REPORT

Ratification of data produced by the UK Ambient Automatic Hydrocarbon Air Quality Network, 1 July 2005 to 30 September 2005

A report produced for the Department for Environment, Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment in Northern Ireland

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1 Introduction

This report contains information on the quality and statistical parameters associated with ratified data from the UK Ambient Automatic Hydrocarbon Air Quality Network (The UK Hydrocarbon Network). The presented information and data cover the period 1 July 2005 to 30 September 2005. The ratified data have been made available on the World Wide Web at http://www.airquality.co.uk/archive/data_and_statistics_home.php

This report contains:

- The definition of a Data Quality Code for each reported hydrocarbon.
- The Data Quality Codes assigned to the data presented on the web.
- A list of periods of data loss, reasons for data loss and descriptions of the most significant causes of data loss.
- Statistical information for each measured hydrocarbon.

In this report the unit used for expressing concentrations of gases is micrograms per cubic metre ($\mu g/m^3$), where some earlier reports have used parts per billion (ppb). This allows comparison to the relevant Air Quality Standards that are now expressed in micrograms per cubic metre ($\mu g/m^3$).

2 Hydrocarbon Data Quality

All hydrocarbon data are assigned a quality value. In general ratified hourly data have an uncertainty (at 95% confidence) of ±10% for values above 0.5 μg/m^3 and ±0.05 μg/m^3 for values below 0.5 μg/m^3. These data are termed 'good quality'.

In some cases, because of instrument problems, data cannot be described as 'good' quality, but the data may still be of use to modellers and is therefore included in the archive. This is termed 'acceptable' quality data, and has an uncertainty (at 95% confidence) of ± 25% above 0.5 μg/m^3 and ± 0.1 μg/m^3 below 0.5 μg/m^3.

Data that do not meet either the 'good' or 'acceptable' criteria do not appear in the archive.

Previous reports have used five separate data quality codes to describe the data. The separate quality codes are derived on the basis of the proportion of monthly data that is deemed either 'good' or 'acceptable'. These codes are shown below:-

A. all 'good' quality data
B. most (> 75%) data points 'good', remainder 'acceptable' quality
C. roughly equal numbers of 'good' and 'acceptable' quality data
D. some (< 25%) data points 'good' quality; remainder 'acceptable' quality
E. all points 'acceptable' quality

On examination of data reported since 2002, predominantly data codes A and E have been used. On this basis a decision has been made to rationalise on the data codes used and all future data will be reported according to the following data codes: -

A. all 'good' quality data
B. all points 'acceptable' quality

3 Summary of Site Operational Issues

The following section provides a summary of data gaps and the main site operational problems during this reporting period. The number of hours and percentage of data lost is also given.

Table 1. Summary of data gaps

Site	Reason	Start date	End date	Hours	% Total hours
Cardiff	Cabin refurbishment	01/07/05	30/09/05	2208	100
Glasgow	Calibrations			37	1.8
	Carrier gas supply fault	10/08/05	11/08/05	25	1.1
Harwell	Calibrations			33	1.5
	CMCU site visit	06/07/05	06/07/05	1	0.0
	Miscellaneous			2	0.1
Marylebone Road	Calibrations			33	1.5
	PC/GC communication problem	02/07/05	04/07/05	48	2.2
	Hydrogen generator failure	16/07/05	18/07/05	50	2.3
	ESU service visit	08/08/05	08/08/05	5	0.2
	Compressed air supply failure	19/08/05	23/08/05	106	4.8
	Mains power supply failure	26/09/05	26/09/05	6	0.3
	PC/GC communication problem	30/09/05	30/09/05	8	0.4
	Miscellaneous			3	0.1
Eltham	Calibrations			49	2.2

'Miscellaneous' is undocumented gaps in the data usually caused by computer systems resets or data deleted during the ratification process. These gaps are of short duration and typically $\leq$ 2 hours.

4 Data Capture and Ratified Data

4.1 DATA CAPTURE TARGETS

The data capture values in previous reports have been presented as the number of ratified hourly data values expressed as a percentage of the total number of hours in the specified period. The EU Framework Directive 96/62/EC on ambient air quality assessment and management and it's associated Daughter Directives states that in calculating data capture, losses of data due to the regular calibration or normal maintenance of the instrument should not be considered. The periods where the instruments have been calibrated and routine maintenance undertaken have, therefore, been included in the total data capture of the period.

The 3rd Daughter Directive relating to ozone in ambient air, states that volatile organic compounds (VOCs) should be monitored to assess their concentrations as ozone precursors. A data capture target is not specified for ozone precursor VOCs, however, it is important to achieve high data capture for all measured VOCs. The 2nd daughter directive relating to limit values for benzene and carbon monoxide in ambient air, sets the benzene minimum data capture target at 90%. The UK Air Quality Strategy suggests 1,3-butadiene data capture also be set to 90%. Defra have specified that all other VOC compounds have a minimum data capture of 50%.

Tables 1 to 4, Appendix 1 contain statistical information relating to the ratified data, for each measured hydrocarbon, over the period 1 July 2005 to 30 September 2005. The tables list the percentage data capture, maximum concentration, mean concentration and minimum concentration of each hydrocarbon.

4.2 THE RATIFIED DATA

The data capture and data quality codes for each site for benzene and 1,3-butadiene are summarised in table 2 below. For comparison, the calculations of data capture using the previous method have been included.

Table 2. Data capture summary

Site	Pollutant	Data capture % (previously reported)	Data capture % (DD 2)	Data Quality Code
Cardiff	Benzene	0	0	
	1,3-Butadiene	0	0	
Glasgow	Benzene	97.2	99.0	A
	1,3-Butadiene	97.2	99.0	A
Harwell	Benzene	98.4	99.9	A
	1,3-Butadiene	98.4	99.9	B
Marylebone Road	Benzene	79.6	81.3	A
	1,3-Butadiene	88.2	89.3	A
Eltham	Benzene	97.7	99.9	A
	1,3-Butadiene	97.2	99.4	A

4.2.1 Cardiff

For the Cardiff site the data capture for benzene and for 1,3-butadiene was 0%.

Refurbishment of the cabin at the Cardiff site commenced last quarter, and all equipment was removed by the CMCU. No data has been collected from 10th May until the quarter end.

4.2.2 Glasgow

For the Glasgow site the data capture for benzene was 99.0% and for 1,3-butadiene was 99.0%. Data quality code A is applied to all compounds for this quarter.

25 hours of data were lost in August, due to a fault with the nitrogen carrier gas supply. The local site operator restored the carrier gas supply on 11th August.

There have been no other significant problems for the period covered by this report.

It should be noted that the hydrocarbon instrumentation at the Glasgow site samples air through a separate inlet from that used for the inorganic measurements. The inlet for the inorganic measurements is within one metre from the kerb and hence these are classed as kerbside measurements. The sample inlet for the hydrocarbon measurements is more than one metre from the kerb (but less than five metres) and hence these are classed as roadside measurements.

4.2.3 Harwell

For the Harwell site the data capture for benzene was 99.9% and for 1,3-butadiene was 99.9%. Data quality code B is applied to 1,3-butadiene and quality code A for all other compounds for this quarter.

During July it was noticed that the peak areas were close to the limit of detection, indicating that the PID lamp was approaching the end of its useful life. This problem was more noticeable with the lower concentrations due to seasonal variation. The PID lamp was changed on the 6th July.

There have been no significant problems for the period covered by this report.

4.2.4 Marylebone Road

For the Marylebone Road site the data capture for benzene was 81.3% and for 1,3-butadiene was 89.9%. Data quality code A is applied to all compounds for this quarter, with the exception of cis-2-pentene and 3-methylpentane. Quality code B is applied to cis-2-pentene and 3-methylpentane from 6th September onwards.

56 hours of data were lost this quarter due to computer and communications problems. During July a fault developed with part of the system that supplies hydrogen to the GC FID, causing 50 hours of data loss. It was noticed that the baseline and chromatograms were noisy after the hydrogen generator restart on 18th July. During the ESU service visit on 8th August the FID regulators were replaced, which corrected this problem. During August a fault developed with part of the system that supplies compressed air to the GC FID. Approximately 106 hours of data was lost before the system was repaired by the ESU on 23rd August. In September a mains power supply problem caused 8 hours of data loss before the system was restarted by the LSO.

The CMCU visited the site on 6th September to change the calibration cylinder. No data was lost as a result of this visit.

There have been no other significant problems for the period covered by this report.

4.2.5 Eltham

For the Eltham site the data capture for benzene was 99.9% and for 1,3-butadiene was 99.4%. Data quality code A is applied to all compounds for this quarter.

The CMCU visited the site on 10th August to change the calibration cylinder. No data was lost as a result of this visit.

There have been no significant problems for the period covered by this report.

4.3 1,3-BUTADIENE DATA FOR THE VOC71M

During the process of calculating response factors for the data covered in this report it was observed that the 1,3-butadiene peak had merged with a neighbouring peak, trans-2-butene, in the chromatograms of the calibration samples. The reported peak areas for 1,3-butadiene in the standards were therefore, overestimated. As a result an accurate response factor for 1,3-butadiene could not be generated, as the degree of overestimation could not be accurately quantified.

An alternative approach was used to generate the response factor for 1,3-butadiene. The response factor for cis-2-butene, a well-resolved peak, was used to derive a response factor for 1,3-butadiene. The relative response factors for 1,3-butadiene and cis-2-butene are fairly constant over time when both peaks are well resolved. The cis-2-butene response factor and relative response factor were used to derive a response factor for 1,3-butadiene.

It is likely that this approach generates a relatively accurate response factor for 1,3-butadiene. However due to the increased uncertainty associated with this method, all the 1,3-butadiene data at Harwell has been assigned data quality code B.

4.4 CONCENTRATION TRENDS

The periods when data for benzene and 1,3-butadiene were available, for all the sites, are plotted graphically in Figures 1 to 8, Appendix 2. The measured concentrations of 1,3-butadiene fell below 0.02 $\mu g/m^3$ on a number of occasions see Figures 2, 4 and 6, Appendix 2. Where concentrations fell below 0.02 $\mu g/m^3$ the ratified concentrations have been reported as 0.00 $\mu g/m^3$.

At Harwell and Eltham the measured concentrations of hydrocarbons were low for most of the period covered by this report. At these urban background and rural sites there tends to be a pattern of seasonal variation with higher levels during the winter when dispersion is generally poorer and photochemical removal is at a minimum.

The Glasgow and Marylebone Road data tend to exhibit higher levels with less seasonal variation than is apparent in data from the other three sites. The measured concentrations and trends are typical of sites close to busy roads where the source of the measured hydrocarbons is close to the monitoring location, and they will have had little time to mix and react in the atmosphere. The measured concentrations at Marylebone Road for July to August 2005 exhibited no significant episodes of elevated concentrations. There is insufficient information to provide an explanation of the observed difference in the trends from site to site, although spatial variations in meteorological conditions may well be the cause. The variation in trends from site to site is probably due to variations in atmospheric dispersion.

A comparison between Marylebone Road and Eltham has been made to look at the relationship between a roadside site and an urban background site, measuring the same air mass. Figure 4, Appendix 3, shows that the ratio between the compounds measured is very similar at both sites, with levels at Eltham approximately half of those at Marylebone Road.

4.5 CALIBRATION CYLINDER CHANGES AT MARYLEBONE ROAD AND ELTHAM

The EU Framework Directive 96/62/EC on ambient air quality assessment and management and it's associated 3rd Daughter Directive recommends a list of volatile organic compounds (VOC) for measurement as potential ozone precursors. A new reference standard was introduced at the Marylebone Road and Eltham monitoring sites in order to comply with this Directive. New certified National Physical Laboratory (NPL) cylinders are now used for routine calibrations.

The EU list contains thirty-one substances that are recommended for measurement. The existing calibration cylinders supplied by NPL contain twenty-six of these substances and four additional compounds. To comply with the requirements of the EC directive, NPL have supplied new gas mixtures which contain twenty-nine of the thirty-one listed substances (one substance is not included, formaldehyde, as this and the other requirement, total non-methane hydrocarbons, cannot be evaluated using the analyser deployed within the network).

The cylinders were changed at Eltham on 10th August and at Marylebone Road on 6th September. The new cylinder no longer contains cis-2-pentene and 3-methylpentane. Calibration factors for these compounds, after the cylinder change, were derived using relative response factors from trans-2-pentene and 2-methylpentane, which have been observed to be sufficiently constant over time. This method will be used to calculate cis-2-pentene and 3-methylpentane concentrations until the end of 2005.

It is likely that this approach generates a relatively accurate response factor for cis-2-pentene and 3-methylpentane, however, due to the increased uncertainty associated with this method, all the cis-2-pentene and 3-methylpentane data at Marylebone Road and Eltham, after the standard change, has been assigned data quality code B.

The new standard contains four new compounds, 1-pentene, 2,2,4-trimethylpentane, n-octane and 1,2,3-trimethylbenzene. Following positive identification during the first calibration using the new cylinders, these compounds have then been reported. The data capture for these compounds is therefore low during this quarter.

4.6 COMPARISON WITH AIR QUALITY OBJECTIVES

The Air Quality Strategy for the UK has set Air Quality Objectives for benzene and 1,3-butadiene. The Air Quality Objective for benzene in the UK is 16.25 μg/m^3 expressed as a running annual mean to be met by 31 December 2003. In England and Wales there is an additional objective for benzene of 5 μg/m^3 expressed as an annual mean to be met by end of 2010. In Scotland a more stringent objective has been set for benzene of 3.25 μg/m^3 to be met by the end of 2010. The Air Quality Objective for 1,3-butadiene is specified as a running annual mean of 2.25 μg/m^3 to be met by the end of 2003.

The annual means for benzene and 1,3-butadiene for 2001, 2002, 2003 and 2004 together with the quarterly mean for the first, second and third quarter of 2005 are given in Tables 3 and 4 below and can be seen graphically in Appendix 3. For benzene the annual means for 2001, 2002, 2003 and 2004 were well below the Air Quality Objective of 16.25 μg/m^3 to be met by the end of 2003. The annual means for 2004 were also below the Air Quality Objective to be met by 2010 for the respective region.

The means for benzene and 1,3-butadiene for quarter 3, 2005 were lower or equal to the means for quarter 2, 2005, with the exception of Marylebone Road where benzene concentrations were slightly higher for quarter 3 than those measured in quarter 2.

Table 3. Means of measured benzene concentrations (μg/m^3) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2001 Annual Mean	2002 Annual Mean	2003 Annual Mean	2004 Annual Mean	Quarter 1 2005 Mean	Quarter 2 2005 Mean	Quarter 3 2005 Mean
Cardiff Centre	$$	1.22$	1.17	0.84	0.84	0.65	$$$$$
Glasgow	$$$	2.33 $	1.82	1.40	1.49	1.07	0.88
Harwell	0.62	0.60	0.59	0.40	0.58	0.29	0.26
Marylebone Road	4.55	3.91	3.32	2.75	2.14	2.08	2.27
Eltham	$$$$	$$$$	$$$$	0.76	0.97	0.62	0.62

$ Annual means calculated from significantly less than 12 months data.
$$ The Cardiff Centre site was installed on 5th September 2002.
$$$ The Glasgow site was installed on 1st August 2002.
$$$$ The Eltham site was installed on 17th October 2003.
$$$$$ No data collected from the Cardiff site during this quarter.

Table 4. Means of measured 1,3-butadiene concentrations (μg/m^3) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2001 Annual Mean	2002 Annual Mean	2003 Annual Mean	2004 Annual Mean	Quarter 1 2005 Mean	Quarter 2 2005 Mean	Quarter 3 2005 Mean
Cardiff Centre	$$	0.15$	0.15	0.11	0.07	0.04	*
Glasgow	$$$	0.36$	0.42	0.28	0.20	0.18	0.16
Harwell	0.11	0.04	0.03	0.02	0.02	0.02	0.00
Marylebone Road	1.12	0.95	0.64	0.56	0.43	0.45	0.45
Eltham	$$$$	$$$$	$$$$	0.15	0.13	0.07	0.07

$ Annual means calculated from significantly less than 12 months data.
$$ The Cardiff Centre site was installed on 5th September 2002.
$$$ The Glasgow site was installed on 1st August 2002.
$$$$ The Eltham site was installed on 17th October 2003.
$$$$$ No data collected from the Cardiff site during this quarter.

Appendices

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Appendix 1
Summary Statistical Information

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Note The Cardiff site was de-commissioned for the whole of this period, therefore, no data are presented here for this site.

Table 1. Percentage data capture maximum, mean and minimum values of ratified data from the Glasgow site of the UK Hydrocarbon Network, for the period 1 July 2005 to 30 September 2005

Compound	% Data capture	Maximum hourly concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum hourly concentration ($\mu g/m^3$)
1,3-Butadiene	98.99	6.56	0.16	0.00
Benzene	98.99	4.57	0.88	0.13
Toluene	98.99	28.69	2.98	0.31
Ethylbenzene	98.72	121.46	0.88	0.04
(m+p)-Xylene *	98.99	164.43	3.09	0.22
o-Xylene	98.99	132.30	1.59	0.09

* (m+p)-Xylene data are reported as the sum of the 2 individual components due to the fact that they are not sufficiently well resolved in the chromatogram.

Table 2. Percentage data capture, maximum, mean and minimum values of ratified data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

Compound	% Data capture	Maximum hourly concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum hourly concentration ($\mu g/m^3$)
1,3-Butadiene	99.87	0.25	0.00	0.00
Benzene	99.87	2.76	0.26	0.00
Toluene	99.87	19.55	0.69	0.04
Ethylbenzene	84.74	4.85	0.09	0.00
(m+p)-Xylene *	97.88	11.72	0.31	0.00
o-Xylene	85.06	4.54	0.13	0.00

* (m+p)-Xylene data are reported as the sum of the 2 individual components due to the fact that they are not sufficiently well resolved in the chromatogram.

Table 3. Percentage data capture, maximum, mean and minimum values of ratified data from the Marylebone Road site affiliated to the UK Hydrocarbon Network for the period; 1 July 2005 to 30 September 2005

Compound	% Data capture	Maximum hourly concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum hourly concentration ($\mu g/m^3$)
Ethane	89.97	65.83	7.53	1.56
Ethene	89.97	18.32	3.92	0.22
Propane	89.97	42.35	5.36	0.95
Propene	89.97	10.30	2.15	0.17
Ethyne	89.92	20.44	2.90	0.19
2-Methylpropane	89.97	42.66	4.39	0.29
n-Butane	89.97	76.73	8.46	0.51
trans-2-Butene	89.97	3.21	0.61	0.21
1-Butene	89.79	3.07	0.54	0.05
cis-2-Butene	89.83	2.33	0.35	0.05
2-Methylbutane	89.79	112.35	11.26	0.42
n-Pentane	89.79	26.97	3.20	0.18
1,3-Butadiene	89.88	1.73	0.45	0.04
trans-2-Pentene	89.65	5.56	0.67	0.03
1-Pentene	26.65	1.72	0.44	0.03
cis-2-Pentene	88.75	24.33	0.38	0.03
2-Methylpentane	89.97	19.13	3.29	0.14
3-Methylpentane	89.88	11.51	2.00	0.07
n-Hexane	89.97	5.43	1.18	0.11
Isoprene	89.43	6.64	0.57	0.03
Benzene	81.27	11.19	2.27	0.10
2,2,4-trimethylpentane	26.84	11.90	2.94	0.05
n-Heptane	80.28	10.81	0.67	0.00
n-Octane	26.61	2.42	0.38	0.00
Toluene	89.79	63.19	10.17	0.50
Ethylbenzene	88.57	9.39	1.67	0.09
(m+p)-Xylene *	88.70	36.36	6.13	0.09
o-Xylene	89.43	13.00	2.16	0.09
1,3,5-Trimethylbenzene	88.84	4.19	0.75	0.05
1,2,4-Trimethylbenzene	89.61	10.73	2.34	0.15
1,2,3-Trimethylbenzene	26.88	4.74	1.05	0.15

* (m+p)-Xylene are reported as the sum of the 2 individual components due to the fact that they are not sufficiently well resolved in the chromatogram.

Table 4. Percentage data capture, maximum, mean and minimum values of ratified data from the Eltham site affiliated to the UK Hydrocarbon Network for the period; 1 July 2005 to 30 September 2005

Compound	% Data capture	Maximum hourly concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum hourly concentration ($\mu g/m^3$)
Ethane	99.94	60.05	4.65	1.15
Ethene	99.66	5.46	0.81	0.02
Propane	99.94	24.15	2.52	0.31
Propene	99.94	15.26	0.44	0.03
Ethyne	99.94	4.53	0.51	0.06
2-Methylpropane	99.94	17.56	1.59	0.14
n-Butane	99.94	29.52	2.89	0.27
trans-2-Butene	99.94	1.09	0.14	0.05
1-Butene	99.44	2.31	0.12	0.00
cis-2-Butene	99.89	0.84	0.07	0.02
2-Methylbutane	99.98	20.30	2.54	0.03
n-Pentane	99.94	13.35	0.63	0.06
1,3-Butadiene	99.39	0.61	0.07	0.00
trans-2-Pentene	98.35	0.73	0.09	0.00
1-Pentene	56.50	0.52	0.09	0.03
cis-2-Pentene	93.50	0.41	0.06	0.00
2-Methylpentane	99.94	12.44	0.54	0.04
3-Methylpentane	99.89	15.59	0.43	0.04
n-Hexane	99.94	44.37	0.32	0.04
Isoprene	99.66	5.23	0.59	0.03
Benzene	99.94	8.92	0.62	0.16
2,2,4-trimethylpentane	55.78	2.51	0.43	0.05
n-Heptane	99.75	1.29	0.25	0.04
n-Octane	51.70	0.52	0.09	0.00
Toluene	99.94	22.76	2.26	0.15
Ethylbenzene	99.53	2.69	0.40	0.04
(m+p)-Xylene *	91.78	10.05	1.41	0.04
o-Xylene	99.44	3.66	0.44	0.04
1,3,5-Trimethylbenzene	90.97	1.90	0.25	0.00
1,2,4-Trimethylbenzene	28.69	3.74	0.70	0.15
1,2,3-Trimethylbenzene	52.88	2.39	0.30	0.05

* (m+p)-Xylene are reported as the sum of the 2 individual components due to the fact that they are not sufficiently well resolved in the chromatogram.

Appendix 2
Time Series Plots of Hydrocarbon Concentrations

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Note The Cardiff site was de-commissioned for the whole of this period, therefore, no data are presented here for this site.

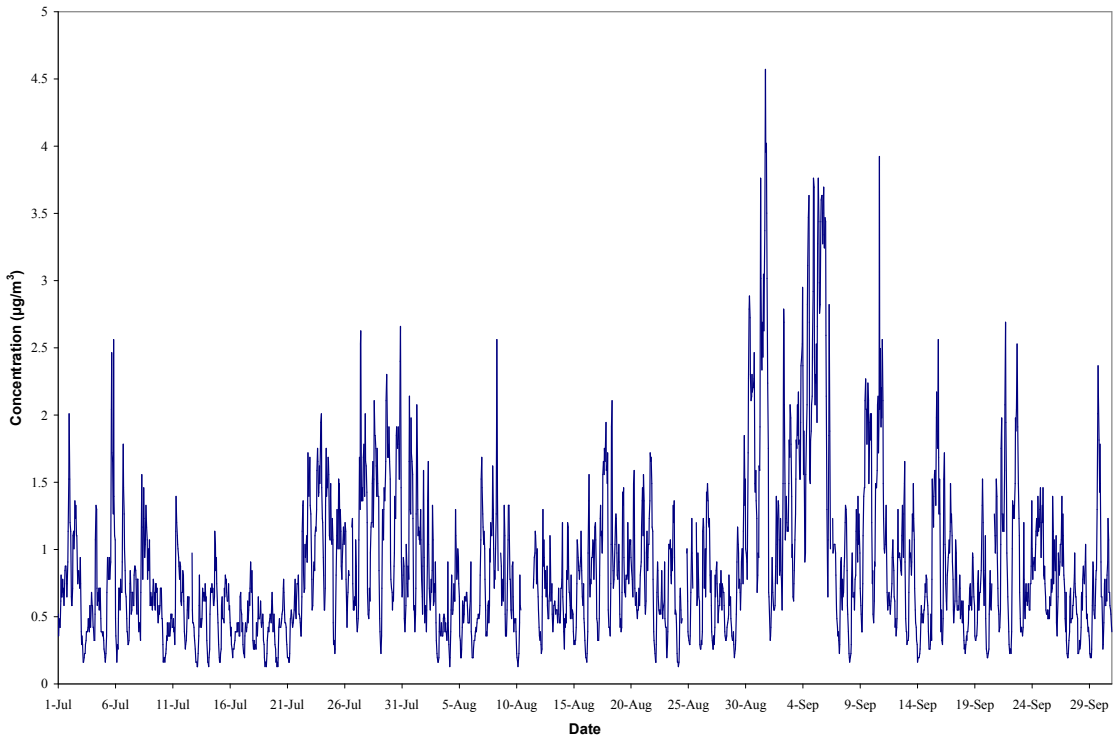

Figure 1. Time series plots for the ratified benzene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

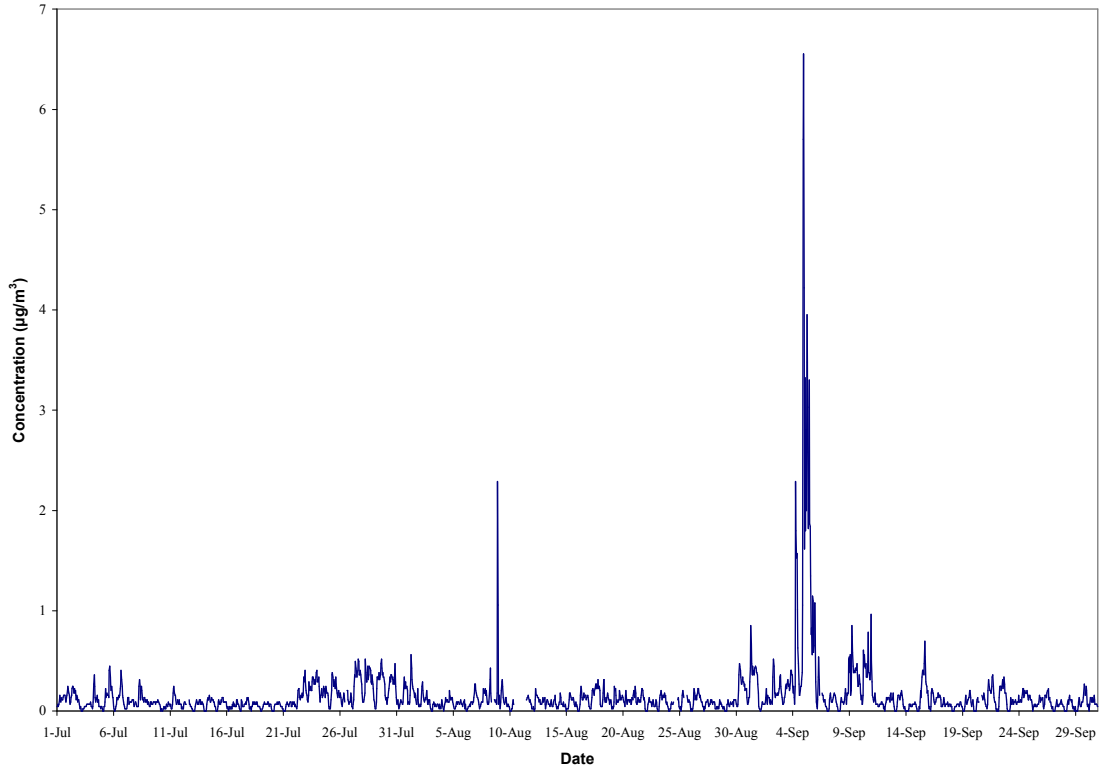

Figure 2. Time series plots for the ratified 1,3-butadiene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

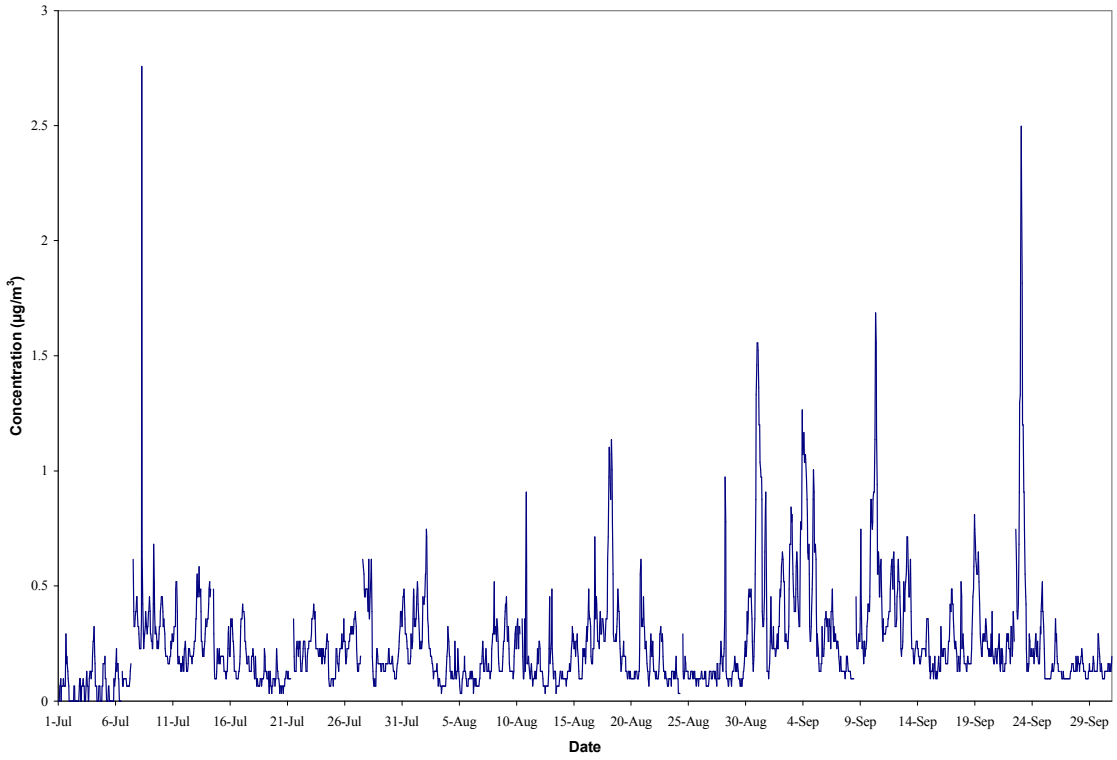

Figure 3. Time series plots for the ratified benzene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

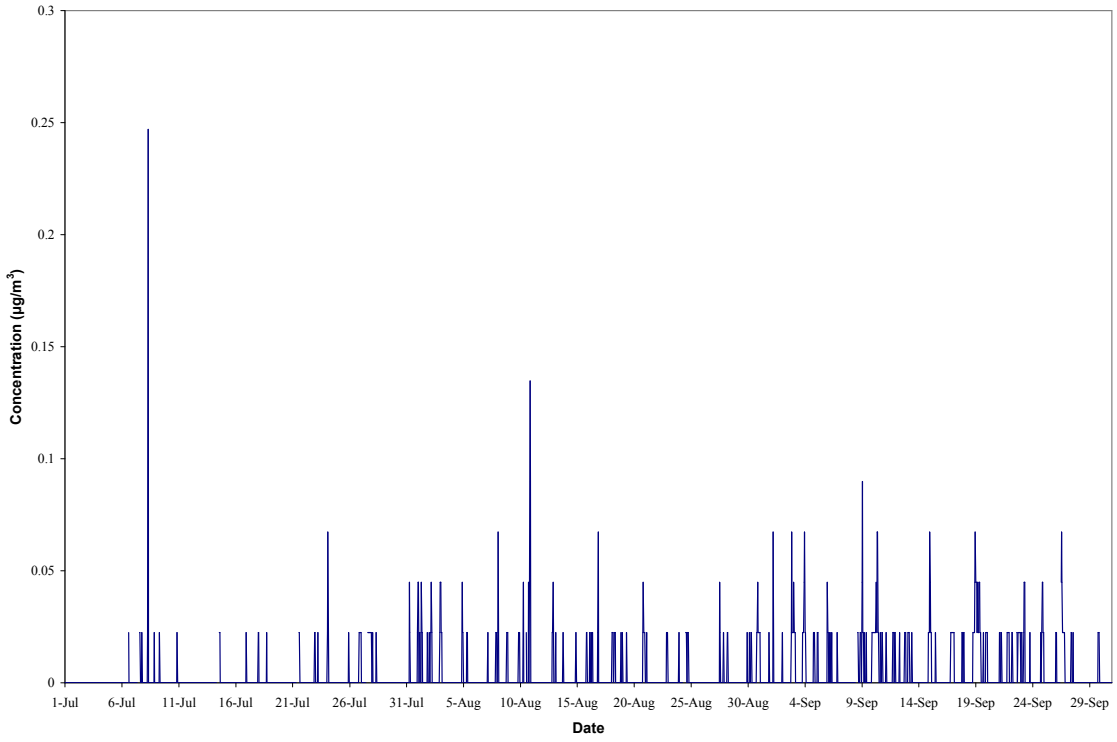

Figure 4. Time series plots for the ratified 1,3-butadiene data from the Harwell site of The UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

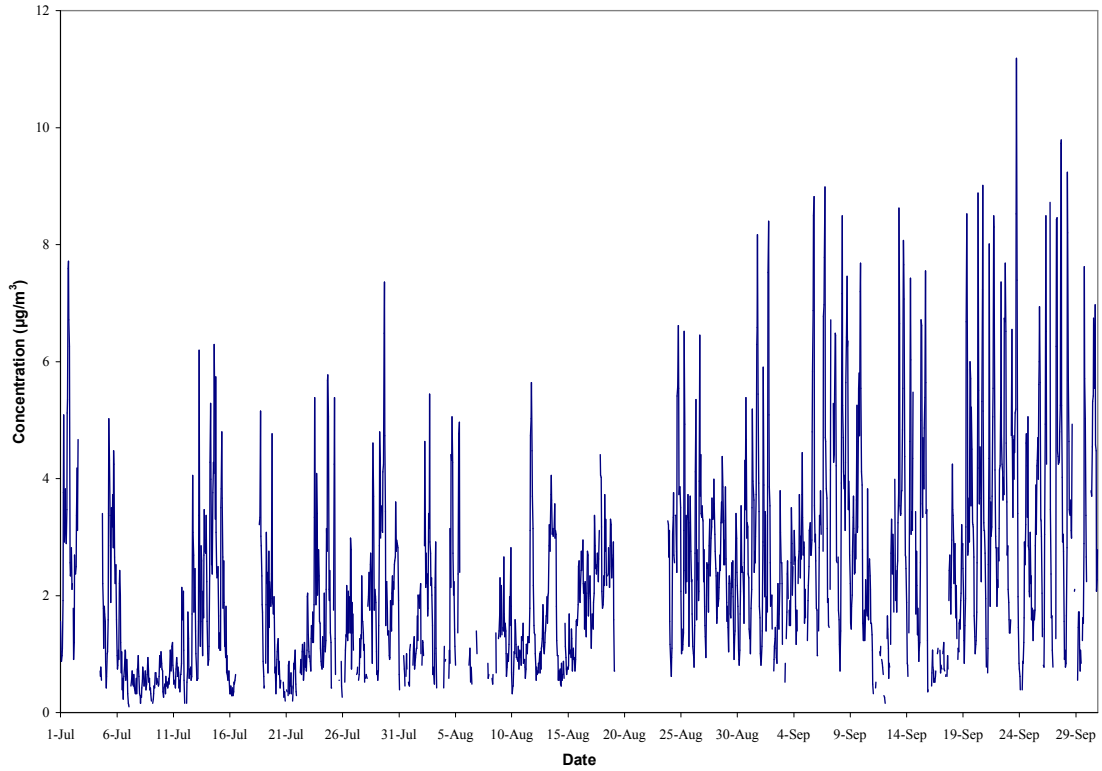

Figure 5. Time series plots for the ratified benzene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

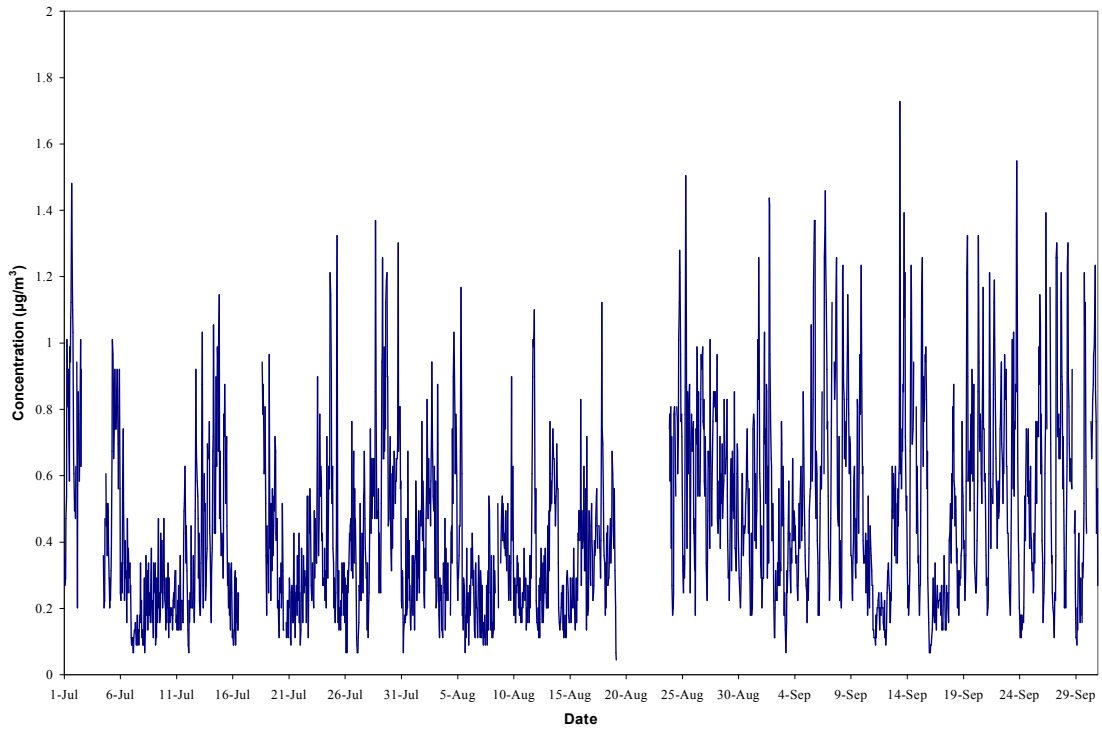

Figure 6. Time series plots for the ratified 1,3-butadiene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

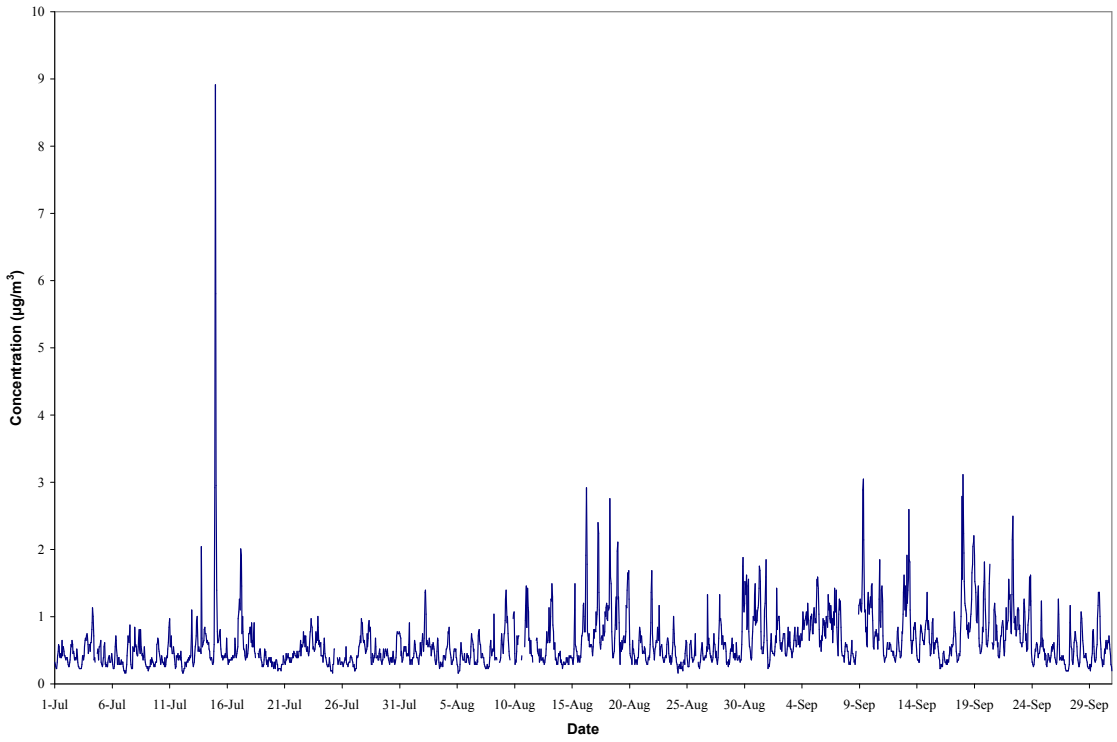

Figure 7. Time series plots for the ratified benzene data from the Eltham site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

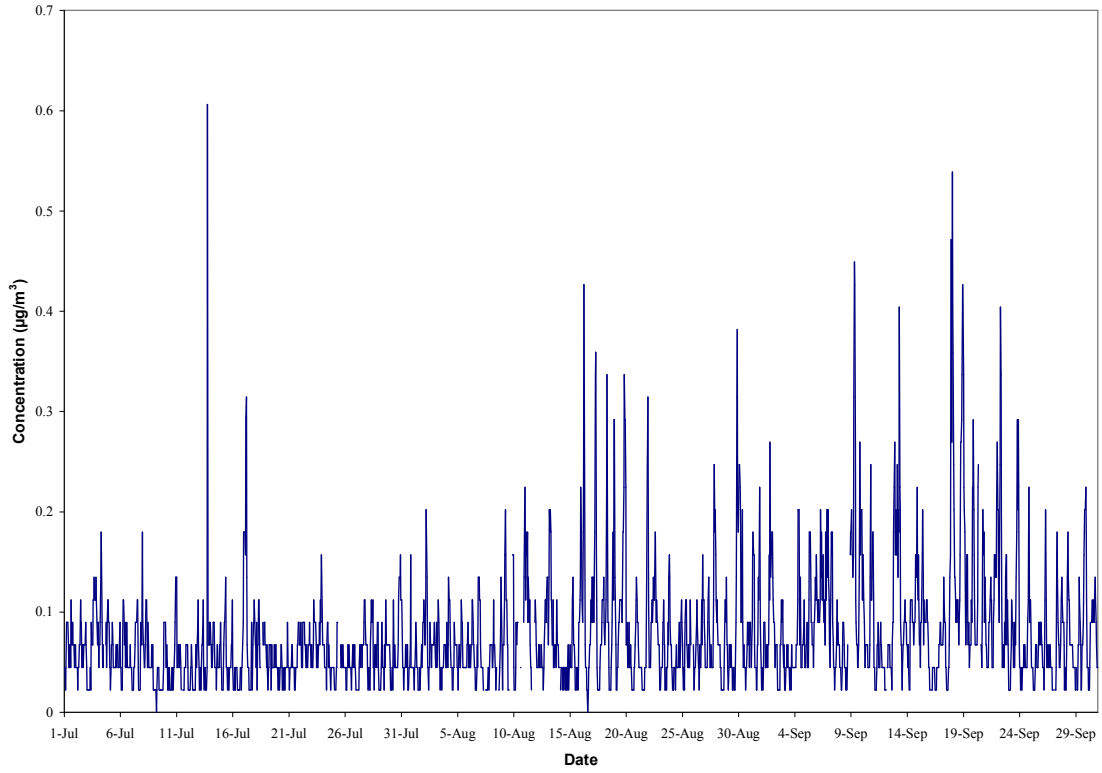

Figure 8. Time series plots for the ratified 1,3-butadiene data from the Eltham site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005

Appendix 3
Annual and Quarterly Mean Plots

CONTENTS

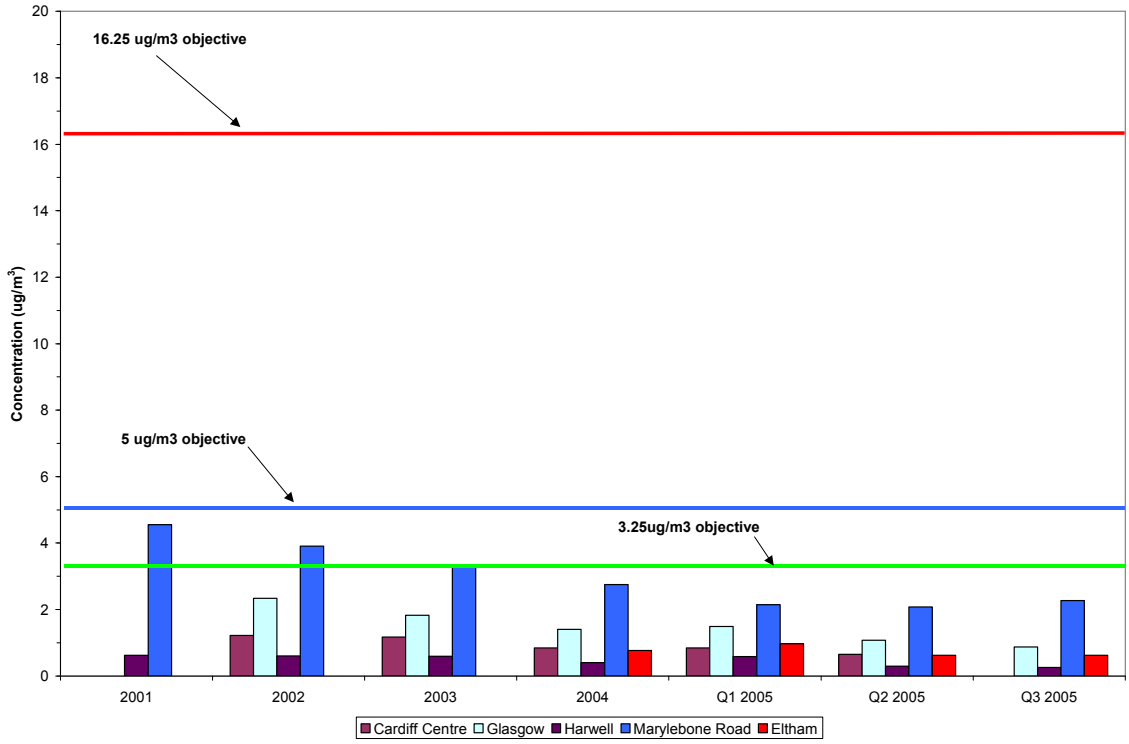

Figure 1. Mean benzene concentrations for the UK Automatic Hydrocarbon Network, 2001-2004 and quarter 1, 2 and 3, 2005

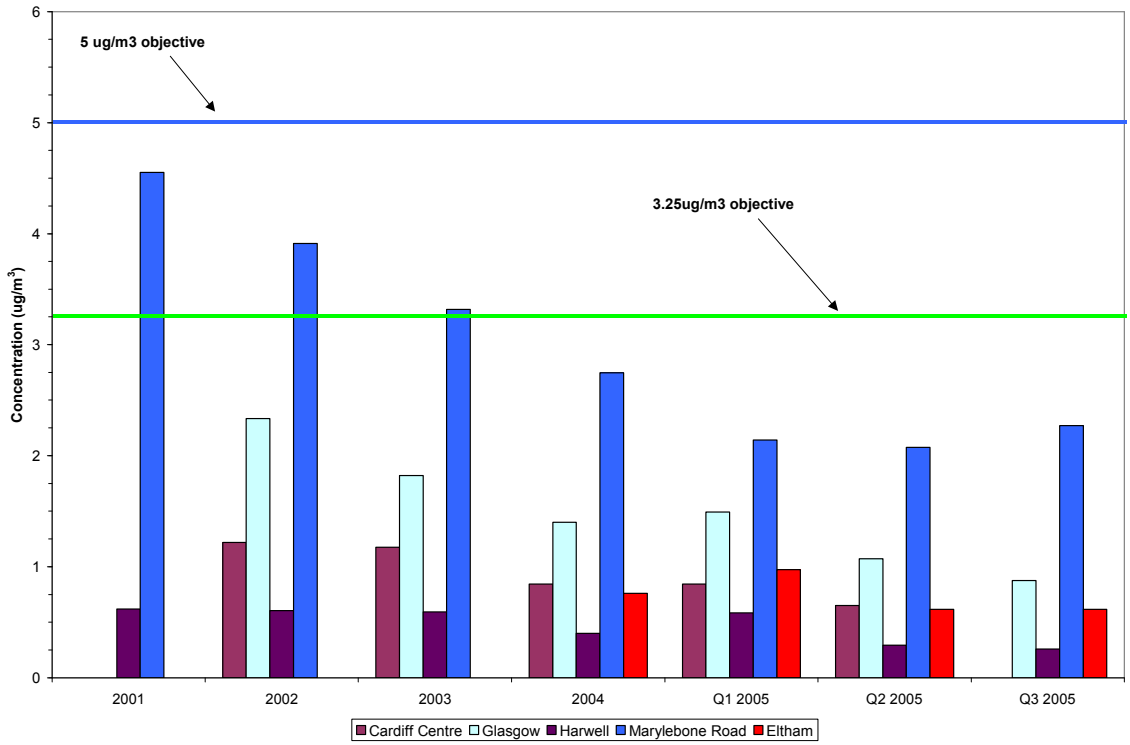

Figure 2. Mean Benzene concentrations for the UK Automatic Hydrocarbon Network, 2001-2004 and quarter 1, 2 and 3, 2005 (magnified y-axis)

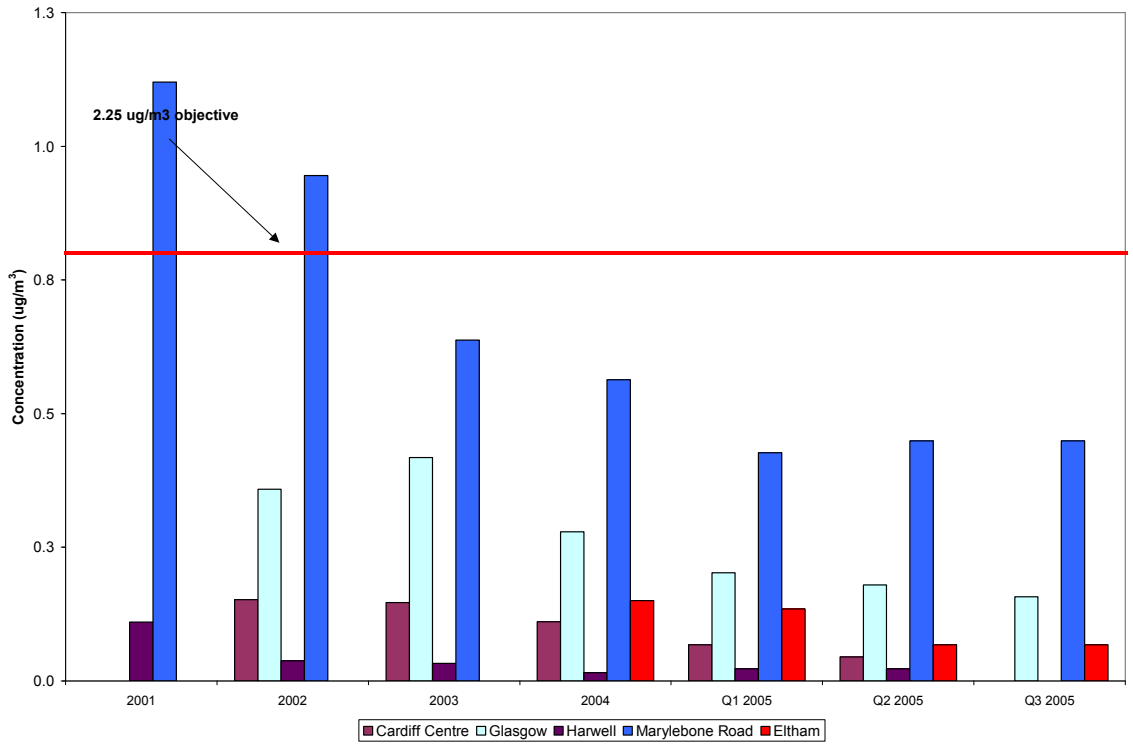

Figure 3. Mean 1,3-Butadiene concentrations for the UK Automatic Hydrocarbon Network, 2001-2004 and quarter 1, 2 and 3, 2005

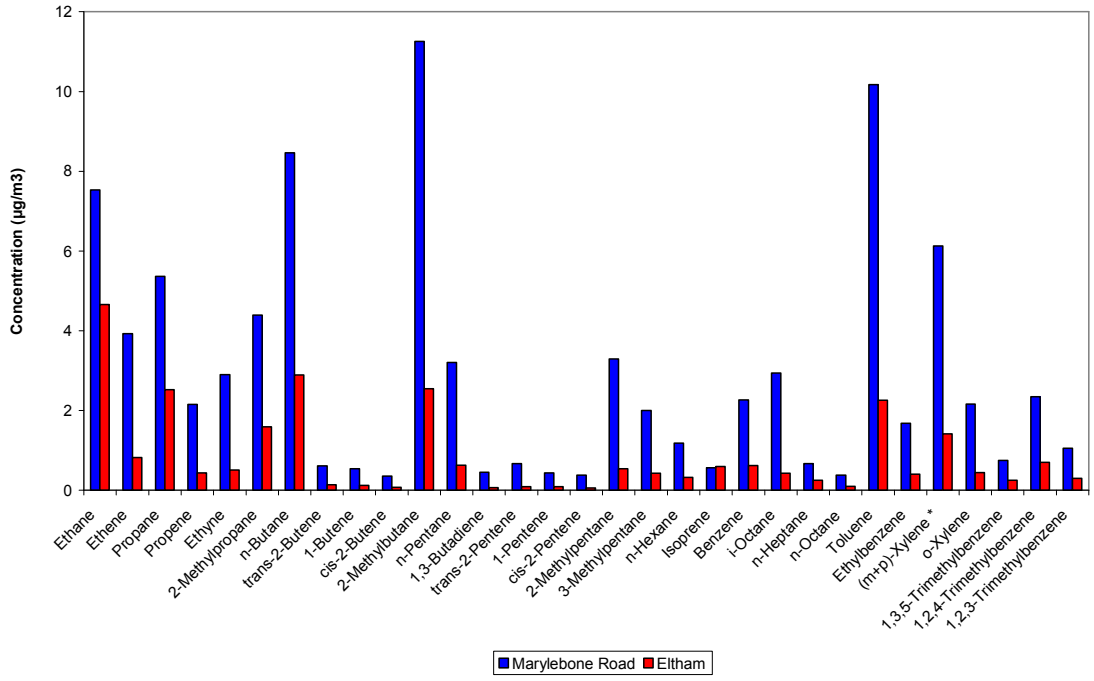

Figure 4. Mean concentrations for all compounds measured at Marylebone road and Eltham for the UK Automatic Hydrocarbon Network, for the period; 1 July 2005 to 30 September 2005