Ratification of data produced by the UK Ambient Hydrocarbon Automatic Air Quality Network, 1 April 2002 to 30 June 2002

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1 Introduction

This report contains information on the quality and statistical parameters associated with ratified data from the UK Ambient Hydrocarbon Automatic Air Quality Network (The UK Hydrocarbon Network). The presented information and data cover the period 1 April 2002 to 30 June 2002. The ratified data have been made available on the World Wide Web at http://www.airquality.co.uk/archive/data_and_statistics.php?f_group_id=7&action=step1&go=Step+1

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 for each individual month.

In this report the unit used for expressing concentrations of gases is micrograms per cubic metre ($\mu g/m^3$), where previous 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 $\mu g/m^3$ and ±0.05 $\mu g/m^3$ for values below 0.5 $\mu g/m^3$. 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 $\mu g/m^3$ and ± 0.1 $\mu g/m^3$ below 0.5 $\mu g/m^3$.

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

Each month's data are assigned a Data Quality Code for each species as follows:

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

3 Monthly Data Reports

The following sections give details of issues affecting data on a month by month basis. Data quality codes have been assigned for each monthly set of data.

3.1 CARDIFF

3.1.1 April

3.1.1.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.1.1.2 Missing Data – All hydrocarbons

Calibration 04/04/02 hours 13 to 14.
Calibration 23/04/02 hours 12 to 14.
PC/GC communication problem 26/04/02 hours 06 to 07.

3.1.1.3 Missing Data – Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.1.2 May

3.1.2.1 Data Quality Codes

Data quality code A for all data for all of the month

3.1.2.2 Missing Data - All hydrocarbons

Calibration 09/05/02 hours 13 to 14.
Calibration 23/05/02 hours 12 to 13.

3.1.2.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.1.3 June

3.1.3.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.1.3.2 Missing Data - All hydrocarbons

Calibration 06/06/02 hours 12 to 13.
PC/GC communication problem 14/06/02 hours 23 to 24.
Calibration 20/06/02 hours 10 to 11.

3.1.3.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.2 EDINBURGH

3.2.1 April

3.2.1.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.2.1.2 Missing Data - All hydrocarbons

PC/GC communication problem 03/04/02 hour 13 to 04/04/02 hour 08.
Calibration 10/04/02 hours 14 to 18.
PC/GC communication problem 11/04/02 hour 11 to 12/04/02 hour 09.
Calibration 25/04/02 hours 13 to 18.

3.2.1.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.2.2 May

3.2.2.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.2.2.2 Missing Data - All hydrocarbons

Calibration 09/05/02 hours 11 to 16.
Retention time instability 15/05/02 hour 12 to 22/05/02 hour 11.
Calibration 22/05/02 hours 12 to 16.

3.2.2.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.2.3 June

3.2.3.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.2.3.2 Missing Data - All hydrocarbons

Power supply fault / Site closed 03/06/02 hour 12.

3.2.3.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.3 HARWELL

3.3.1 April

3.3.1.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.3.1.2 Missing Data - All hydrocarbons

Calibration 11/04/02 hours 14 to 15.
Calibration 25/04/02 hours 10 to 11.

3.3.1.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.3.2 May

3.3.2.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.3.2.2 Missing Data - All hydrocarbons

Calibration 09/05/02 hours 10 to 12.
Calibration 23/05/02 hours 12 to 13.
PC/GC communication problem 31/05/02 hours 09 to 12.

3.3.2.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.3.3 June

3.3.3.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.3.3.2 Missing Data - All hydrocarbons

Calibration 06/06/02 hours 12 to 14.
Calibration 20/06/02 hours 09 to 11.

3.3.3.3 Missing Data - Specific hydrocarbons

None, except where the integration was unreliable due to very low concentrations.

3.4 MARYLEBONE ROAD

3.4.1 April

3.4.1.1 Data Quality Codes

Data quality code A for all data for all of the month except:
Data quality code E for 3-methylpentane for all of the month.

3.4.1.2 Missing Data - All hydrocarbons

Calibration 11/04/02 hours 06 to 09.
Calibration 17/04/02 hours 18 to 21.
PC/GC communication problem 23/04/02 hour 12 to 24/04/02 hour 12.
Calibration 24/04/02 hours 13 to 16.

3.4.1.3 Missing Data - Specific hydrocarbons

None.

3.4.2 May

3.4.2.1 Data Quality Codes

Data quality code A for all data for all of the month except:
Data quality code E for 3-methylpentane from 01/05/02 to 09/05/02.

3.4.2.2 Missing Data - All hydrocarbons

Calibration 01/05/02 hours 16 to 19.
Service visit 07/05/02 hour 15 to 08/05/02 hour 15.
Calibration 08/05/02 hours 18 to 21.
Service visit 09/05/02 hours 10 to 13.
Calibration 09/05/02 hours 16 to 19.
Calibration 24/05/02 hours 07 to 10.
Calibration 29/05/02 hours 18 to 21.

3.4.2.3 Missing Data - Specific hydrocarbons

None.

3.4.3 June

3.4.3.1 Data Quality Codes

Data quality code A for all data for all of the month.

3.4.3.2 Missing Data - All hydrocarbons

Calibration 13/06/02 hours 09 to 12.
Calibration 19/06/02 hours 15 to 18.

3.4.3.3 Missing Data - Specific hydrocarbons

None.

4 Discussion

4.1 THE RATIFIED DATA

Tables 1 to 4, Appendix 1 contain statistical information relating to the ratified data, for each measured hydrocarbon, over the period 1 April 2002 to 30 June 2002. The tables list the percentage data capture, maximum concentration, mean concentration and minimum concentration of each hydrocarbon. The data capture is the number of ratified hourly data values expressed as a percentage of the number of hours in the specified period.

4.1.1 Cardiff

For the Cardiff site the data capture for Benzene was 99.08% and for 1,3-Butadiene was 99.13%. There were no significant problems for the period covered by this report.

4.1.2 Edinburgh

For the Edinburgh site the data capture for Benzene was 58.79% and for 1,3-Butadiene was 58.79%. During May the retention times of the peaks in the chromatograms became unstable making the data very difficult to process. The problem disappeared before it could be investigated. Approximately one week of data was lost.
Early in June a fuse was blown on an internal power supply. It was then decided to return the analyser to the CMCU for servicing and testing before the site was relocated to Glasgow in the next quarter.

4.1.3 Harwell

For the Harwell site the data capture for Benzene was 92.86% and for 1,3-Butadiene was 92.99%. There were no significant problems for the period covered by this report.

4.1.4 Marylebone Road

For the Marylebone Road site the data capture for Benzene was 95.56% and for 1,3-Butadiene was 95.56%. There were no significant problems for the period covered by this report.

4.2 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 Cardiff, Edinburgh and Harwell the measured concentrations of hydrocarbons were low for most of the period covered by this report with no episodes of significantly elevated concentrations. 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.

Marylebone Road tends to exhibits higher levels with less seasonal variation than is apparent at the other sites. The measured concentrations and trends are typical of a roadside site where the source of the measured hydrocarbons is close to the monitoring location. The emitted hydrocarbons will have had little time to mix and react in the atmosphere. The measured concentrations at Marylebone Road for April to June 2002 exhibited no significant episodes of elevated concentrations.

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 $\mu g/m^3$ 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 $\mu g/m^3$ expressed as an annual mean to be met by end of 2010. In Scotland an additional objective has been set for benzene of 3.25 $\mu g/m^3$ to be met by the end of 2010. The Air Quality Objective for 1,3-butadiene is specified as a RAM of 2.25 $\mu g/m^3$ to be met by the end of 2003.

The annual means for 2000 and 2001 and the quarterly means for the first two quarters of 2002 are given in tables 1 and 2 below. The annual means for 2000 and 2002 were well below the respective Air Quality Objective to be met by the end of 2003. The means for both benzene and 1,3-butadiene for quarter 1, 2002 were slightly lower than the annual means for 2001. The means for quarter 2, 2002 were significantly lower than the means for quarter 1, 2002 and annual means for 2000 and 2001. There is insufficient data to determine whether the lower concentrations are a true reflection of the long-term trend or due to annual variations or prevailing meteorological conditions during the monitoring period.

Table 1. Means of measured Benzene Concentrations ($\mu g/m^3$) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2000 Annual Mean	2001 Annual Mean	Quarter 1 2002 Mean	Quarter 2 2002 Mean
Cardiff	1.68	1.75	1.01	0.58
Edinburgh	1.17	1.33	0.88	0.58
Harwell	0.53	0.62	0.68	0.39
Marylebone Road	6.29	4.55	4.64	3.31

Table 2. Means of measured 1,3-Butadiene Concentrations ($\mu g/m^3$) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2000 Annual Mean	2001 Annual Mean	Quarter 1 2002 Mean	Quarter 2 2002 Mean
Cardiff	0.29	0.27	0.09	0.04
Edinburgh	0.14	0.20	0.07	0.04
Harwell	0.09	0.11	0.04	0.02
Marylebone Road	1.63	1.12	1.15	0.88

Appendices

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Appendix 1
Summary Statistical Information

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Table 1. Percentage data capture, maximum, mean and minimum values of ratified data from the Cardiff site of the UK Hydrocarbon Network, for the period 1 April 2002 to 30 June 2002

Compound	%data capture	Maximum concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum concentration ($\mu g/m^3$)
1,3-Butadiene	99.13	0.43	0.04	0.00
Benzene	99.08	8.89	0.58	0.00
Toluene	99.22	19.70	3.14	0.23
Ethylbenzene	87.96	2.07	0.35	0.04
(m+p)-Xylene *	99.13	20.93	1.37	0.04
o-Xylene	92.54	4.98	0.62	0.04

* (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 Edinburgh site of the UK Hydrocarbon Network, for the period 1 April 2002 to 30 June 2002

Compound	%data capture	Maximum concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum concentration ($\mu g/m^3$)
1,3-Butadiene	58.79	1.23	0.04	0.00
Benzene	58.79	5.80	0.58	0.00
Toluene	58.88	12.47	2.18	0.08
Ethylbenzene	43.04	1.94	0.44	0.09
(m+p)-Xylene *	58.42	8.55	1.67	0.09
o-Xylene	46.43	3.04	0.53	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 3. Percentage data capture, maximum, mean and minimum values of ratified data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

Compound	%data capture	Maximum concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum concentration ($\mu g/m^3$)
1,3-Butadiene	92.99	0.22	0.02	0.00
Benzene	92.86	1.88	0.39	0.00
Toluene	98.9	12.97	1.45	0.04
Ethylbenzene	28.85	0.97	0.22	0.04
(m+p)-Xylene *	84.16	3.09	0.40	0.04
o-Xylene	43.54	1.32	0.26	0.04

* (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 4. Percentage data capture, maximum, mean and minimum values of ratified data from the Marylebone Road site for the period; 1 April 2002 to 30 June 2002

Compound	%data capture	Maximum concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum concentration ($\mu g/m^3$)
Ethane	95.56	65.73	7.73	2.06
Ethene	95.56	22.56	6.55	0.27
Propane	95.56	205.62	4.10	0.57
Propene	95.56	12.35	3.54	0.26
Ethyne	95.56	18.01	4.13	0.24
2-Methylpropane	95.56	89.59	5.21	0.31
n-Butane	95.56	127.71	9.62	0.48
trans-2-Butene	95.56	7.05	0.70	0.07
1-Butene	95.56	6.64	0.79	0.05
cis-2-Butene	95.51	4.77	0.56	0.05
2-Methylbutane	95.56	108.25	14.07	0.60
n-Pentane	95.56	28.14	3.20	0.27
1,3-Butadiene	95.56	2.76	0.88	0.04
trans-2-Pentene	95.47	5.76	0.96	0.03
cis-2-Pentene	95.05	3.29	0.52	0.00
2-Methylpentane	95.47	34.15	4.36	0.18
3-Methylpentane	85.71	21.56	2.40	0.07
Isoprene	95.19	2.74	0.62	0.03
n-Hexane	87.04	14.30	1.61	0.04
n-Heptane	94.73	6.94	0.83	0.00
Benzene	95.56	19.94	3.31	0.03
Toluene	95.6	172.13	14.92	0.50
Ethylbenzene	95.6	22.17	2.82	0.04
(m+p)-Xylene *	95.6	58.92	9.34	0.09
o-Xylene	95.6	23.93	3.48	0.04
1,3,5-Trimethylbenzene	95.6	16.51	1.20	0.05
1,2,4-Trimethylbenzene	95.56	47.35	3.44	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.

Appendix 2
Time Series Plots of Hydrocarbon Concentrations

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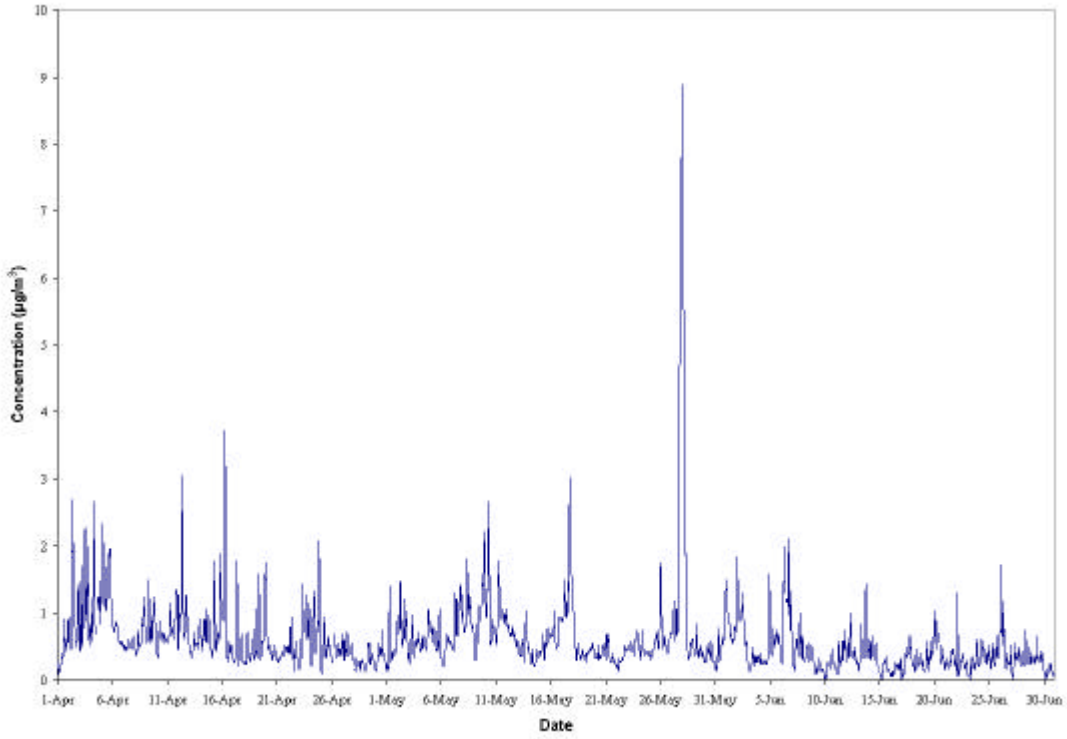

Figure 1. Time series plot of the ratified Benzene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

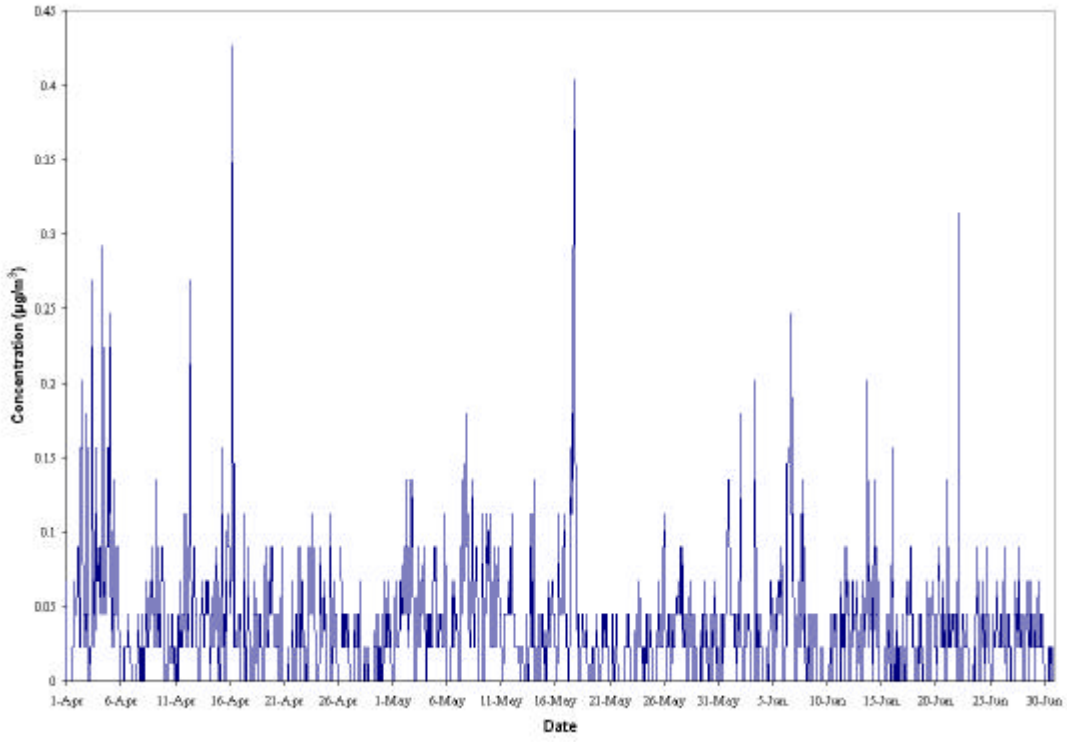

Figure 2. Time series plot of the ratified 1,3-Butadiene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

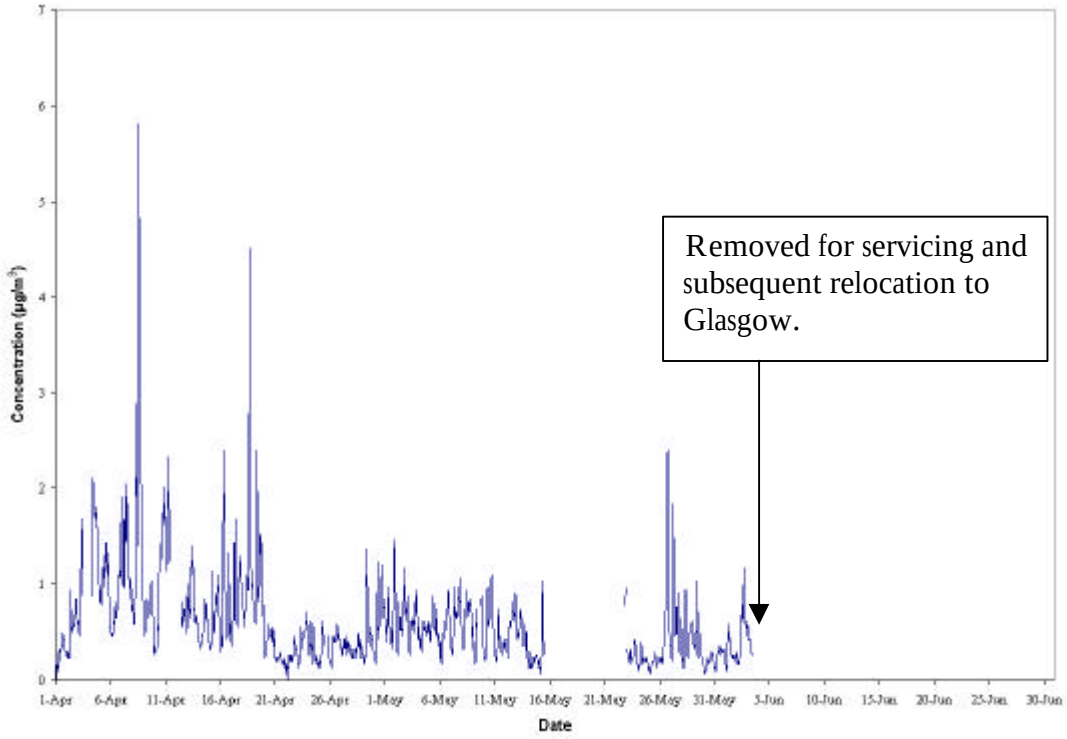

Figure 3. Time series plots for the ratified Benzene data from the Edinburgh site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

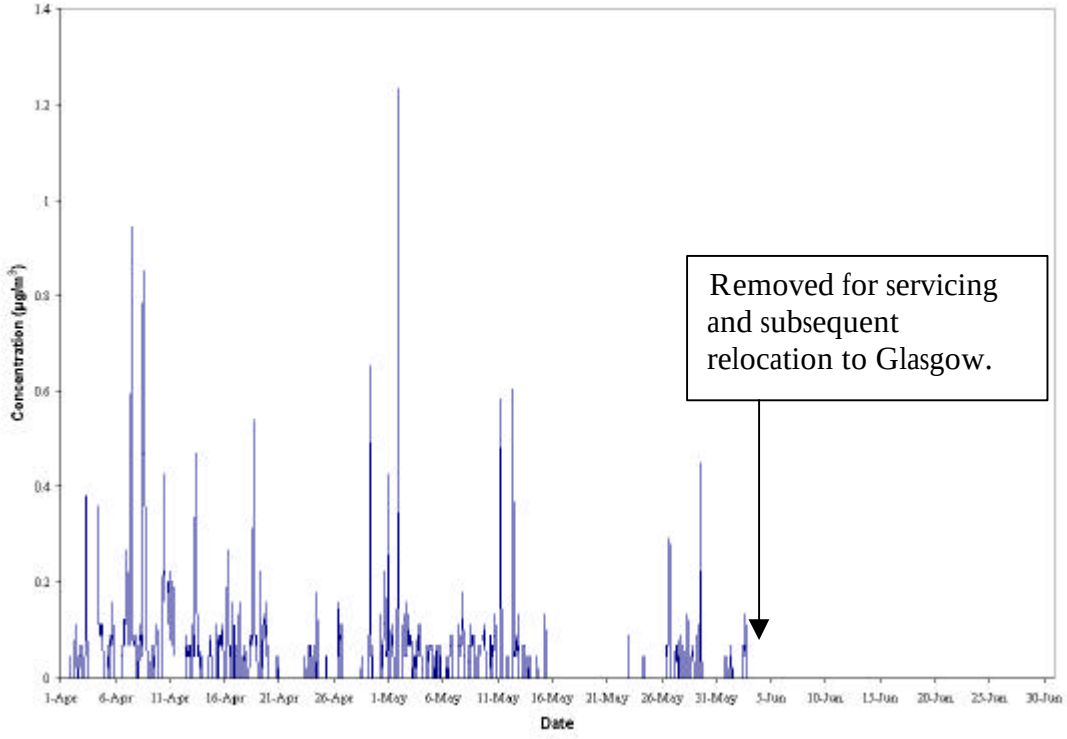

Figure 4. Time series plots for the ratified 1,3-Butadiene data from the Edinburgh site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

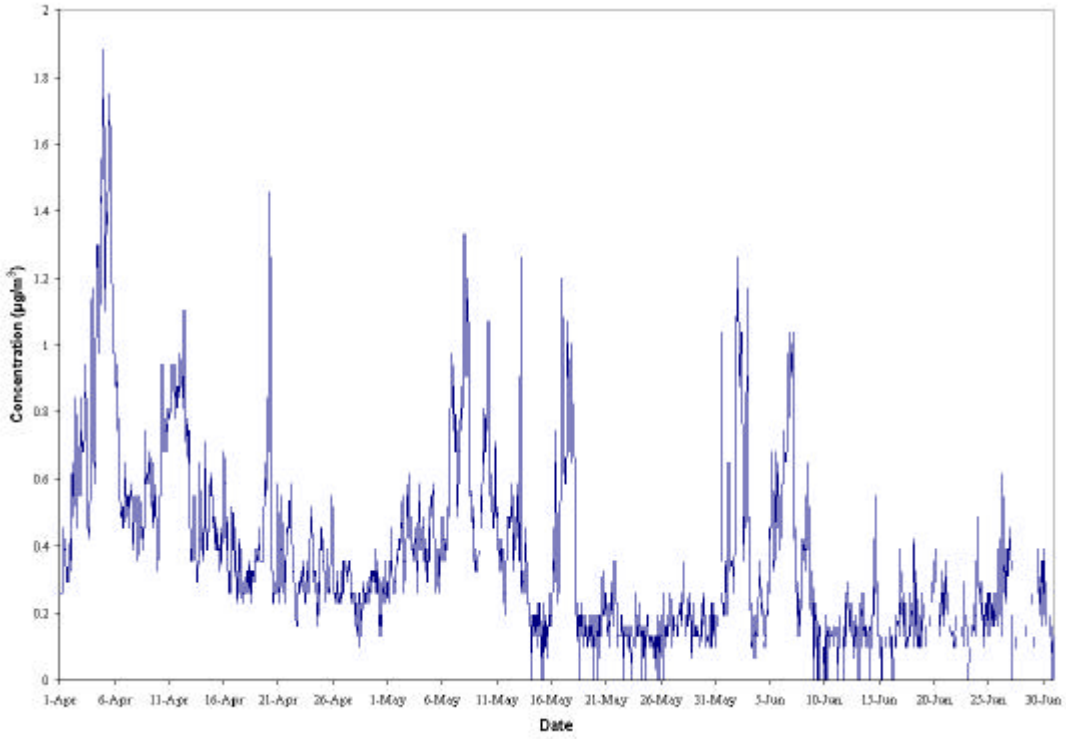

Figure 5. Time series plots for the ratified Benzene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

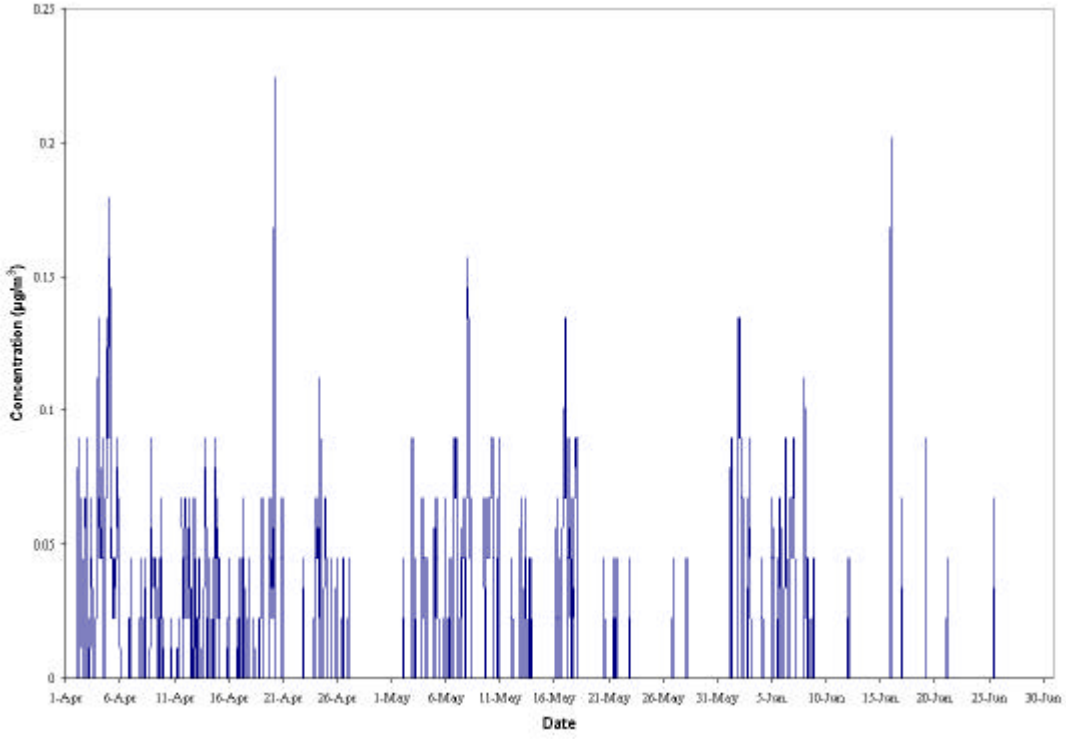

Figure 6. Time series plots for the ratified 1,3-Butadiene data from the Harwell site of The UK Hydrocarbon Network, for the period; 1 April 2002 to 30 June 2002

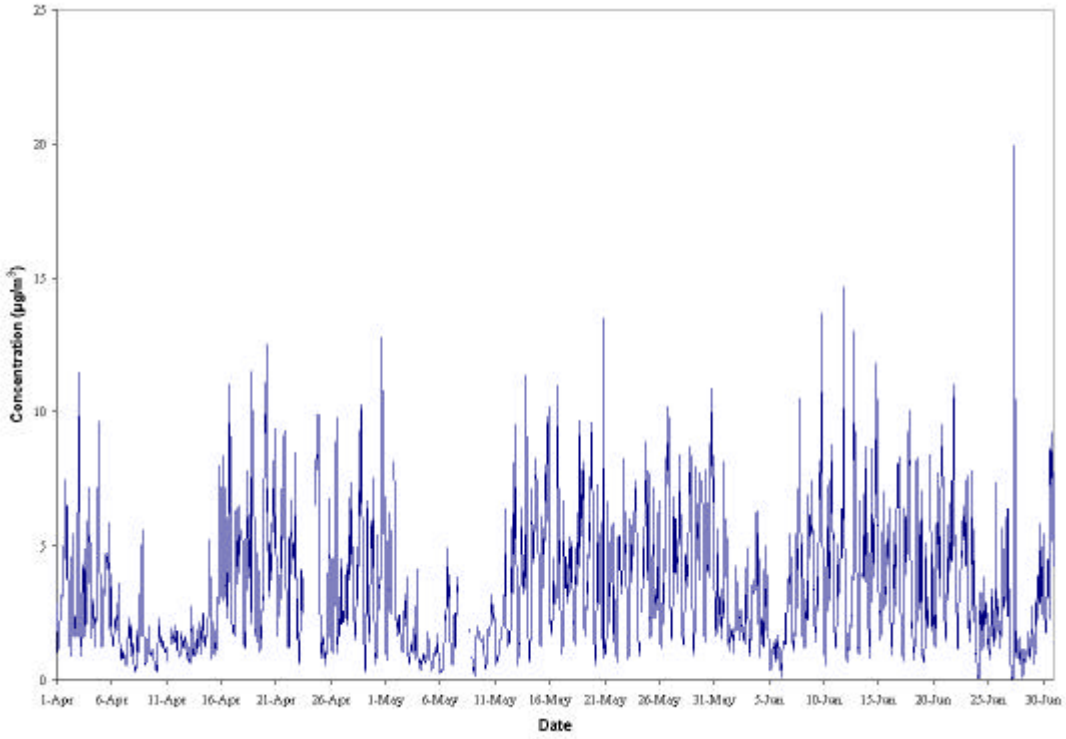

Figure 7. Time series plots for the ratified Benzene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period;
1 April 2002 to 30 June 2002

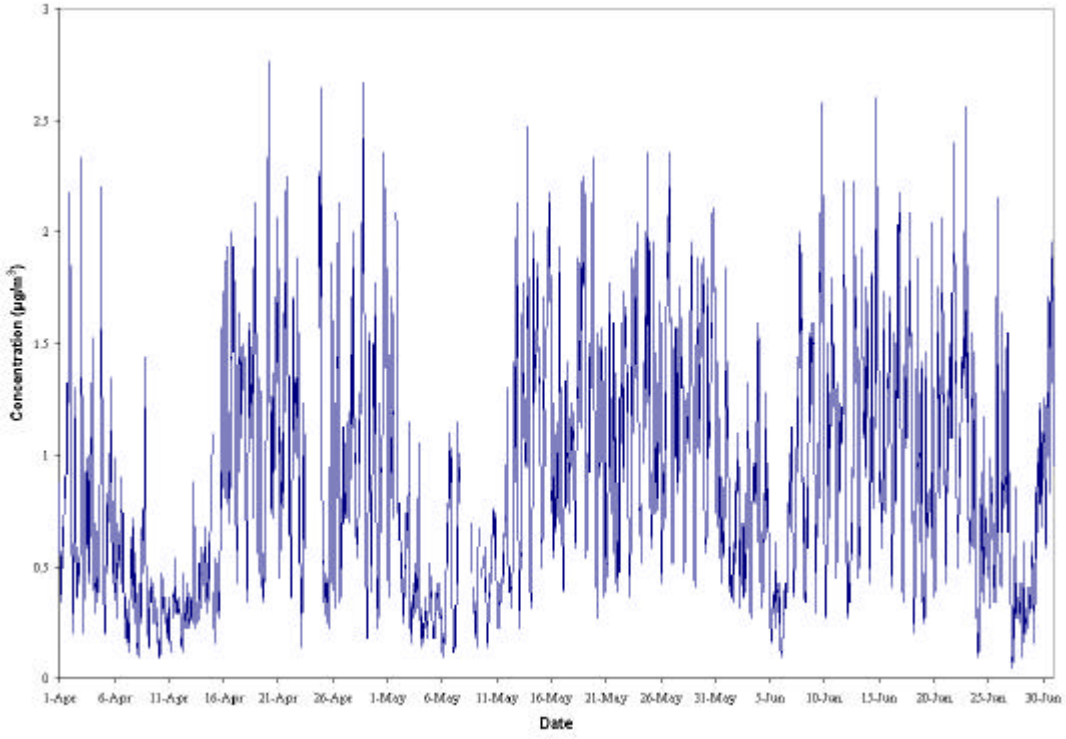

Figure 8. Time series plots for the ratified 1,3-Butadiene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period;
1 April 2002 to 30 June 2002