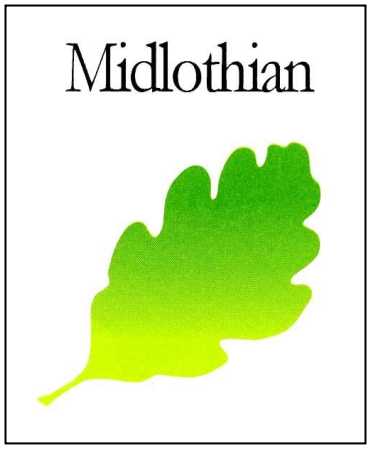

Further Assessment for *Midlothian Council*

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

August 2010

Local Authority Officer	Edel Ryan Principal Environmental Health Officer

Department	Communities and Wellbeing
Address	Midlothian Council Fairfield House 8 Lothian Road Dalkeith Midlothian EH22 3ZH
Telephone	0131 270 7500
e-mail	Edel.Ryan@midlothian.gov.uk

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Executive Summary

Midlothian Council has carried out a Further Assessment 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 and discusses the results of air quality monitoring carried out by Midlothian Council in Pathhead following declaration of an AQMA for PM_{10} in 2008.

It was found that concentrations of PM_{10} measured by both the Partisol and TEOM complied with the annual average air quality objective and the 24-hour mean air quality objective. However, the annual mean PM_{10} concentration is close to the objective value and will be continued to be monitored to inform the decision on whether the AQMA should remain in place or be revoked at a later date.

If future measured concentrations indicate that the AQMA should remain in place and an Air Quality Action Plan is drawn up, the estimated contribution of domestic solid fuel burning to total measured PM_{10} concentrations will be determined in more detail. Based on the further analysis carried out by Midlothian Council set out in this report, it is estimated that the contribution to annual mean PM_{10} concentrations is approximately 3 – 4 $\mu g/m^3$. This will assist in identifying the likely effectiveness of any options identified in the Air Quality Action Plan.

Based on the data and analysis set out in this Further Assessment, the next course of action for Midlothian Council is summarised as:

- Continue monitoring PM_{10} using the TEOM and Partisol in Pathhead;
- Carry out analysis of elemental and organic carbon on a selection of exposed filters throughout the year. Analysis of metals and anions will be ceased; and
- Discuss the need/requirements for the Air Quality Action Plan with the Scottish Government following a further monitoring period.

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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.

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

Local Authorities are required to regularly review and assess air quality within their area. These reviews and assessments are the basis of Local Air Quality Management (LAQM) and are intended to compare current and future concentrations of air pollutants with the objectives detailed in Regulations as part of the Air Quality Strategy.

Where the review concludes that air quality objectives will not be met within the statutory timeframe, the local authority is required by law to designate an Air Quality Management Area (AQMA). Midlothian Council declared such an AQMA at Pathhead in 2008 as information gathered for the previous LAQM reports confirmed that the annual mean air quality objective for PM_{10} (particulate matter with an aerodynamic diameter of 10 microns or less) of 18 $\mu g/m^3$ would be exceeded.

Where an AQMA has been declared the local authority must undertake a Further Assessment of pollutant levels within 12 months of the AQMA being declared. This assessment should seek to confirm the original appraisal of pollutant levels, report on additional monitoring or assessment, seek to quantify the improvement in pollution levels necessary to meet the objectives and confirm that the designation of the AQMA is still valid.

The AQMA at Pathhead having been declared, it was necessary to obtain further results of monitoring of PM_{10} over a further 12 months using a gravimetric technique as the original declaration was based on measurements recorded using a Tapered Element Oscillating Microbalance (TEOM) analyser.

The need to use a gravimetric technique as well as the need for chemical speciation of results has also meant that the process would take more than the normal 12 months. Midlothian Council asked the Scottish Government for an extension in the time required for this exercise and this was agreed.

1.3 Air Quality Objectives

The air quality objectives relevant to this Further Assessment are set out in Table 1. 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).

Table 1 Relevant air quality objectives set out in Regulations SI 2000/97 and SI 2002/297

Pollutant	Objective Value (µg/m^3)	Measured as
Particulate matter (PM_{10})	50	24 hour mean not to be exceeded more than 7 times per year (equivalent to the 98.08th percentile of 24-hour means)
	18	Annual mean

1.4 Aim of This Further Assessment

The aim of this Further Assessment is to supplement the information gathered from the earlier studies. It should conclude that the original data and the findings from the Detailed Assessment are still valid. This report should also identify any necessary improvement to air quality to enable compliance with the air quality objectives.

This report specifically aims to:

- Confirm the original pollutant assessment against the objectives;
- Report on additional monitoring within the AQMA;
- Calculate more accurately the improvement needed to meet the objective;
- Assess if the reasons for the designation of the AQMA still appropriate and identify any further steps to be taken.

2 Analysis of Monitoring Data

2.1 Automatic Monitoring Undertaken by Midlothian Council

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. The details are set out in Table 2.

Table 2: 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} (TEOM) SO_2	N	N (>25m)	3m	N/A
Pathhead	Roadside	X 339585 Y 664203	PM_{10} (TEOM) PM_{10} (Grav) SO_2	Y *	Y (4m)	1m	Y

* AQMA declared for PM_{10}

Comparison of Partisol and TEOM Results

Results of the analysis carried out on the Partisol and TEOM data are shown in Table 3.

Table 3: Partisol and TEOM PM_{10} monitoring results 5 March 2009 – 4 March 2010

Monitoring Method	Data Capture (%)	Annual Mean (µg/m^3)	No. Days >50 µg/m^3	98.08th percentile of 24 hour mean (µg/m^3)
Partisol	86%	17.0	4	45.5
TEOM (VCM corrected)	99.5%	18.0	4	46.3
Air Quality Objective		18.0	7	50.0

The annual mean concentration of PM_{10} measured by the Partisol sampler and TEOM analyser for the measurement period was 17.0 µg/m^3 and 18.0 µg/m^3, respectively.

Both measurements indicate that concentrations of PM_{10} within the Pathhead AQMA do not exceed the annual mean air quality objective. For context, the measured annual mean PM_{10} concentration recorded by the TEOM analyser in Dalkeith town centre for 2009 was 14.0 µg/m^3.

There were 4 exceedences of the 24-hour mean objective level recorded by the Partisol and 4 exceedences recorded by the TEOM. A maximum of 7 exceedances are permitted annually.

Local Air Quality Management Technical Guidance Note, TG (09), indicates that where data capture is less than 90%, it may be more appropriate to express the 24-hour mean values as percentiles. The 98.08th percentile of 24 hour means PM_{10} concentrations were 45.5 µg/m^3 and 46.2 µg/m^3 for the Partisol and TEOM measurements, respectively. These are within the 24 hour mean objective of 50 µg/m^3.

The variations of the 24 hour mean PM_{10} concentrations measured by the Partisol and TEOM for the 1 year period are shown in Figure 1.

Figure 1: Partisol and TEOM PM_{10} monitoring results, 5 March 2009 – 4 March 2010

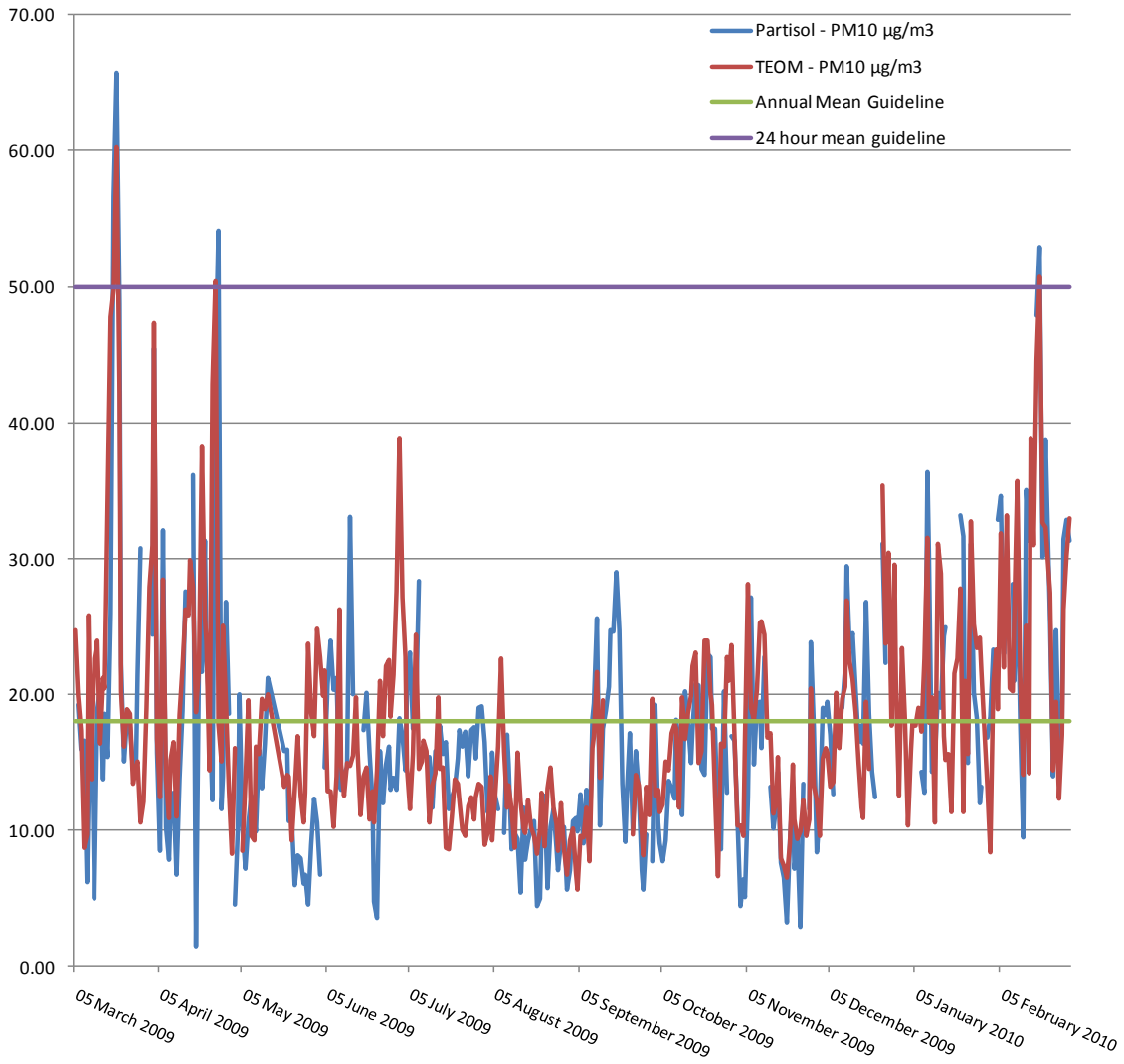


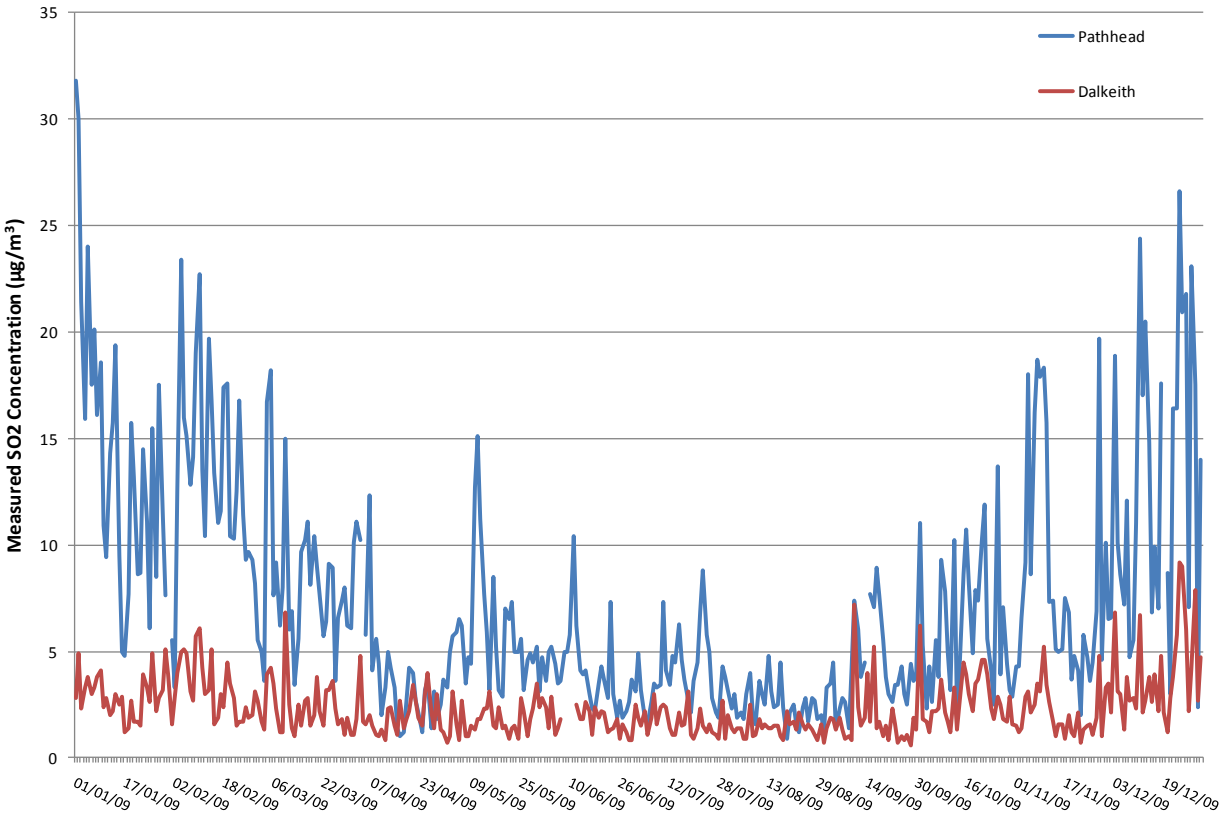
Figure 1 shows that concentrations measured by the Partisol and the TEOM are broadly similar throughout the year, although extreme peaks and troughs are generally larger for the Partisol measurements. Levels of PM_{10} are generally higher during the winter months, which is likely to be due to an increase in domestic fuel combustion in Pathhead.

The most significant peak in levels of PM_{10} which resulted in 2 exceedences of the daily air quality objective measured by the Partisol occurred during mid March 2009. It has been noted that over half of the PM_{10} monitoring sites on the Scottish Air Quality Database recorded exceedences of the daily objective. These elevated concentrations of PM_{10} were attributed to long-range transport of pollution from Northern Europe and Southern England, creating a "haze" and causing poor visibility.

Sulphur Dioxide

A comparison of the concentrations of sulphur dioxide measured at Pathhead and Dalkeith town centre was carried out and is shown in Figure 2. As there is significantly less domestic solid fuel use in Dalkeith a difference in the measured concentrations during the winter months would be expected. The measured concentrations set out in Figure 2 confirm that measured concentrations of sulphur dioxide are significantly higher in the winter months at Pathhead.

Figure 2: 24-hour mean sulphur dioxide concentrations measured at Pathhead and Dalkeith, 2009



2.2 Metals

Analysis of thirteen metals was carried out on four of the exposed Partisol filters. The four filters were selected by Midlothian Council to reflect potential variance in concentrations between the four seasons.

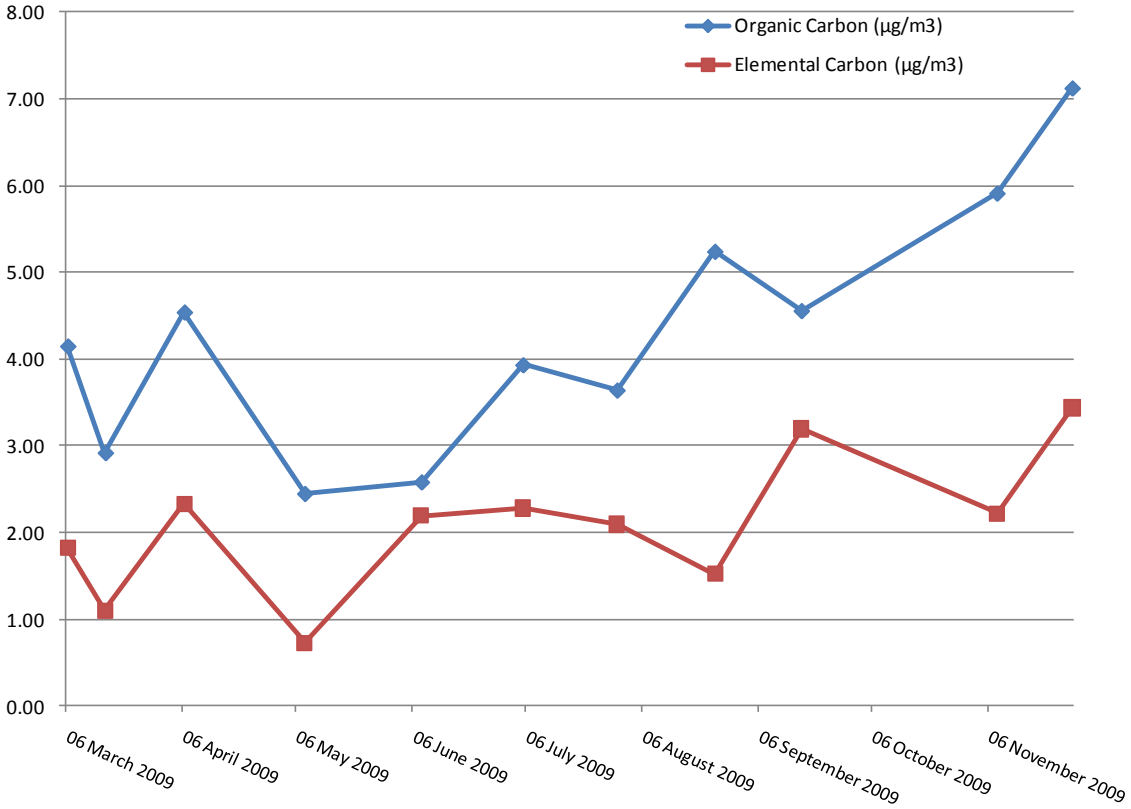
Of the thirteen metals sampled, eight metals were below the limit of detection for each of the four samples. The results of the metals analysis do not conclusively identify coal or other solid fuel combustion as a significant local source. Any metals present in coal are highly variable and depend largely on the location of the coal mine, and local factors.

2.3 Organic Carbon and Elemental Carbon

Combustion of coal and wood can contribute to levels of organic carbon and elemental carbon in ambient air. Organic carbon of the PM_{10} size fraction is not generally naturally occurring, but is generated through low temperature burning e.g. coal combustion, wood burning stoves, burning of garden waste on bonfires etc. Elemental carbon is generally a product of combustion at higher temperatures e.g. combustion of diesel fuel in engines but combustion of domestic solid fuel will also produce elemental carbon. Eleven filter exposed Partisol papers were analysed for levels of organic and elemental carbon throughout the year. The National Physical Laboratory (NPL), who conducted the laboratory analysis, indicated that the filter papers used in the survey (Whatman QMA) contain a notable mass of organic carbon prior to sampling (an average of 50 µg OC/filter). Results were corrected according to this average organic carbon filter content.

The results of the filter carbon analysis are shown in Figure 3.

Figure 3 Organic and elemental carbon analysis of exposed Partisol filters



Measured concentrations of organic carbon are generally higher than elemental carbon for each of the samples analysed. The trend of how both forms of carbon vary across the year is relatively similar, except for the samples in June and September. The similar trend suggests that carbon may be produced by the same sources.

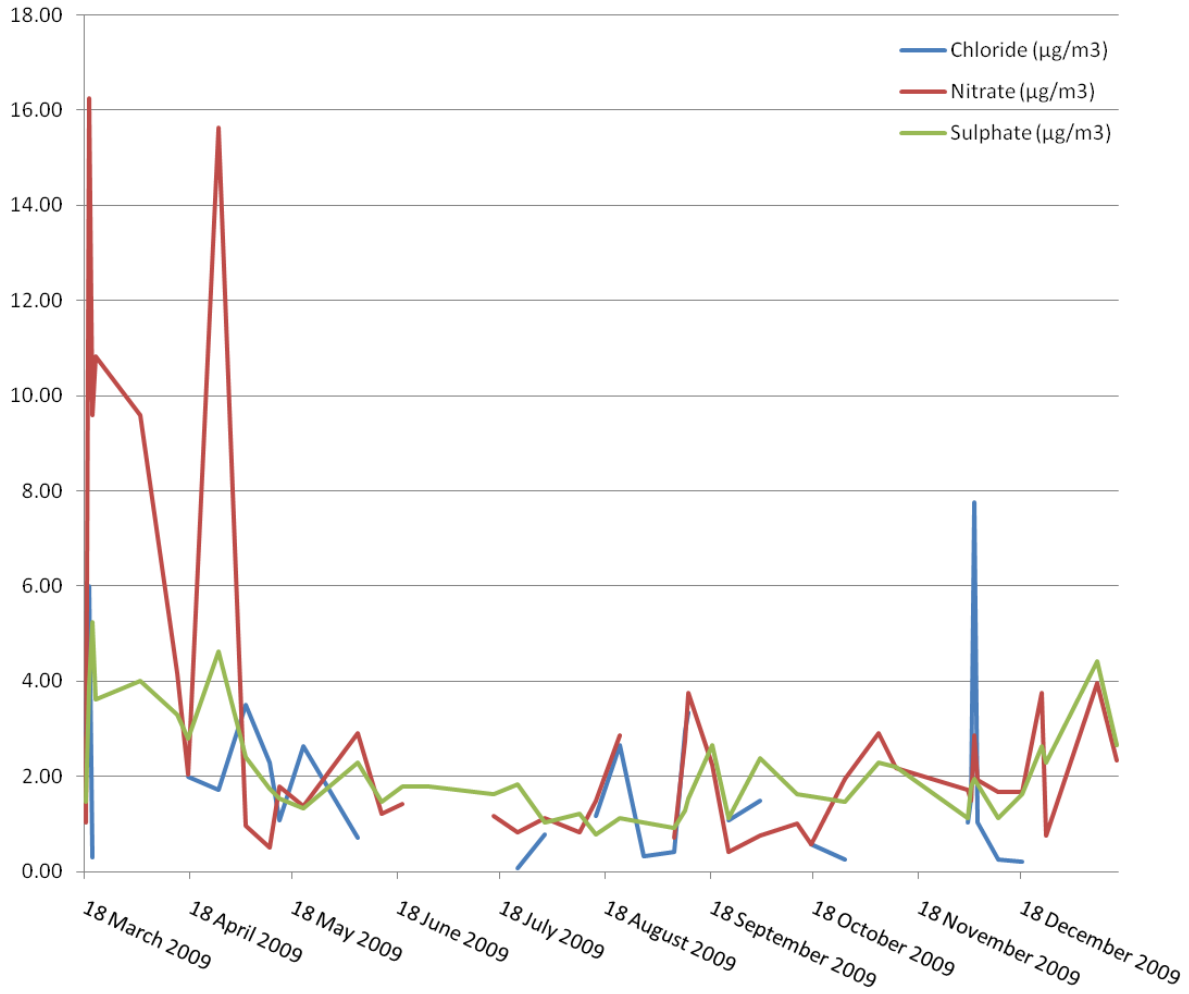
The results indicate that approximately 3 – 10 µg/m^3 of the particulate material collected is in the form of carbon. When compared to the measured PM_{10} concentrations for each filter, this equates to 21% - 44% of the collected particulate matter. Figure 3 shows that the organic carbon concentration increased significantly in the winter months of 2009. The proportion of organic carbon increased to an average of 30% of the total PM_{10} concentration compared to approximately 20% for the summer months (i.e. an increase of 10%). Taking the average measured PM_{10} concentrations over the winter and summer months into account (19.8 µg/m^3 in winter months and 15.7 µg/m^3 in summer months), this would indicate that combustion of domestic solid fuel contributes an additional 2 µg/m^3 to total PM_{10} concentrations during the winter months and a smaller proportion during summer months. The total contribution is likely to be higher than this throughout the year if the domestic solid fuel combustion contributes to the baseline of organic carbon. On this basis, it is estimated that the combustion of solid fuels would contribute approximately 3 – 4 µg/m^3 to the annual mean PM_{10} concentration.

This estimate of the contribution of domestic solid fuel use to total measured PM_{10} concentrations will be useful in determining the reduction required and the performance of any options which would form part of an Air Quality Action Plan, should this be required.

2.4 Anions

During the monitoring period, 46 exposed Partisol filters were analysed for the presence of chlorides, nitrates and sulphates. Lab blanks were included in the laboratory reports, which have been used to adjust the results. As a result of blank correction, several of the results were discarded.
The results of anion sampling are presented in Figure 4.

Figure 4 Chloride, nitrate and sulphate analysis



Due to the omission of a number of results, trends shown by chloride levels appear inconclusive. Levels of nitrate remained mostly low throughout the year. Two notable peaks occurred during March and April 2009. The peak during mid-March was as a result of the long-range pollution transport episode recorded by the PM_{10} analysers for the same period. The peak measured in April also corresponds to a similar peak in measured PM_{10} concentrations. No explanation for this occurrence was available.

Levels of sulphates appear greater during the winter months and lower in the summer months. This may be as a result of increased fuel combustion during winter. Depending on the sulphur content of coal combusted in Pathhead, this may have contributed to levels of sulphates measured.

3 Conclusions and Proposed Actions

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

3.1 Conclusions of the Monitoring Data

Concentrations of PM_{10} measured by both the Partisol and TEOM complied with the annual average air quality objective and the 24-hour mean air quality objective. However, the annual mean PM_{10} concentration is close to the objective value and will be continued to be monitored to inform the decision on whether the AQMA should remain in place or be revoked at a later date.

If future measured concentrations indicate that the AQMA should remain in place and an Air Quality Action Plan is drawn up, the estimated contribution of domestic solid fuel burning to total measured PM_{10} concentrations will be determined in more detail. Based on the further analysis carried out by Midlothian Council set out in this report, it is estimated that the contribution to annual mean PM_{10} concentrations is approximately 3 – 4 $\mu g/m^3$. This will assist in identifying the likely effectiveness of any options identified in the Air Quality Action Plan.

3.2 Proposed Actions

Based on the data and analysis set out in this Further Assessment, the next course of action for Midlothian Council is summarised as:

- Continue monitoring PM_{10} using the TEOM and Partisol in Pathhead;
- Carry out analysis of elemental and organic carbon on a selection of exposed filters throughout the year. Analysis of metals and anions will be ceased; and
- Discuss the need/requirements for the Air Quality Action Plan with the Scottish Government following a further monitoring period.