

Summary of UK Ambient Hydrocarbon Air Quality Network Operation during 1997

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INTRODUCTION

This report summarises the operation of the UK Ambient Hydrocarbon Air Quality Monitoring Network during 1997. NPL act as central management and control unit (CMCU) for this network on behalf of the Department of the Environment Transport and Regions.

1. CONCENTRATIONS OF BENZENE AND 1,3 BUTADIENE

The following table gives the annual average concentrations in ppb recorded at the network sites for 1997. The table gives the averages of the ratified data produced by NPL. The figures in brackets are the averages of the values reported before ratification.

Table 1 Annual average concentrations for 1,3 butadiene and benzene

	1,3 Butadiene ppb	Benzene ppb
Belfast	0.16 (0.16)	0.93 (0.90)
	0.23 (0.21)	1.05 (1.00)
	0.22 (0.21)	1.42 (1.40)
	0.27 (0.26)	1.34 (1.30)
	0.11 (0.11)	0.67 (0.65)
	0.21 (0.24)	1.00 (1.04)
	0.04 (0.05)	0.35 (0.41)
	0.23 (0.23)	1.11 (1.12)
	0.23 (0.21)	0.89 (0.93)
	0.37 (0.35)	1.80 (1.75)
	0.17 (0.16)	1.05 (1.00)
	0.33 (0.33)	1.83 (1.79)

The site at Marylebone Road was affiliated into the network in August. It produced approximately 3 months of acceptable data during 1997 and so a yearly average cannot be quoted. The averages of the reported values are 1.66 ppb for 1,3 butadiene and 5.06 ppb for benzene.

The following two figures show the monthly averages for 1,3 butadiene and benzene recorded by the network throughout the year.

Figure 1 Benzene monthly average concentrations in ppb for 1997

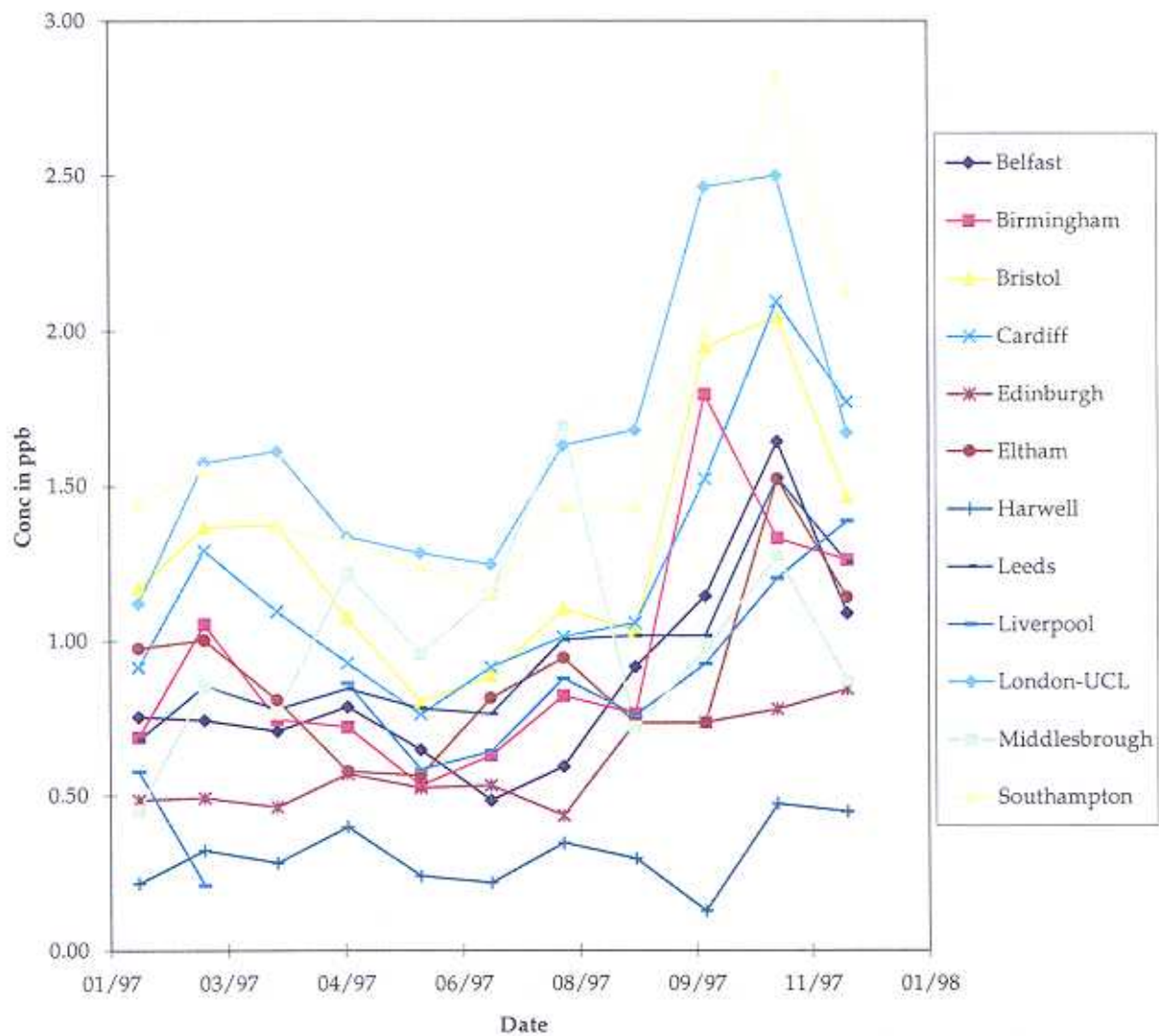
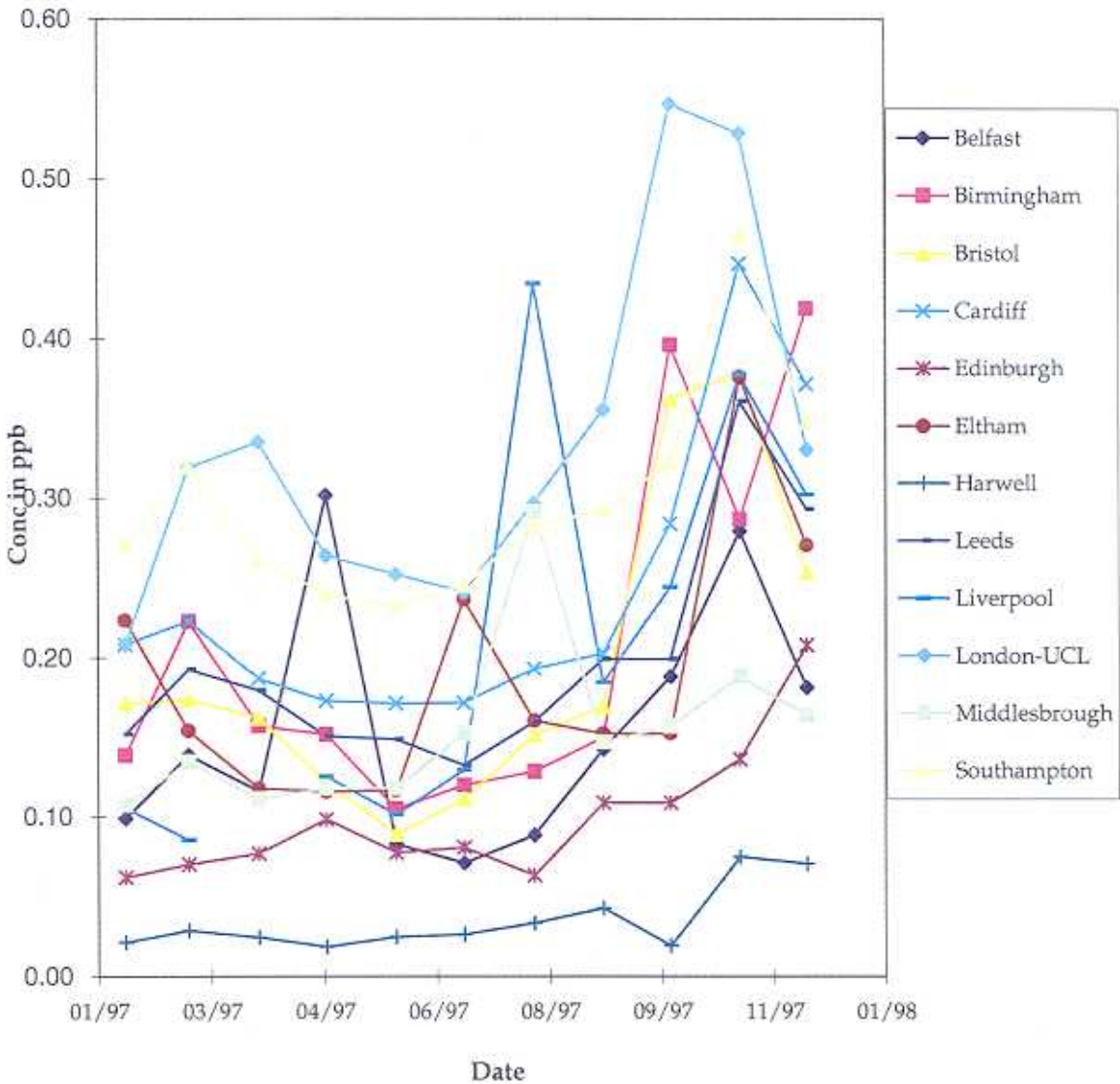


Figure 2 1,3 Butadiene monthly average concentrations in ppb for 1997



2. SPECIFIC HYDROCARBON EVENTS REPORTED

The following table summarises the events observed by the hydrocarbon network during 1997. All observed events were reported to the DETR press office.

Table 2 Summary of reported events.

SITE	DATE/TIME OF EVENT	ELEVATED SPECIES	PEAK CONC'S	MAX BENZ CONC	MAX 13BDIENE CONC
MIDDLESBROUGH	05/05/97 14:00	nHeptane, Benzene, Toluene	27.2ppb, 8.5ppb, 31.7ppb	8.5 ppb	0.1 ppb
LIVERPOOL	12/05/97 05:00	mp-xylene, Ethylbenzene, o-Xylene, Toluene	77ppb, 34ppb, 23ppb, 4ppb	1.0 ppb	0.3 ppb
LIVERPOOL	04/06/97 19:00	Ethane, Propane, nPentane, 2Mepent, iPentane, Benzene	24.7ppb, 16.9ppb, 4.0ppb, 3.8ppb, 13.4ppb, 5.5ppb	5.5 ppb	3.0 ppb
MIDDLESBROUGH	04/06/97 19:00	iPentane, nPentane, 13Bdiene, Benzene	3.5ppb, 1.4ppb, 2.6ppb, 3ppb	3.0 ppb	2.6 ppb
BIRMINGHAM	24/08/97 23:00	Ethane, Propane, 13Bdiene, Benzene, Toluene	42ppb, 17ppb, 1.4ppb, 7ppb, 13ppb	7.0 ppb	1.4 ppb
LIVERPOOL	16/10/97 18:00	nButane, 13Bdiene, Benzene	101.2ppb, 52.2ppb, 13.2ppb,	13.2 ppb	52.2 ppb

In addition an extensive set of data for the period around 19th January 1997 was reported. This data set showed elevated hydrocarbons possibly associated with a tanker spillage in the English Channel.

3. DATA CAPTURE SUMMARY

All data for 1997 have been ratified. A summary of the capture statistics for the key compounds is given in the following two Tables.

Table 3 Percentage Benzene data capture for 1997

	Jan	Feb	Mar	Apr	May	Jun
Belfast	97.8	59.5	89.4	98.5	100.0	97.5
Birmingham	91.4	98.8	98.3	97.5	92.6	84.2
Bristol	97.8	88.1	96.2	99.9	88.0	97.6
Cardiff	95.2	94.9	85.9	96.5	83.9	94.9
Edinburgh	97.2	98.4	98.9	95.4	90.9	97.8
Eltham	98.9	98.8	90.5	96.1	87.6	98.5
Harwell	95.2	68.9	76.5	23.3	44.5	71.0
Leeds	97.8	98.8	98.7	72.1	90.2	91.1
Liverpool	97.4	66.5	28.1	0.0	97.2	90.8
London-UCL	84.0	97.5	88.4	86.2	97.0	91.9
Middlesborough	80.9	92.1	95.4	96.9	94.1	98.9
Southampton	96.3	97.0	89.0	96.0	92.2	97.9
Monthly mean	94.2	88.3	86.3	79.9	88.2	92.7

	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Belfast	99.2	97.7	95.3	95.0	96.4	94.8	93.5
Birmingham	92.6	96.1	96.5	98.3	78.6	98.9	93.7
Bristol	97.0	95.4	91.8	89.7	96.4	95.4	94.4
Cardiff	87.9	98.7	82.8	97.7	91.4	86.9	91.2
Edinburgh	93.8	86.4	91.4	98.8	98.5	84.0	94.1
Eltham	89.8	97.2	95.7	99.1	95.4	98.1	95.3
Harwell	88.8	55.9	87.6	93.3	98.3	98.8	74.6
Leeds	96.4	98.9	98.2	98.8	98.9	95.0	94.5
Liverpool	96.1	47.3	83.2	84.5	89.4	87.4	71.6
London-UCL	97.7	97.2	94.7	91.4	86.7	91.0	92.2
Middlesborough	96.2	72.6	96.8	92.5	98.3	93.4	92.7
Southampton	98.9	96.8	81.5	67.3	99.4	95.3	92.1
Monthly mean	94.5	86.7	91.3	92.2	94.0	93.3	90.0

These figures are for NPL ratified data.

Table 4 Percentage 13-Butadiene data capture for 1997

	Jan	Feb	Mar	Apr	May	Jun
Belfast	97.8	92.0	98.5	98.5	100.0	97.5
Birmingham	91.4	98.8	98.3	97.5	92.6	84.3
Bristol	97.8	87.9	96.2	99.9	88.0	97.6
Cardiff	95.2	94.9	84.3	96.5	83.9	94.9
Edinburgh	96.9	98.5	98.9	95.7	90.9	97.6
Eltham	98.9	98.8	90.2	96.1	87.6	98.5
Harwell	96.3	69.3	76.6	20.1	44.6	70.3
Leeds	97.8	98.8	98.7	72.1	89.8	91.0
Liverpool	97.4	66.5	58.6	0.0	96.8	90.8
London-UCL	84.0	95.7	88.4	86.0	97.0	91.9
Middlesbrough	81.3	92.1	94.9	96.9	93.8	98.9
Southampton	96.3	97.2	93.7	96.0	92.2	97.9
Monthly mean	94.3	90.9	89.8	79.6	88.1	92.6

	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Belfast	99.2	97.7	95.3	95.0	96.4	94.8	96.9
Birmingham	97.0	96.1	96.3	98.3	78.6	98.9	94.1
Bristol	97.0	95.4	91.9	89.8	96.5	95.4	94.4
Cardiff	88.0	98.7	82.8	97.7	91.4	86.9	91.1
Edinburgh	93.8	86.3	91.1	98.7	97.9	84.0	94.0
Eltham	89.8	97.4	95.6	99.1	95.3	98.1	95.3
Harwell	89.1	55.9	87.6	93.1	97.2	98.8	74.3
Leeds	96.4	98.9	98.2	98.8	98.9	95.0	94.4
Liverpool	96.1	47.3	83.2	84.5	89.4	87.4	74.2
London-UCL	97.7	97.2	94.7	91.3	86.7	91.0	92.1
Middlesbrough	96.2	72.8	96.8	92.2	98.3	93.5	92.6
Southampton	98.9	96.8	81.5	67.3	99.3	95.3	92.5
Monthly mean	94.9	86.7	91.3	92.2	93.8	93.3	90.5

These figures are for NPL ratified data.

4. CAUSES OF MAJOR DATA LOSS

Two sites failed to achieve 75% data capture for 1997.

- (i) **Liverpool:** This GC suffered a series of unrelated faults during the first quarter of 1997 which caused a large amount of data to be excluded. These faults were finally cured by a major service and overhaul of the instrument. Later in the year a failure in the liquid nitrogen dewar resulting in further data loss. This was cured by replacing the dewar.
- (ii) **Harwell:** The instrument at Harwell was initially in a relatively poor state of repair and suffered a number of faults in the first half of 1997. The instrument was given a complete overhaul during it's annual service in June. Other data loss was caused by a series of liquid nitrogen dewar problems which were resolved by replacing the dewar and the insulation on the transfer line.

5. SITE OPERATIONS

The 12 network sites were visited by Chrompack engineers during the year to conduct annual services of the chromatographic instruments as a part of a preventative maintenance program.

During this service the machines were given a complete service and a number of components were routinely replaced.

In addition, a second 6-month minor service is carried out by Chrompack engineers. During this minor service a number of key components which have lifetimes of less than 1 year of continuous use are replaced.

The total number of visits by Chrompack engineers, and the number of 'special' visits by LSO's, are given in the following table. LSO 'special' visits are requested by the CMCU.

Table 5 Summary of service visits and LSO special visits

Site	Chrompack Visits	LSO Special visits	Annual Service 1997
Belfast	2	13	February
Birmingham	2	8	November
Bristol	5	7	February
Cardiff	6	21	November
Edinburgh	4	3	September
Eltham	12	10	July
Harwell	12	30 ¹	June
Leeds	3	3	June
Liverpool	10	5	April
Middlesbrough	5	27	October
Southampton	5	1	May
UCL London	6	13	April

¹ The relatively high number of special visits at Harwell are in part due to the LSO needing to be present in order to escort visitors onto the AEAT site.

6. LSO DUTIES PERFORMED

The following table summarises the duties performed by the LSO's at the 12 network sites. LSO's are expected to perform a calibration every two weeks and fill in a check list on every weekly visit. The number of weekly visits has been calculated from the number of checklists received by the CMCU.

Table 6 Summary of LSO weekly visits and site calibrations

Site	Number of Calibrations 1997	Number of Weekly Visits 1997
Belfast	21	51
Birmingham	23	49
Bristol	15	52
Cardiff	26	52
Edinburgh	26	52
Eltham	26	51
Harwell	22	47
Leeds	26	50
Liverpool	11	37
Middlesbrough	24	47
Southampton	23	50
London-UCL	n/a ¹	52

¹ Automated calibrations are performed at London UCL

7. RATIFICATION

Summary sheets for the 1997 data ratified by NPL are provided for each site and month in a separate annex A.

8. SUMMARY

The annual mean benzene and 1,3 butadiene concentrations recorded by the established hydrocarbon monitoring sites are all well below the air quality limit of 5 ppb for benzene and 1 ppb for 1,3 butadiene.

A graphical representation of monthly mean concentrations of benzene and 1,3 butadiene shows the expected correlation between time of year and measured hydrocarbons. The Harwell background site shows a steady level of activity with little seasonal or industrial variation.

Data capture was generally good with an average of 90% data capture and only two sites falling below 75%. These two cases were due to instrument reliability problems which were addressed early in the year.

The performance of the new Perkin Elmer based Marylebone Road site has been erratic, but indications are that concentrations of benzene and 1,3 butadiene may be close to the air quality standards.

The network recorded some elevated hydrocarbons mainly in Liverpool and Middlesbrough. The concentrations measured at Liverpool on the 16/10/97 were particularly notable.

The performance of Chrompack engineers and the local site operators has been generally good.

The network has shown improvement over the year with a more active maintenance schedule. Further improvements in data quality should result from a series of investigations carried out during the site audits and using NPL's own VOC air system.