

REPORT

Ratification of data produced by the UK Ambient Automatic Hydrocarbon Air Quality Network, 1 July 2004 to 30 September 2004

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

AEAT/ENV/R/1912 Issue 1
March 2005

Ratification of data produced by the UK Ambient Automatic Hydrocarbon Air Quality Network, 1 July 2004 to 30 September 2004

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

AEAT/ENV/R/1912 Issue 1
March 2005

Title	Ratification of data produced by the UK Ambient Automatic Hydrocarbon Air Quality Network, 1 July 2004 to 30 September 2004
Customer	Department for Environment, Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment in Northern Ireland
Customer reference	RMP 2423
Confidentiality, copyright and reproduction	Copyright AEA Technology plc. All rights reserved. Enquiries about copyright and reproduction should be addressed to the Commercial Manager, AEA Technology plc.
File reference	ED48202
Report number	AEAT/ENV/R/1912
Report status	Issue 1

AEA Technology plc
Netcen
 Building 551
 Harwell
 Didcot
 Oxon, OX11 0QJ

Telephone 0870 1905425
 Facsimile 0870 1906377

netcen is an operating division of AEA Technology plc
 AEA Technology is certificated to BS EN ISO9001:(2000)

	Name	Signature	Date
Author	Emma James		
Reviewed by	Peter Dumitrean		
Approved by	Steve Telling		

Contents

1	Introduction	1
2	Hydrocarbon Data Quality	2
3	Monthly Data Reports	3
3.1	CARDIFF	3
3.1.1	July	3
3.1.1.1	Data Quality Codes	3
3.1.1.2	Missing Data - All hydrocarbons	3
3.1.1.3	Missing Data - Specific hydrocarbons	3
3.1.2	August	3
3.1.2.1	Data Quality Codes	3
3.1.2.2	Missing Data - All hydrocarbons	3
3.1.2.3	Missing Data - Specific hydrocarbons	3
3.1.3	September	3
3.1.3.1	Data Quality Codes	3
3.1.3.2	Missing Data - All hydrocarbons	3
3.1.3.3	Missing Data - Specific hydrocarbons	3
3.2	GLASGOW	4
3.2.1	July	4
3.2.1.1	Data Quality Codes	4
3.2.1.2	Missing Data - All hydrocarbons	4
3.2.1.3	Missing Data - Specific hydrocarbons	4
3.2.2	August	4
3.2.2.1	Data Quality Codes	4
3.2.2.2	Missing Data - All hydrocarbons	4
3.2.2.3	Missing Data - Specific hydrocarbons	4
3.2.3	September	4
3.2.3.1	Data Quality Codes	4
3.2.3.2	Missing Data - All hydrocarbons	4
3.2.3.3	Missing Data - Specific hydrocarbons	4
3.3	HARWELL	5
3.3.1	July	5
3.3.1.1	Data Quality Codes	5
3.3.1.2	Missing Data - All hydrocarbons	5
3.3.1.3	Missing Data - Specific hydrocarbons	5
3.3.2	August	5
3.3.2.1	Data Quality Codes	5
3.3.2.2	Missing Data - All hydrocarbons	5
3.3.2.3	Missing Data - Specific hydrocarbons	5

3.3.3	September	5
3.3.3.1	Data Quality Codes	5
3.3.3.2	Missing Data - All hydrocarbons	5
3.3.3.3	Missing Data - Specific hydrocarbons	5
3.4	MARYLEBONE ROAD	6
3.4.1	July	6
3.4.1.1	Data Quality Codes	6
3.4.1.2	Missing Data - All hydrocarbons	6
3.4.1.3	Missing Data - Specific hydrocarbons	6
3.4.2	August	6
3.4.2.1	Data Quality Codes	6
3.4.2.2	Missing Data - All hydrocarbons	6
3.4.2.3	Missing Data - Specific hydrocarbons	6
3.4.3	September	6
3.4.3.1	Data Quality Codes	6
3.4.3.2	Missing Data - All hydrocarbons	6
3.4.3.3	Missing Data - Specific hydrocarbons	6

4 Discussion 7

4.1	THE RATIFIED DATA	7
4.1.1	Cardiff	7
4.1.2	Glasgow	7
4.1.3	Harwell	7
4.1.4	Marylebone Road	8
4.2	1,3-BUTADIENE DATA FOR THE VOC71M	8
4.3	CONCENTRATION TRENDS	8
4.4	COMPARISON WITH AIR QUALITY OBJECTIVES	9

APPENDIX 1 - Summary Statistical Information

APPENDIX 2 - Time Series Plots of Hydrocarbon Concentrations

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 2004 to 30 September 2004. 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 ($\mu\text{g}/\text{m}^3$) at the standardised temperature of 293K and a pressure of 101.3KPa, 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 ($\mu\text{g}/\text{m}^3$).

2 Hydrocarbon Data Quality

All hydrocarbon data are assigned a quality value. In general ratified hourly data have an uncertainty (at 95% confidence) of $\pm 10\%$ for values above $0.5 \mu\text{g}/\text{m}^3$ and $\pm 0.05 \mu\text{g}/\text{m}^3$ for values below $0.5 \mu\text{g}/\text{m}^3$. 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 $\pm 25\%$ above $0.5 \mu\text{g}/\text{m}^3$ and $\pm 0.1 \mu\text{g}/\text{m}^3$ below $0.5 \mu\text{g}/\text{m}^3$.

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 July

3.1.1.1 Data Quality Codes

Data quality code A for all data for all of the month except:
Data quality code E for 1,3-butadiene for all of the month.

3.1.1.2 Missing Data – All hydrocarbons

- Sample pump failure 01/07/04 hour 01. Replacement analyser installed 06/07/04 hour 09.
- Sampling tube valve failure 09/07/04 at hour 09. Replacement analyser installed 13/07/04 hour 09.
- Calibration 20/07/04 hours 11 to 13.

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 except:
Data quality code E for 1,3-butadiene for all of the month.

3.1.2.2 Missing Data - All hydrocarbons

- Calibration 05/08/04 hours 09 to 11.
- Calibration 23/08/04 hours 13 to 14.

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 except:
Data quality code E for 1,3-butadiene for all of the month.

3.1.3.2 Missing Data - All hydrocarbons

- Sample pump failure 03/09/04 hours 05. Sample pump replaced 10/10/04 hour 10.
- Calibration 14/09/04 hours 11 to 14.

3.1.3.3 Missing Data - Specific hydrocarbons

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

3.2 GLASGOW

3.2.1 July

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 01/07/04 hours 17 to 21.
- Calibration 27/07/04 hour 12 to 28/07/04 hour 10.
- CMCU visit to install new analyser 28/07/04 hour 15 to 29/07/04 to 13.

3.2.1.3 Missing Data - Specific hydrocarbons

1,3-butadiene from the start of July to 29/07/04 hour 13. No other hydrocarbons except where the integration was unreliable due to very low concentrations.

3.2.2 August

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

- PC/GC communication problem 01/08/04 hour 15 to 02/08/04 hour 08.
- Calibration 02/08/04 hours 10 to 15.
- Calibration 10/08/04 hours 10 to 15.
- Calibration 24/08/04 hours 10 to 14.

3.2.2.3 Missing Data - Specific hydrocarbons

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

3.2.3 September

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

- Calibration 07/09/04 hours 09 to 14.
- Calibration 21/09/04 hours 12 to 16.

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 July

3.3.1.1 Data Quality Codes

Data quality code A for all data for all of the month except:
Data quality code E for 1,3-butadiene for all of the month.

3.3.1.2 Missing Data - All hydrocarbons

- Calibration 01/07/04 hours 08 to 10.
- Analyser moved to Cardiff 05/07/04 hour 15. Replacement analyser installed 07/07/04 hour 18.
- Analyser moved to Cardiff 12/07/04 hour 18 to 31/07/04 hour 24.

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 except:
Data quality code E for 1,3-butadiene for all of the month.

3.3.2.2 Missing Data - All hydrocarbons

- Analyser moved to Cardiff in previous month. Replacement analyser installed 04/08/04 hour 09.
- Calibration 05/08/04 hours 10 to 11.
- Calibration 18/08/04 hours 07 to 13.
- Analyser fault 26/08/04 hour 05 to 31/08/04 hour 24.

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 except:
Data quality code E for 1,3-butadiene for all of the month.

3.3.3.2 Missing Data - All hydrocarbons

- Analyser fault in previous month. Replacement analyser installed 03/09/04 hour 17.
- Calibration 09/09/04 hours 15 to 16.
- PC locked up 23/09/04 hours 09 to 14.
- Calibration 24/09/04 hours 11 to 13.
- PC locked up 24/09/04 hour 19 to 27/09/04 hour 10.

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

- Power supply failure 01/07/04 hours 01 to 16.
- PC locked up 13/07/04 hour 09 to 14/07/04 hour 11.
- Calibration 28/07/04 hours 04 to 07.

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 04/08/04 hours 13 to 16.
- Calibration 19/08/04 hours 04 to 07.
- ESU service visit 25/08/04 hour 15 to 26/08/04 hour 21.
- Calibration 27/05/04 hours 12 to 15.
- Hydrogen generator fault 29/08/04 hour 20 to 31/08/04 hour 11.

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

- Carrier gas supply fault 02/09/04 hour 12 to 06/09/04 hour 15.
- Calibration 08/09/04 hours 16 to 19.
- Cold Trap replaced 09/09/04 hours 09 to 21.
- Calibration 24/09/04 hours 10 to 15.
- Calibration 29/09/04 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 July 2004 to 30 September 2004. 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 79.62% and for 1,3-butadiene was 79.71%.

There was a sample pump failure at the start of July and the analyser was removed for repair. The analyser from Harwell was moved to Cardiff to prevent any further data loss at this site. The analyser then developed a sampling tube valve problem and was removed for repair. The Harwell analyser was again moved to Cardiff to prevent any further data loss. At the start of September the analyser had a second sample pump failure and was repaired on site.

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

4.1.2 Glasgow

For the Glasgow site the data capture for benzene was 85.37% and for 1,3-butadiene was 66.76%.

In the first quarter of 2004 a problem occurred with the power supply of the analyser. It was not possible to repair this at the site or at the CMCU, so the analyser was returned to the manufacturer. A temporary analyser was installed on 13th April 2004 to prevent further loss of data. The analyser was configured to measure BTX compounds only and not 1,3-butadiene. A new analyser, configured to measure 1,3-butadiene, was installed on 28th July.

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.

4.1.3 Harwell

For the Harwell site the data capture for benzene was 53.58% and for 1,3-butadiene was 53.58%.

On the 5th July the analyser installed at the Harwell site was moved to Cardiff to prevent further loss at the Cardiff site. The repaired Cardiff analyser was installed at the Harwell site on 7th July. This analyser was then moved, following another failure of the analyser at the Cardiff site, on 12th July. A replacement analyser for the Harwell site was not available until 4th August. At the end of August and into the start of September a fuse was blown on an internal power supply and the analyser was repaired by the CMCU on 3rd September. During September the PC locked up on two separate occasions and was manually restarted by the LSO.

There have been no other 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 75.18% and for 1,3-butadiene was 86.19%.

In the previous quarter it was noticed that the benzene peak was poorly integrated in a number of chromatograms. This problem was more noticeable with low concentrations due to seasonal variation. During the ESU service visit on 25th August the columns were replaced, which corrected this problem. During July a fault developed with part of the system that supplies hydrogen to the GC FID. This was repaired on 31 August. A problem with the carrier gas supply to the analyser occurred on 2nd September and approximately 100 hours of data was lost before this was repaired.

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

4.2 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 Cardiff and Harwell has been assigned data quality code E.

4.3 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 9, Appendix 2. The measured concentrations of 1,3-butadiene fell below $0.02 \mu\text{g}/\text{m}^3$ on a number of occasions, see Figures 2 and 7, Appendix 2. Where concentrations fell below $0.02 \mu\text{g}/\text{m}^3$ the ratified concentrations have been reported as $0.00 \mu\text{g}/\text{m}^3$.

At Cardiff and Harwell 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.

At the Cardiff site, during August, high concentrations of 1,3-butadiene (up to $36 \mu\text{g}/\text{m}^3$) were recorded, see figure 2, Appendix 2. Such episodes indicate a local non-motor vehicle source of 1,3-butadiene.

The Glasgow and Marylebone Road data tend to exhibit higher levels with less seasonal variation than is apparent in data from the other two 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 2004 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.

4.4 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 $16.25 \mu\text{g}/\text{m}^3$ 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 $5 \mu\text{g}/\text{m}^3$ expressed as an annual mean to be met by end of 2010. In Scotland an additional objective has been set for benzene of $3.25 \mu\text{g}/\text{m}^3$ to be met by the end of 2010. The Air Quality Objective for 1,3-butadiene is specified as a running annual mean of $2.25 \mu\text{g}/\text{m}^3$ to be met by the end of 2003.

The annual means for benzene and 1,3-butadiene for 2000, 2001, 2002 and 2003 together with the quarterly means for the first, second and third quarters of 2004 are given in Tables 1 and 2 below. For benzene the annual means for 2000, 2001, 2002 and 2003 were well below the Air Quality Objective of $16.25 \mu\text{g}/\text{m}^3$ to be met by the end of 2003. The annual means for 2003 were also below the Air Quality Objective to be met by 2010 for the respective regions.

For 1,3 butadiene the annual means for 2000, 2001, 2002 and 2003 were well below the Air Quality Objective of $2.25 \mu\text{g}/\text{m}^3$ to be met by the end of 2003.

At Cardiff, Glasgow and Harwell the means for both benzene and 1,3-butadiene for quarter 3, 2004 were slightly lower than the quarter 2 means for 2004. This is probably due to seasonal variation as higher concentrations tend to be observed during the winter months. However, the means at Marylebone Road in quarter 3 were slightly higher than those in quarter 2. There is insufficient information to provide an explanation of the difference at this site.

Table 1. Means of measured benzene concentrations ($\mu\text{g}/\text{m}^3$) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2000 Annual Mean	2001 Annual Mean	2002 Annual Mean	2003 Annual Mean	Quarter 1 2004 Mean	Quarter 2 2004 Mean	Quarter 3 2004 Mean
Cardiff Centre	\$\$	\$\$	1.22\$	1.17	1.17	0.68	0.52
Glasgow	\$\$\$	\$\$\$	2.33 \$	1.82	1.65	1.17	1.14
Harwell	0.53	0.62	0.60	0.59	0.52	0.29	0.23
Marylebone Road	6.29	4.55	3.91	3.32	2.92	2.33	2.76

\$ 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.

Table 2. Means of measured 1,3-butadiene concentrations ($\mu\text{g}/\text{m}^3$) at each of the UK Automatic Hydrocarbon Sites.

Monitoring Site	2000 Annual Mean	2001 Annual Mean	2002 Annual Mean	2003 Annual Mean	Quarter 1 2004 Mean	Quarter 2 2004 Mean	Quarter 3 2004 Mean
Cardiff Centre	\$\$	\$\$	0.15\$	0.15	0.13	0.04	0.13
Glasgow	\$\$\$	\$\$\$	0.36\$	0.42	0.31	\$\$\$\$	0.25
Harwell	0.09	0.11	0.04	0.03	0.02	0.00	0.00
Marylebone Road	1.63	1.12	0.95	0.64	0.56	0.47	0.61

\$ 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.

\$\$\$\$ No 1,3-butadiene measured in this quarter.

Appendices

CONTENTS

Appendix 1	Summary Statistical Information
Appendix 2	Time Series Plots of Hydrocarbon Concentrations

Appendix 1

Summary Statistical Information

CONTENTS

- 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 July 2004 to 30 September 2004
- 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 2004 to 30 September 2004
- 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 2004 to 30 September 2004
- 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 2004 to 30 September 2004

Table 1. Percentage data capture, maximum, mean and minimum values of the ratified data from the Cardiff site of the UK Hydrocarbon Network, for the period 1 July 2004 to 30 September 2004

Compound	%Data capture	Maximum hourly concentration ($\mu\text{g}/\text{m}^3$)	Mean concentration ($\mu\text{g}/\text{m}^3$)	Minimum hourly concentration ($\mu\text{g}/\text{m}^3$)
1,3-Butadiene	79.71	36.87	0.13	0.00
Benzene	79.62	4.38	0.52	0.00
Toluene	81.20	54.78	2.60	0.34
Ethylbenzene	66.80	2.47	0.31	0.04
(m+p)-Xylene *	79.21	10.71	1.01	0.04
o-Xylene	66.58	6.30	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 2004 to 30 September 2004

Compound	%data capture	Maximum hourly concentration ($\mu\text{g}/\text{m}^3$)	Mean concentration ($\mu\text{g}/\text{m}^3$)	Minimum hourly concentration ($\mu\text{g}/\text{m}^3$)
1,3-Butadiene	66.76	6.35	0.25	0.00
Benzene	85.37	4.86	1.14	0.00
Toluene	94.97	18.86	3.48	0.31
Ethylbenzene	67.03	3.13	0.75	0.13
(m+p)-Xylene *	93.16	13.22	2.42	0.18
o-Xylene	76.99	4.85	1.41	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 July 2004 to 30 September 2004

Compound	%data capture	Maximum hourly concentration ($\mu\text{g}/\text{m}^3$)	Mean concentration ($\mu\text{g}/\text{m}^3$)	Minimum hourly concentration ($\mu\text{g}/\text{m}^3$)
1,3-Butadiene	53.58	1.50	0.00	0.00
Benzene	53.58	1.59	0.23	0.00
Toluene	52.76	8.30	0.65	0.04
Ethylbenzene	19.16	0.93	0.18	0.04
(m+p)-Xylene *	49.00	5.46	0.35	0.04
o-Xylene	25.36	1.01	0.18	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 2004 to 30 September 2004

Compound	%data capture	Maximum hourly concentration ($\mu\text{g}/\text{m}^3$)	Mean concentration ($\mu\text{g}/\text{m}^3$)	Minimum hourly concentration ($\mu\text{g}/\text{m}^3$)
Ethane	88.09	42.85	6.97	1.45
Ethene	88.13	19.20	4.80	0.21
Propane	87.91	26.49	4.28	0.59
Propene	87.95	9.95	2.53	0.19
Ethyne	85.24	31.04	3.73	0.03
2-Methylpropane	88.04	46.78	3.88	0.22
n-Butane	88.04	96.80	8.87	0.43
trans-2-Butene	88.09	3.59	0.61	0.19
1-Butene	87.91	2.35	0.56	0.05
cis-2-Butene	87.91	2.77	0.44	0.05
2-Methylbutane	88.09	78.91	12.03	0.45
n-Pentane	88.09	16.46	3.11	0.21
1,3-Butadiene	86.19	2.29	0.61	0.09
trans-2-Pentene	87.68	5.24	0.79	0.03
cis-2-Pentene	86.41	3.03	0.44	0.03
2-Methylpentane	87.82	17.95	3.65	0.07
3-Methylpentane	87.05	12.41	2.29	0.14
Isoprene	86.82	2.63	0.51	0.03
n-Hexane	84.42	6.47	1.43	0.04
n-Heptane	84.65	9.48	0.87	0.00
Benzene	75.18	11.09	2.76	0.06
Toluene	87.41	88.86	11.44	0.31
Ethylbenzene	86.59	8.20	1.90	0.09
(m+p)-Xylene *	73.87	25.69	7.01	0.40
o-Xylene	84.69	11.06	2.56	0.09
1,3,5-Trimethylbenzene	87.77	3.94	1.05	0.05
1,2,4-Trimethylbenzene	87.77	11.67	2.89	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

CONTENTS

- Figure 1. Time series plot of the ratified benzene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- 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 July 2004 to 30 September 2004
- Figure 3. Expanded time series plot of the ratified 1,3-butadiene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 4. Time series plot of the ratified benzene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 5. Time series plot of the ratified 1,3-butadiene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 6. Time series plot of the ratified benzene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 7. Time series plot of the ratified 1,3-butadiene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 8. Time series plot of the ratified benzene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004
- Figure 9. Time series plot of the ratified 1,3-butadiene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

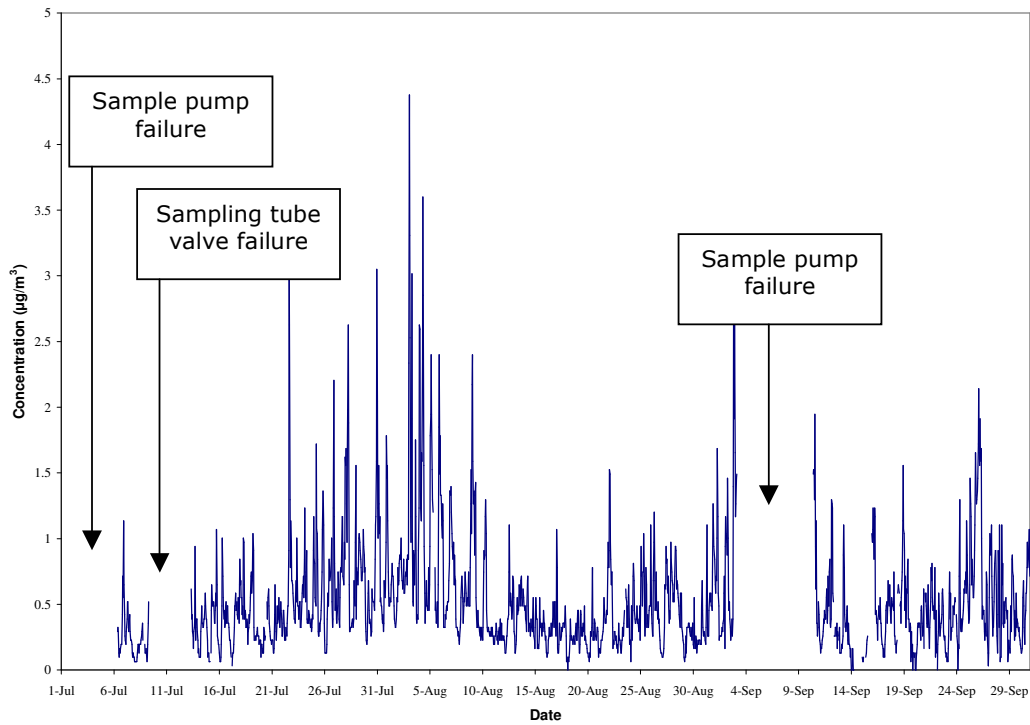


Figure 1. Time series plot of the ratified benzene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

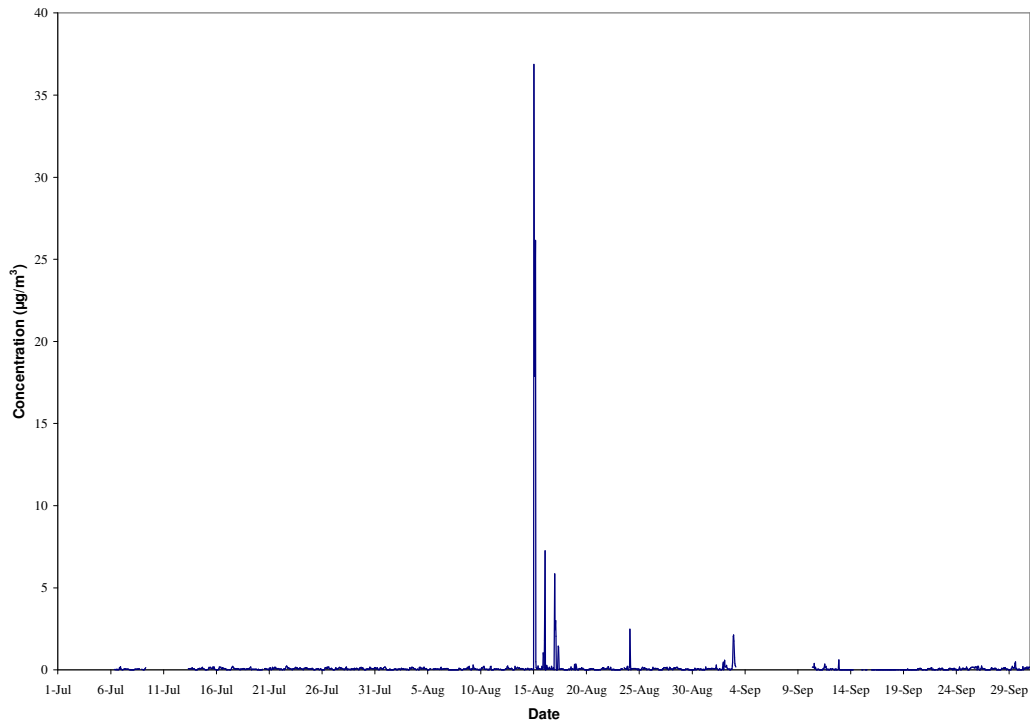


Figure 2. Time series plot of the ratified 1,3-butadiene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

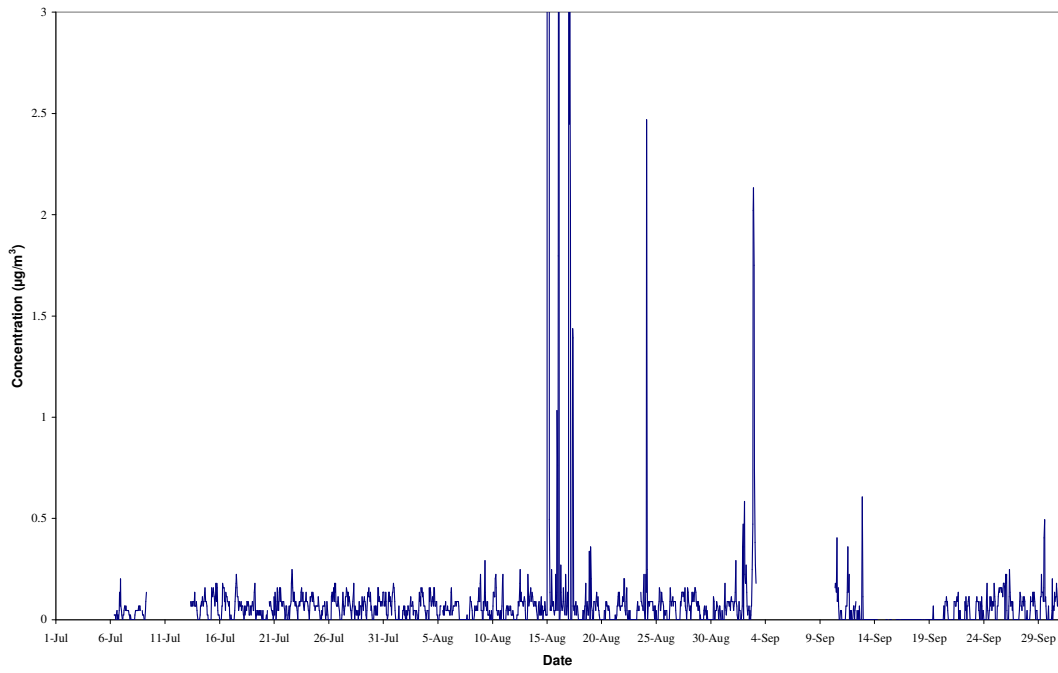


Figure 3. Expanded time series plot of the ratified 1,3-butadiene data from the Cardiff site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

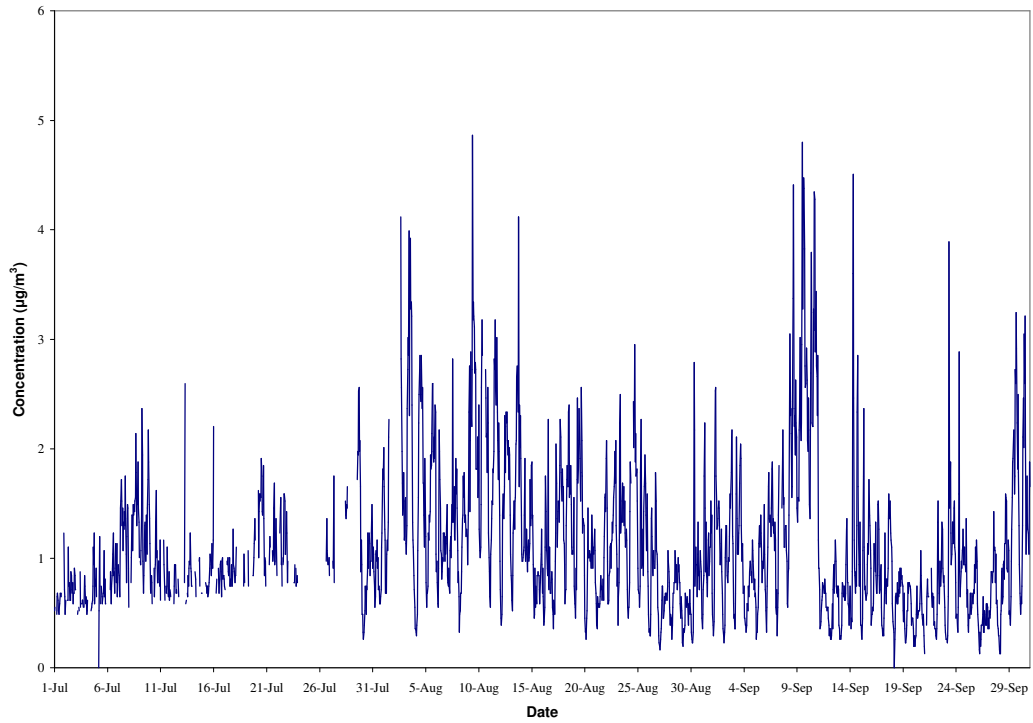


Figure 4. Time series plots for the ratified benzene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

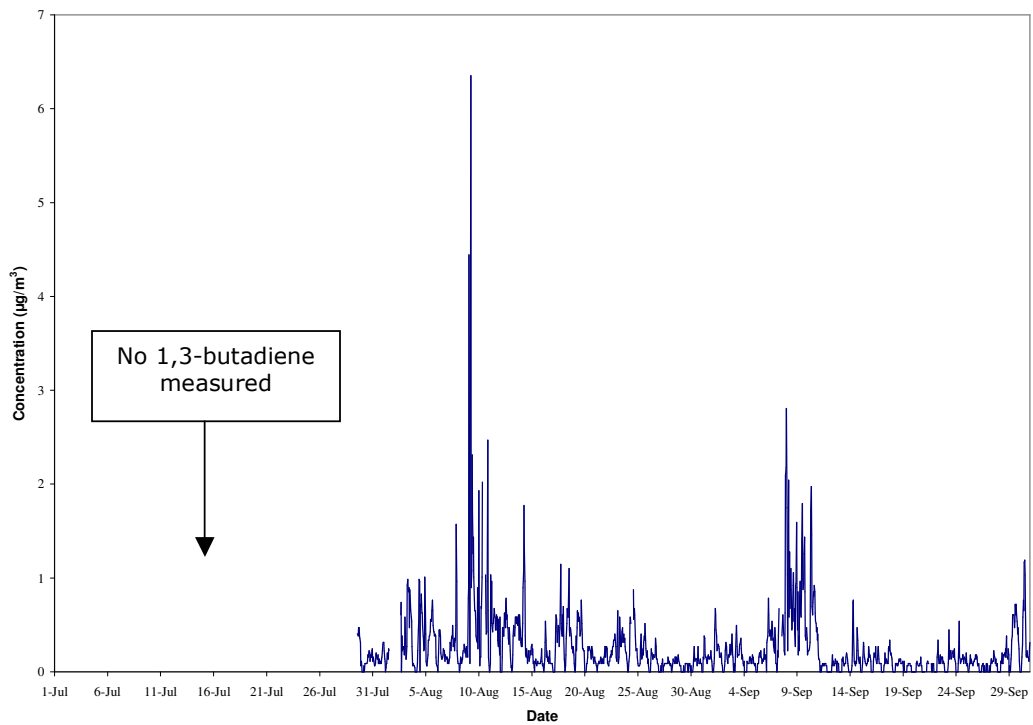


Figure 5. Time series plots for the ratified 1,3-butadiene data from the Glasgow site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

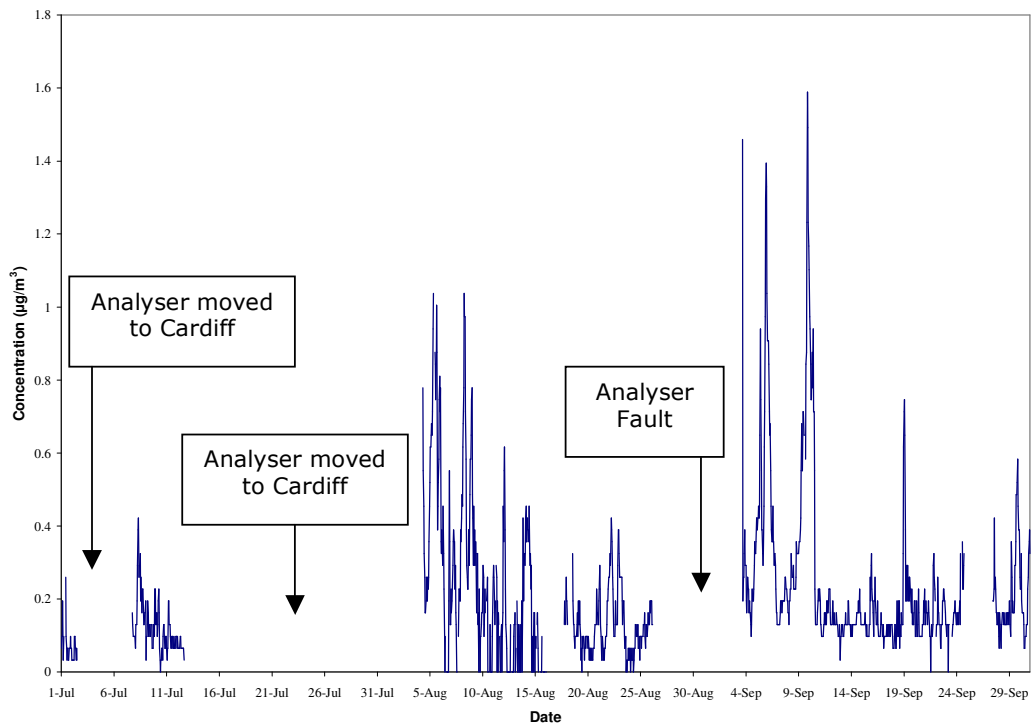


Figure 6. Time series plots for the ratified benzene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

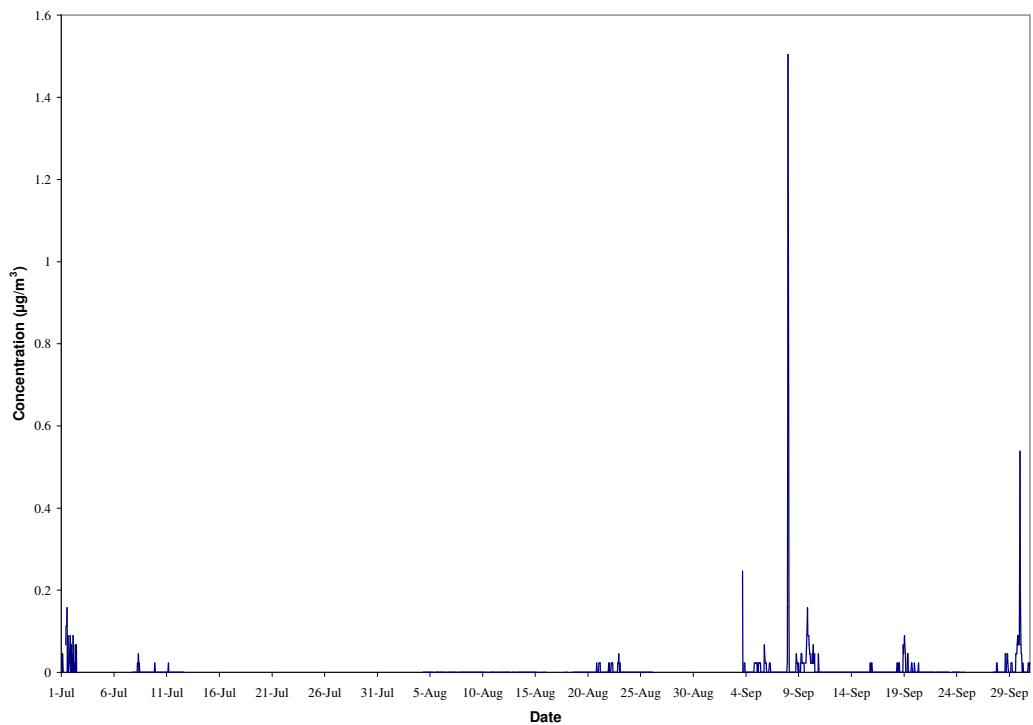


Figure 7. Time series plots for the ratified 1,3-butadiene data from the Harwell site of the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

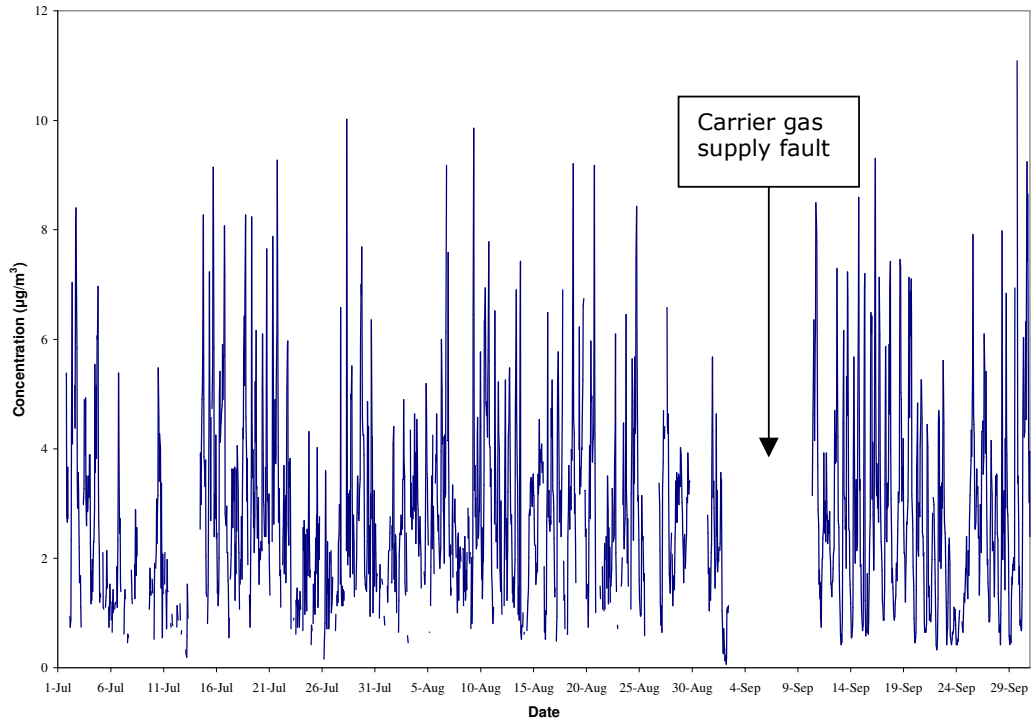


Figure 8. Time series plots for the ratified benzene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004

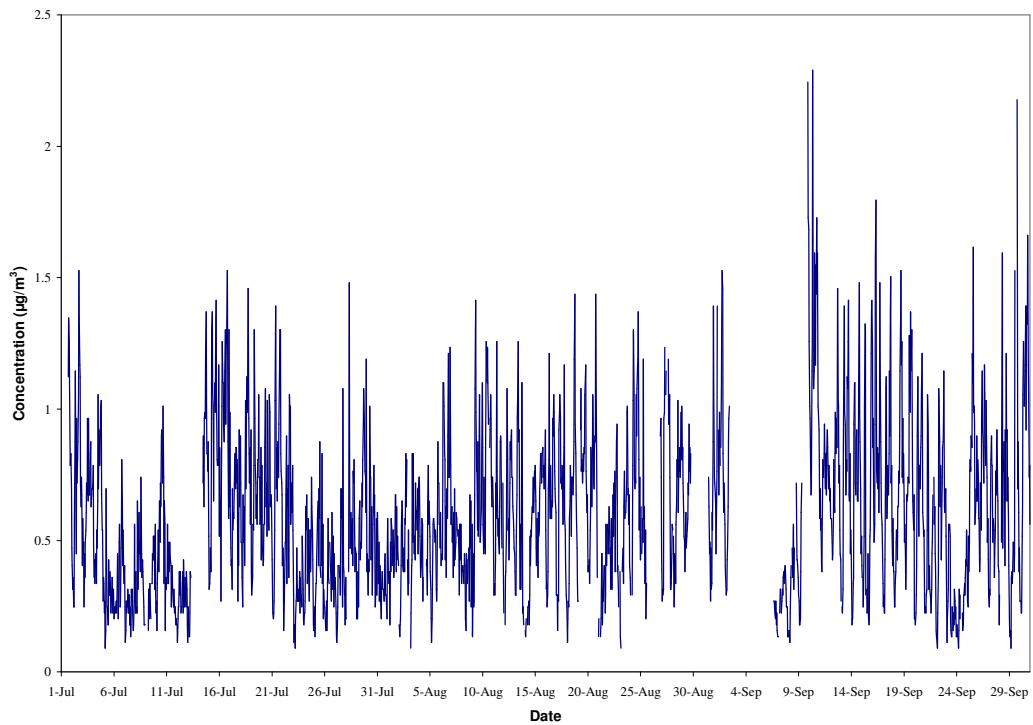


Figure 9. Time series plots for the ratified 1,3-butadiene data from the Marylebone Road site affiliated to the UK Hydrocarbon Network, for the period; 1 July 2004 to 30 September 2004