REPORT

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

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

AEAT/ENV/R/1360 Issue 1
January 2003

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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 July 2002 to 30 September 2002. 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 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 ($\mu g/m^3$).

During the period covered by this report two of the analysers in the Hydrocarbon Network have been relocated to new sites. The analyser previously at the Cardiff East site was moved to Cardiff Centre site and the analyser at Edinburgh was moved to the the Glasgow Kerbside site. Both of these new sites are housed in existing Automatic Urban Network sites and a range of inorganic pollution species is already measured at these locations.

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.

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.

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

The Cardiff site was relocated on the 5th September 2002. The instrumentation was removed from the Cardiff East site (CAR2) and installed at the Cardiff Centre centre site (CARD) to co-locate with other AURN instrumentation. The data sets from both sites have been combined for the purposes of statistical analyses for this period.

3.1.1 July

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 04/07/02 hours 12 to 13.
Calibration 18/07/02 hours 09 to 10.
Calibration 31/7/02 hours 09 to 11.

3.1.1.3 Missing Data – Specific hydrocarbons

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

3.1.2 August

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

PC/GC communication problem 03/08/02 hours 16 to 17.
Calibration 15/08/02 hours 12 to 13.
Calibration 29/08/02 hours 10 to 11.

3.1.2.3 Missing Data - Specific hydrocarbons

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

3.1.3 September

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

Site relocation 05/09/02 hours 08 to 16.
GC circuit board fault 20/09/02 hour 15 to 30/09/02 hour 24.

3.1.3.3 Missing Data - Specific hydrocarbons

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

3.2 GLASGOW

The analyser from the Edinburgh site was returned to the CMCU for servicing and testing before installation on the 1st August 2002. Ratified data is available from 01/08/02 hour 15.

3.2.1 August

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

GC installed 01/08/02 hour 08.
Calibration 01/08/02 hours 08 to 15.
Calibration 14/08/02 hours 12 to 14.
Calibration 28/08/02 hours 14 to 16.

3.2.1.3 Missing Data - Specific hydrocarbons

None.

3.2.2 September

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 11/09/02 hours 11 to 15.
PC/GC communication problem 19/09/02 hours 14 to 15.
Calibration 24/09/02 hours 10 to 14.

3.2.2.3 Missing Data - Specific hydrocarbons

None.

3.3 HARWELL

3.3.1 July

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 03/07/02 hours 09 to 10.
Calibration 19/07/02 hours 16 to 18.
Power supply fault 29/07/02 hour 13 to 30/07/02 hour 13.

3.3.1.3 Missing Data - Specific hydrocarbons

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

3.3.2 August

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 01/08/02 hours 09 to 10.
Calibration 15/08/02 hours 09 to 11.
PC/GC communication problem 29/08/02 hours 11 to 13.

3.3.2.3 Missing Data - Specific hydrocarbons

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

3.3.3 September

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 02/09/02 hours 16 to 18.
Calibration 12/09/02 hours 12 to 13.
Service visit 16/09/02 hours 07 to 17.
Calibration 26/09/02 hours 10 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 July

3.4.1.1 Data Quality Codes

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

3.4.1.2 Missing Data - All hydrocarbons

Calibration 04/07/02 hours 07 to 10.
Calibration 10/07/02 hours 12 to 15.
Calibration 25/07/02 hours 04 to 07.
Calibration 31/07/02 hours 13 to 16.

3.4.1.3 Missing Data - Specific hydrocarbons

None.

3.4.2 August

3.4.2.1 Data Quality Codes

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

3.4.2.2 Missing Data - All hydrocarbons

Calibration 15/08/02 hours 04 to 07.

3.4.2.3 Missing Data - Specific hydrocarbons

None.

3.4.3 September

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 05/09/02 hours 02 to 06.
Calibration 11/09/02 hours 15 to 18.
PC/GC communication problem 26/09/02 hours 10 to 11.

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 July 2002 to 30 September 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 87.27% and for 1,3-Butadiene was 87.32%. On the 5th September the instrument was relocated from Cardiff East to Cardiff Centre, so that it could be co-located with the AURN site. The Cardiff East site was classified as an Urban Background site, whereas the Cardiff Centre site is classified as Urban Centre, located in a pedestrianised street, 190m from a major road.

On the 20th September a fault developed on the circuit board that controlled the PID heater. It was not possible to repair this at the site or at the CMCU so the analyser was returned to the manufacturer. This resulted in no data from the 20th September to the end of the quarter.

4.1.2 Glasgow

For the Glasgow site the data capture for Benzene was 64.81% and for 1,3-Butadiene was 64.81%. In the previous quarter a fault had developed on the Edinburgh analyser which was returned to the CMCU for repair and testing. The decision to relocate the Edinburgh site to Glasgow had been agreed at an earlier date. After repair, the instrument was retained at the CMCU while effort was put into preparing the Glasgow site prior to installation. The instrument was installed at the Glasgow site in Hope Street on the 1st August 2002.

4.1.3 Harwell

For the Harwell site the data capture for Benzene was 87.86% and for 1,3-Butadiene was 87.91%. 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 98.14% and for 1,3-Butadiene was 98.14%. 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 μg/m^3 on a number of occasions see figures 2 and 6, Appendix 2. Where concentrations fell below 0.02 μg/m^3 the ratified concentrations have been reported as 0.00 μg/m^3.

At Cardiff 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 and photochemical removal is at a minimum. On the 5th September the Cardiff site was relocated from an urban background to an urban centre location. There appeared to be a small decrease in the observed concentrations, probably due to the source of the measured hydrocarbons being further from the monitoring station.

Glasgow and Marylebone Road tend to exhibit higher levels with less seasonal variation than is apparent at the other 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. The emitted hydrocarbons will have had little time to mix and react in the atmosphere. The measured concentrations at Glasgow and Marylebone Road for July to September 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 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 an additional 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 2000 and 2001 and the quarterly means for the first three quarters of 2002 are given in Tables 1 and 2 below. The annual means for 2000 and 2001 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. The means for quarter 3, 2002 are very similar to those of quarter 2, 2002. 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 (μg/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	Quarter 3 2002 Mean
Cardiff	1.68	1.75	1.01	0.58	0.49
Edinburgh	1.17	1.33	0.88	0.58	$
Glasgow	$	$	$	$	1.95
Harwell	0.53	0.62	0.68	0.39	0.39
Marylebone Road	6.29	4.55	4.64	3.31	3.47

$ The Edinburgh instrument was relocated to the Glasgow site.

Table 2. Means of measured 1,3-Butadiene Concentrations (μg/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	Quarter 3 2002 Mean
Cardiff	0.29	0.27	0.09	0.04	0.04
Edinburgh	0.14	0.20	0.07	0.04	$
Glasgow	$	$	$	$	0.40
Harwell	0.09	0.11	0.04	0.02	0.02
Marylebone Road	1.63	1.12	1.15	0.88	0.83

$ The Edinburgh instrument was relocated to the Glasgow site.

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Appendix 1
Summary Statistical Information

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Table 2. 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 2002 to 30 September 2002

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 July 2002 to 30 September 2002

Table 4. 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 2002 to 30 September 2002

Table 1. Percentage data capture, maximum, mean and minimum values of the combined ratified data sets from the Cardiff East and Cardiff Centre sites of the UK Hydrocarbon Network, for the period 1 July 2002 to 30 September 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	87.32	0.81	0.04	0.00
Benzene	87.27	3.83	0.49	0.00
Toluene	87.68	28.15	2.75	0.34
Ethylbenzene	77.17	4.50	0.40	0.04
(m+p)-Xylene *	87.64	13.00	1.45	0.04
o-Xylene	82.61	4.89	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 Glasgow site of the UK Hydrocarbon Network, for the period 1 July 2002 to 30 September 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	64.81	8.17	0.40	0.00
Benzene	64.81	8.82	1.95	0.26
Toluene	64.49	21.46	7.73	1.03
Ethylbenzene	64.81	20.10	1.72	0.13
(m+p)-Xylene *	64.81	20.80	5.64	0.57
o-Xylene	64.81	18.25	2.42	0.31

* (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 July 2002 to 30 September 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	87.91	0.34	0.02	0.00
Benzene	87.86	2.04	0.39	0.00
Toluene	96.74	23.26	1.99	0.11
Ethylbenzene	34.38	1.98	0.26	0.04
(m+p)-Xylene *	79.76	6.70	0.62	0.09
o-Xylene	44.52	2.51	0.31	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 affiliated to the UK Hydrocarbon Network for the period; 1 July 2002 to 30 September 2002

Compound	%data capture	Maximum concentration ($\mu g/m^3$)	Mean concentration ($\mu g/m^3$)	Minimum concentration ($\mu g/m^3$)
Ethane	98.19	68.19	8.49	1.87
Ethene	98.19	22.76	6.03	0.48
Propane	98.19	467.23	5.16	0.91
Propene	98.19	12.01	3.34	0.33
Ethyne	98.19	21.32	3.88	0.32
2-Methylpropane	98.19	45.21	5.62	0.43
n-Butane	98.19	78.52	9.77	0.60
trans-2-Butene	98.19	3.84	0.75	0.14
1-Butene	98.19	4.12	0.84	0.07
cis-2-Butene	98.19	3.05	0.58	0.07
2-Methylbutane	98.19	97.53	16.40	0.99
n-Pentane	98.19	21.28	3.98	0.42
1,3-Butadiene	98.14	2.83	0.83	0.07
trans-2-Pentene	98.19	5.62	1.02	0.06
cis-2-Pentene	97.92	3.00	0.55	0.03
2-Methylpentane	98.19	33.61	4.90	0.32
3-Methylpentane	98.19	22.92	3.04	0.18
Isoprene	98.10	2.46	0.68	0.03
n-Hexane	98.01	10.91	1.82	0.07
n-Heptane	97.78	9.77	0.91	0.00
Benzene	98.14	16.57	3.47	0.10
Toluene	98.14	638.02	16.07	0.57
Ethylbenzene	98.05	31.20	3.00	0.04
(m+p)-Xylene *	95.65	95.81	10.27	0.40
o-Xylene	98.01	24.20	3.75	0.13
1,3,5-Trimethylbenzene	98.14	16.12	1.40	0.05
1,2,4-Trimethylbenzene	98.14	45.70	3.79	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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Figure 1. Time series plot of the combined ratified Benzene data sets from the Cardiff East and Cardiff Centre sites of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

Figure 2. Time series plot of the combined ratified 1,3-Butadiene data sets from the Cardiff East and Cardiff Centre sites of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

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

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

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

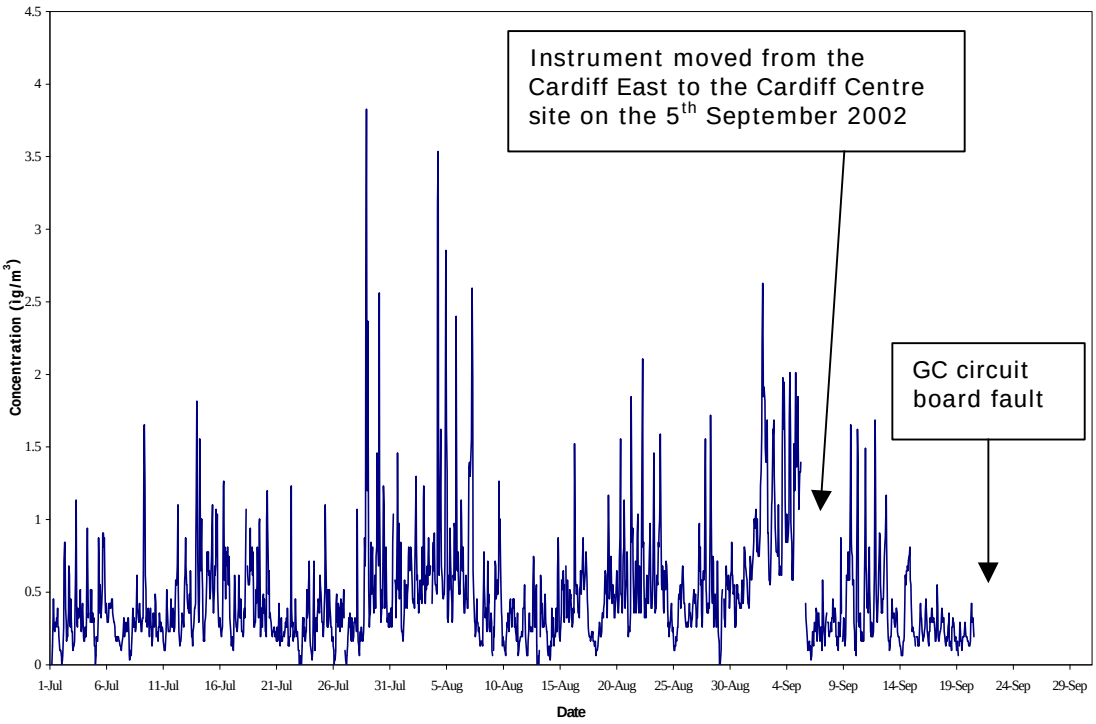

Figure 1. Time series plot of the combined ratified Benzene data sets from the Cardiff East and Cardiff Centre sites of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

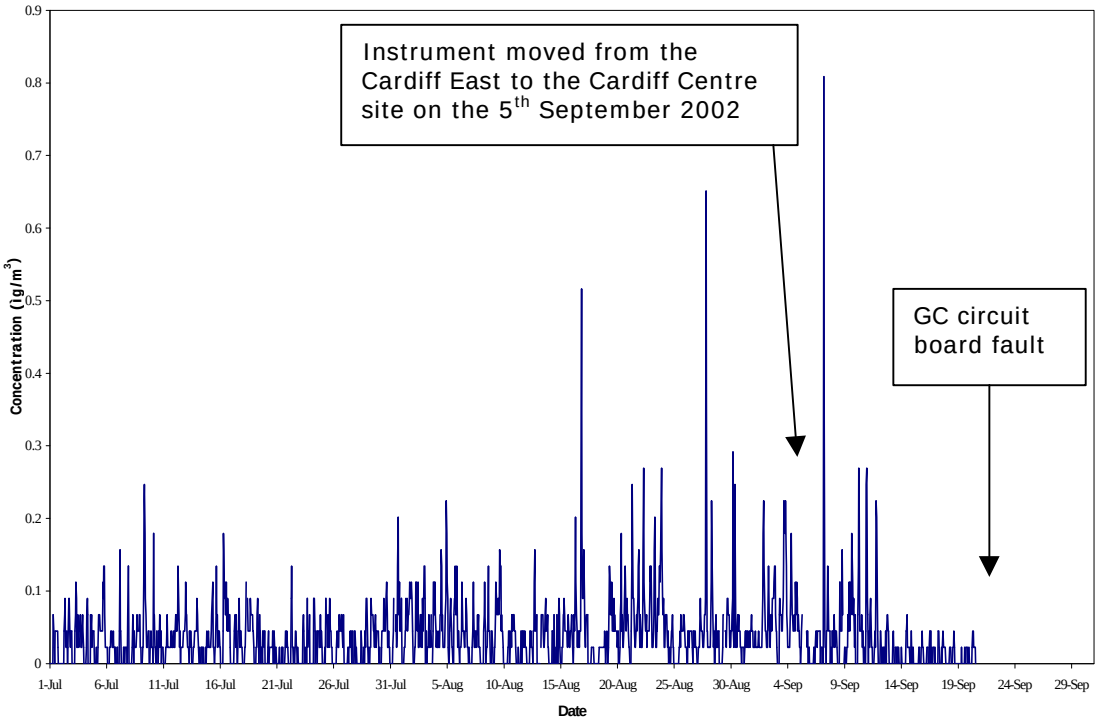

Figure 2. Time series plot of the combined ratified 1,3-Butadiene data sets from the Cardiff East and Cardiff Centre sites of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

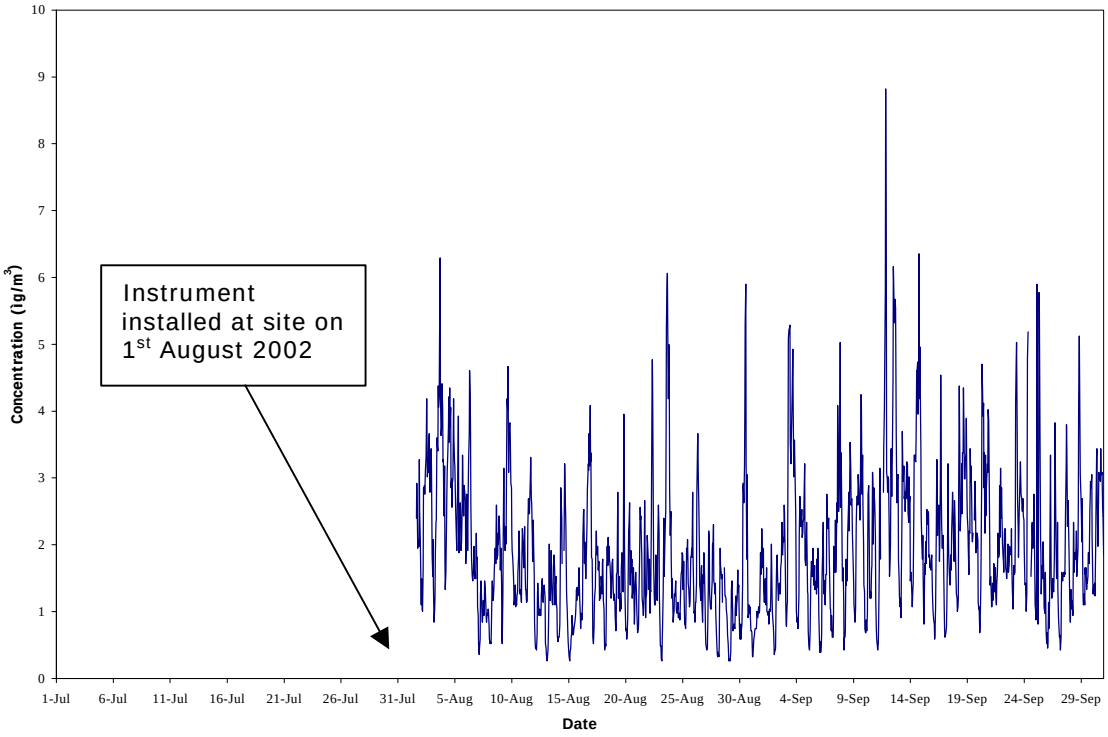

Figure 3. Time series plots for the ratified Benzene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

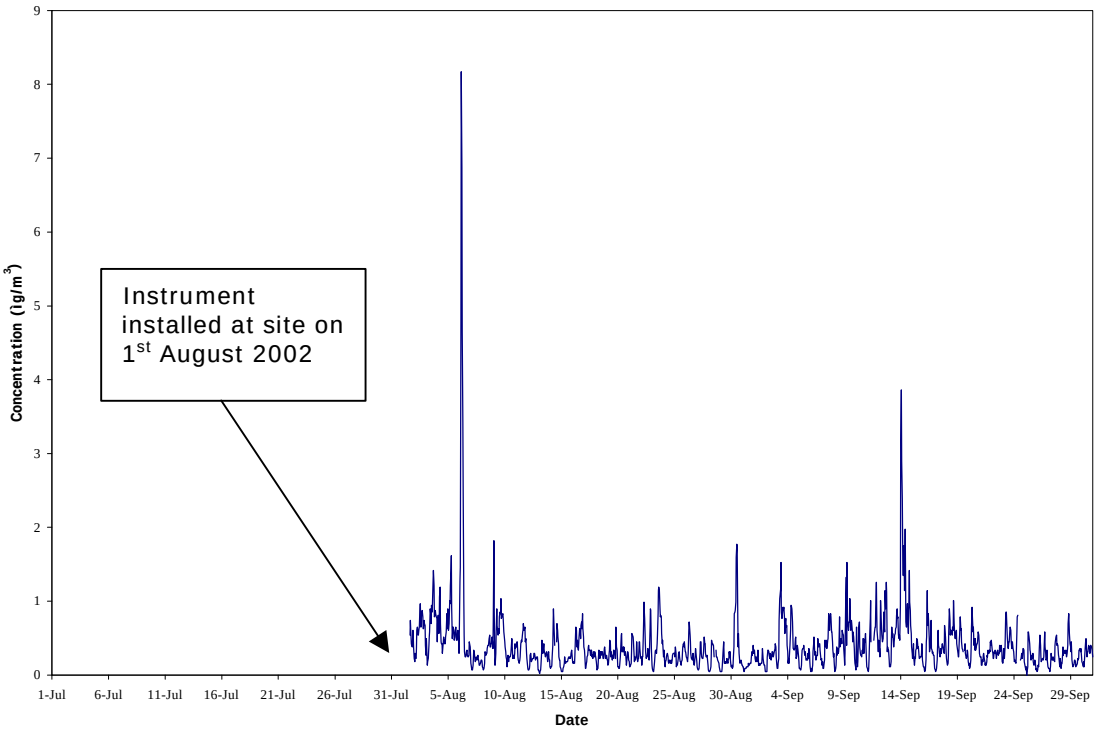

Figure 4. Time series plots for the ratified 1,3-Butadiene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

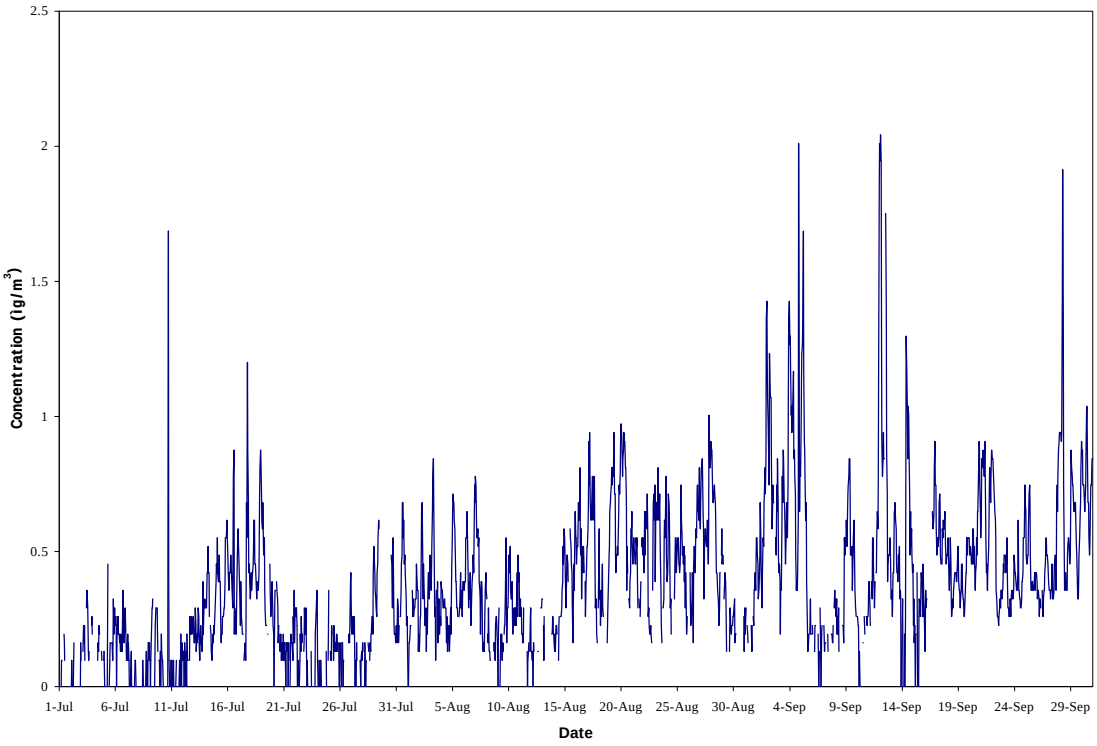

Figure 5. Time series plots for the ratified Benzene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

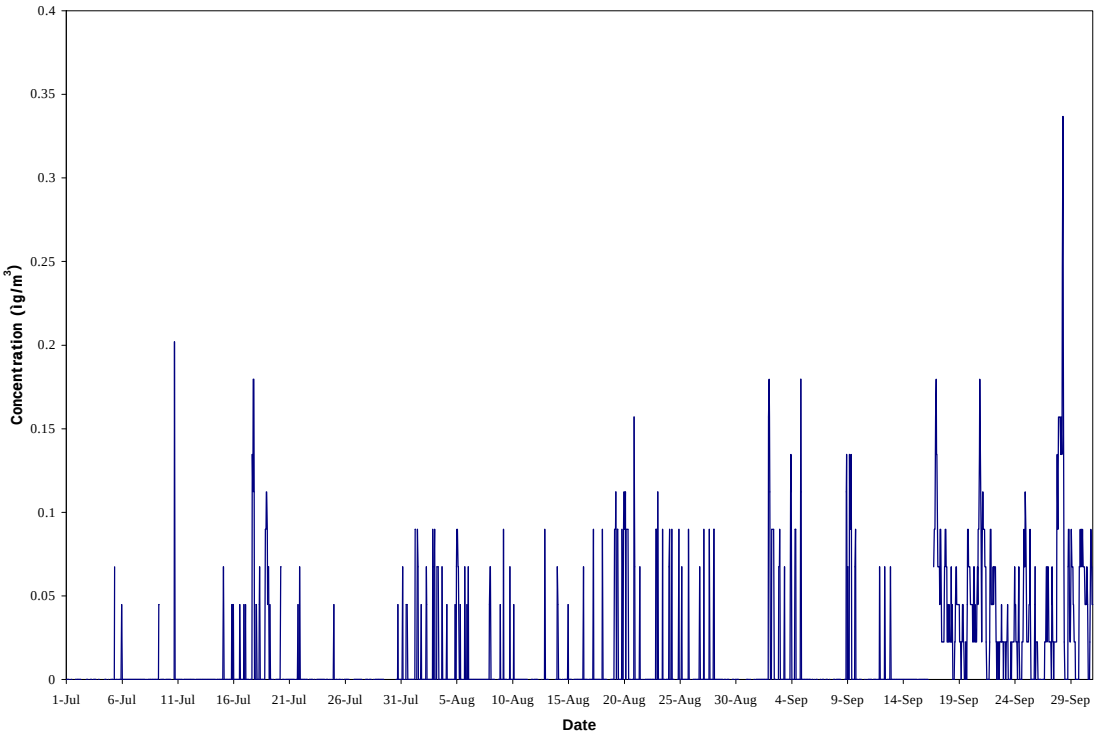

Figure 6. Time series plots for the ratified 1,3-Butadiene data from the Harwell site of The UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002

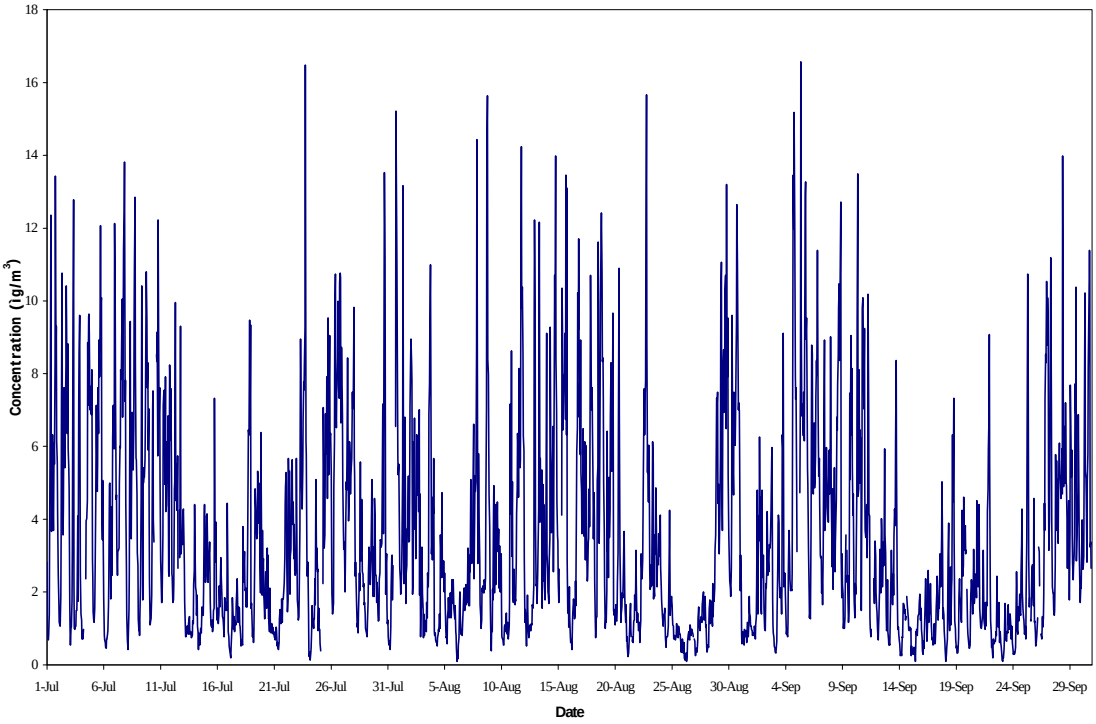

Figure 7. Time series plots for the ratified Benzene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period;1 July 2002 to 30 September 2002

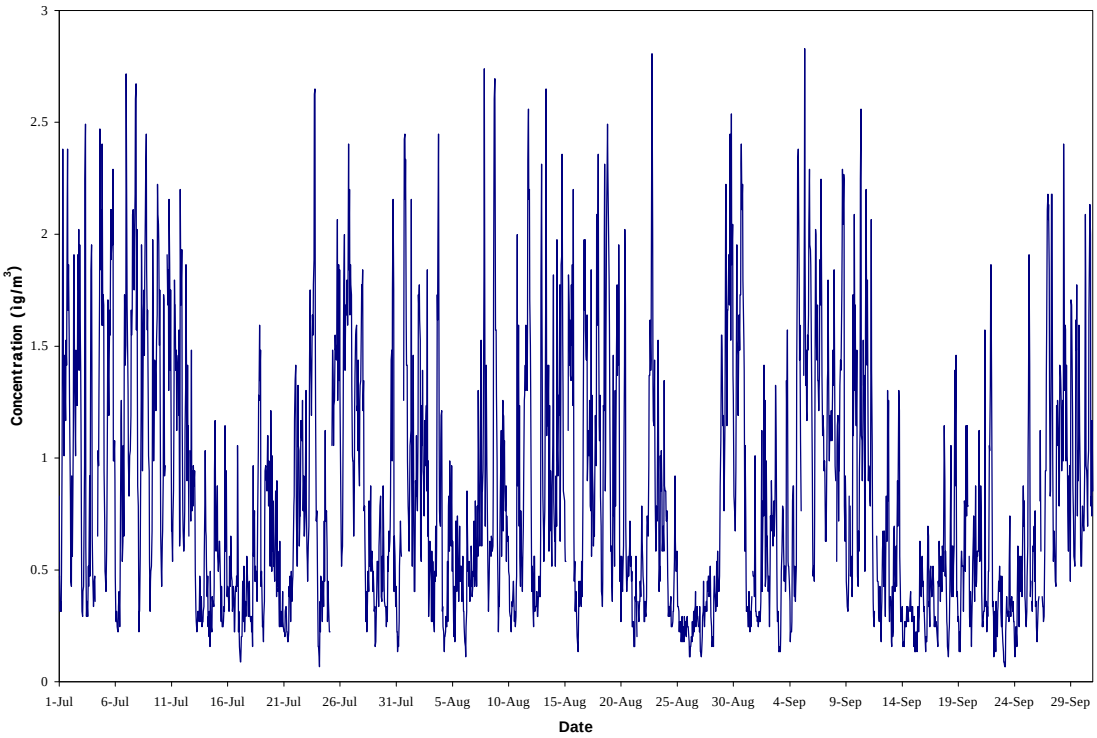

Figure 8. Time series plots for the ratified 1,3-Butadiene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2002 to 30 September 2002