

1. Introduction

This is the fifth report to DEFRA and indicates the progress made to date, covering the period October - December 2002. It provides summary statistics and data capture rates. Where significant amounts of data are missing the reasons for these are given together with details of any remedial action taken.

In addition, the report includes a brief comparison of SMPS and CPC data collected at London Bloomsbury, where the instruments have been co-located

2. Sampling Locations and Details

Instruments are located at 11 established sites, ten of which form part of DEFRA's Automatic Urban and Rural Monitoring Network either directly or through affiliation, and one (Harwell Organic) which is part of the Automatic Hydrocarbon Monitoring Network. The sites are:

- Belfast Centre (Urban Centre, O.S Grid ref J339744)
- Birmingham Centre (Urban Centre, O.S Grid ref SP064868)
- Glasgow Centre (Urban Centre, O.S Grid ref NS589650)
- Harwell Inorganic (Rural, O.S Grid ref SU474863)
- Harwell Organic (Rural, O.S Grid ref SU 474863)
- London Bloomsbury (Urban Centre, O.S Grid ref TQ302820)
- London Kensington (Urban Centre, O.S Grid ref TQ240817)
- London Marylebone Rd (Urban Kerbside, O.S Grid ref TQ281820)
- Manchester Piccadilly (Urban Centre, O.S Grid ref SJ843983)
- Port Talbot (Urban Centre, O.S Grid ref SS780882)
- Rochester (rural, O.S Grid ref TQ831762)

Table 1 details the location of the monitoring equipment.

Table 1 Location of monitoring equipment

Site	PM _{2.5} Partisol	PM _{2.5} TEOM	PM ₁₀ Partisol	PM ₁₀ TEOM	PM ₁₀ Sulphate	PM ₁₀ Carbon	PM _{2.5} Nitrate	SMPS	CPC	Met Sensor
Belfast Centre	*			*	√	√	√		√	
Birmingham Centre	*			*					√	
Glasgow Centre	*		*	*					√	
Harwell (Inorganic)		√		√				√		√
Harwell (organic)					√	√	√			
London Bloomsbury		√		*				√	√	
London Kensington	*			*	√	√			√	
London Marylebone Rd		√		*	√	√		√		
Manchester Piccadilly	*		*	*					√	
Port Talbot	*			*					√	
Rochester		√		*						√ ⁽¹⁾

* Monitoring equipment operating under AURN contract

(1) Local authority owned equipment

3. Data Capture

3.1 TEOM

Data capture statistics for PM₁₀ and PM_{2.5} mass concentrations are presented in Table 2 for each of the monitoring sites.

**Table 2 Monthly particle mass data capture (%)
 October - December 2002**

	PM ₁₀				PM _{2.5}			
	LM ⁽¹⁾	LB ⁽²⁾	RO ⁽²⁾	HAR	LM	LB	RO ⁽³⁾	HAR
October	99	95	-	98	100	99	93	98
November	99	95	-	100	100	94	100	99
December	99	90	-	97	87	99	100	97
Quarterly	99	95	-	99	96	97	98	98
Running (Oct 01 – Dec 02)	93	96	98*	99	98	97	88	99

(1) PM₁₀ data from Marylebone Rd is available as part of the London Network, which is operated by seiph (ERG). Casella Stanger do not report these data directly.

(2) London Bloomsbury PM₁₀, and Harwell PM₁₀ are operated under DEFRA's AURN contract.

(3) Rochester PM10 data provided by Medway District Council. The TEOM has been removed from the site following a serious fault. * Running data capture does not include this quarter.

Data capture from the TEOM instruments was high, with the few significant losses occurring.

3.2 SMPS

Table 3 SMPS particle count data capture (%) at London Bloomsbury, Marylebone Rd and Harwell, October - December 2002

	Bloomsbury	Marylebone Rd	Harwell
October	80	53	34
November	78	88	80
December	65	72	86
Quarterly	74	70	66
Running (Oct 01 – Dec 02)	49	68	76

A significant period of data from London Bloomsbury was lost between the 28th November and the 6th of December due to failure of the logging software.

Data from Marylebone Rd was lost between the 2nd and 11th of October due to problems with the logging software which resulted in the sample runs stalling between visits. Further Data was lost between the 27th October and the 4th November and again between the 1st and 6th December, due to power interruptions at the site.

There were two large periods of missing data at Harwell during October. The first of these, 1st – 14th, was due to a seized pump. The second, between the 24th October and 6th November, was due to problems with the logging software.

3.3 CPC

Table 4 CPC particle count data capture (%) at the seven monitoring sites, October - December 2002

	CPC						
	LB	Belf	Man Pic	Birm	Port Talbot	Glasgow	N Kens
October	100	94	92	87	100	24	44
November	100	100	0	22	100	12	100
December	98	60	0	16	67	75	95
Quarterly	99	85	31	42	89	37	79
Running (Oct 01 – Dec 02)	80	96	96	86	91	57	84

Belfast's instrument experienced a pump failure at the beginning of December resulting in low data capture for that month.

A serious fault with the Manchester CPC resulted in it being returned to BIRAL for repair. The instrument was not returned before the end of the quarter.

Birmingham Centre experienced a large number of software related problems, causing sampling to stop between sample runs. This was aggravated by power problems at the site, which also caused the sampling run to end before completion

Port Talbot's CPC continued to work well although sampling stopped on the 21st and was not restarted until the New Year, due to the Christmas break.

Although appearing to operate normally, the Glasgow CPC was recording corrupted data from much of October and November. This data has therefore been removed. A further period of data is missing at the end of December, although this data should exist, and may yet be recovered from site.

Once reinstated on the 18th following a repair by BIRAL, the North Kensington instrument operated well for the rest of the quarter

3.4 Sulphate Partisol

Table 5 Particulate sulphate data capture (%)
October - December 2002

Site	Data capture
North Kensington	75
Marylebone Road	35
Belfast	82
Harwell	63

Data capture is based on available exposure data as filter analysis results are not yet available for the whole period. Capture was generally good for the Sulphate particulate monitoring during the report period with the exception of Marylebone Rd which suffered recurrent sample flow and software problems throughout the period. A filter exchange fault at Harwell in December reduced overall data capture.

3.5 Carbon Particulate Monitor

**Table 6 Carbon particulate data capture (%)
 October - December 2002**

Site	October	November	December	Average
Belfast Centre	20	0	0	7
Harwell	99	99	98	99
London Marylebone Road	99	99	99	99
London North Kensington	99	100	99	99

Data capture for this period at Harwell, London Marylebone Road and London North Kensington was excellent, averaging 99% in each case.

The Belfast unit suffered from continuing problems with the sample and afterburner temperatures, and the sample flow problem identified in the previous report steadily deteriorated. According to the instrument manual, the status conditions displayed on the screen indicate that the faults were not critical, and that data would still be valid. However closer examination showed this not to be the case, and the instrument should have stopped sampling indicating a serious problem. This discrepancy is being investigated by the equipment supplier.

Since this is the longest operating carbon unit within the Network it was decided that the instrument should undergo a full service, and this has been put in hand.

**Table 7 Carbon particulate rolling average data capture
from start of monitoring to 31 December 2002**

Site	Data capture (%)
Belfast Centre	65
Harwell	77
London Marylebone Road	86
London North Kensington	100

The Carbon Particulate monitoring start dates for each site were:

Belfast Centre: 21 November 2001

Harwell: 14 February 2002

London Marylebone Road: 13 March 2002

London North Kensington: 13 March 2002

and data capture statistics have been prepared from these dates.

3.6 Nitrate Particulate Monitor

4 Summary Data and Statistics

4.1 Particle Mass concentration

**Table 8 Average particle mass concentration ($\mu\text{g m}^{-3}$),
 October - December 2002**

	PM₁₀	PM_{2.5}	PM_{coarse}
Harwell	11.6	9.3	2.3
London Bloomsbury	29.6	13.7	15.9
Marylebone Road	34.4	20.0	14.4
Rochester	-	11.3	-

- PM_{coarse} is defined as PM₁₀ – PM_{2.5}

Note that with the exception of Harwell, there is very little change from the previous quarter apart from a very slight reduction in coarse fraction. The results from Harwell show a marked increase in fine particular matter, with the coarse fraction being half the July to September figure. It would have been interesting to see whether this trend was repeated at Rochester, but unfortunately the PM₁₀ data was not available.

4.2 CPC vs SMPS measurements (London Bloomsbury)

Co-located monitoring has remained at London Bloomsbury during this quarter as space restrictions made it impossible to move the CPC to Harwell as originally planned.

Available data show that the average total particle counts differ by a factor ranging from 1.1- 2.9. The main reason for this lies in the fact that the size ranges of the

instruments are different, the CPC and SMPS sampling between 7.5 – 1000nm and 11.5 – 450nm respectively.

The SMPS will also undergo particle losses in the classifier, which may not be correctly quantified by the algorithms built into the software.

Average particle counts for the quarter are shown in the following table.

Table 9 Comparison of total particles # cm⁻³ measured at London Bloomsbury using the CPC and SMPS, October - November 2002

	CPC	SMPS	Factor
October	27,432	14,164	1.9
November	27,355	15,314	1.8
December	27,410	15,318	1.8
Quarter	27,398	14,837	1.8

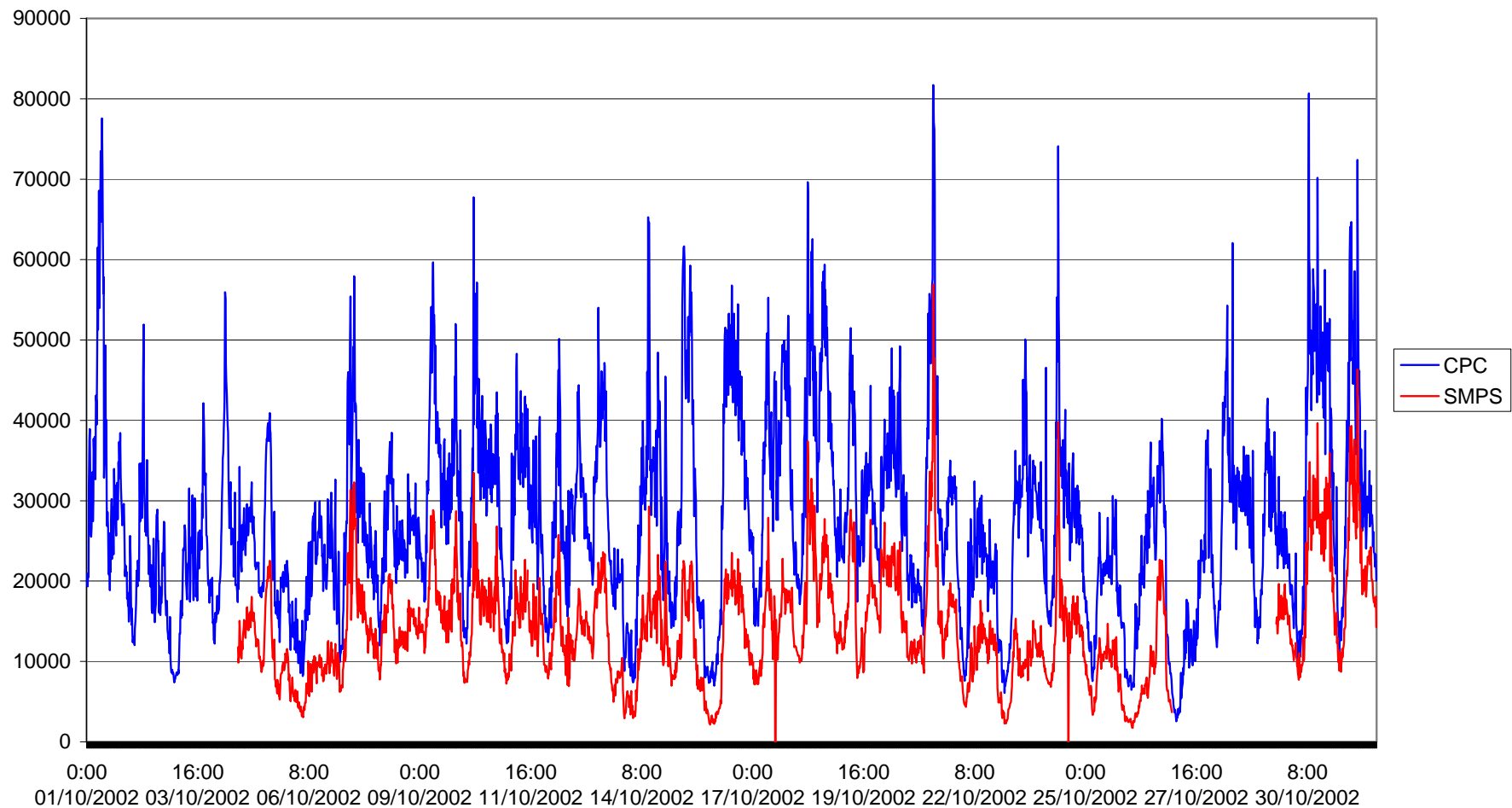
Both instruments performed well this quarter providing a good data set for comparison. Total particle counts are considerably higher than in previous months and the factor is much more constant. Variation from month to month during the quarter is also less marked for both instruments, possibly due to the late onset of winter conditions at the end 2002. TEOM data from London Bloomsbury shows a similar trend in the monthly average mass concentrations

Graphs in APPENDIX 1 show the correlation between CPC and SMPS total particulate numbers during the quarter. Note the clear drop of particle numbers over the Christmas period due to reduced traffic in the area.

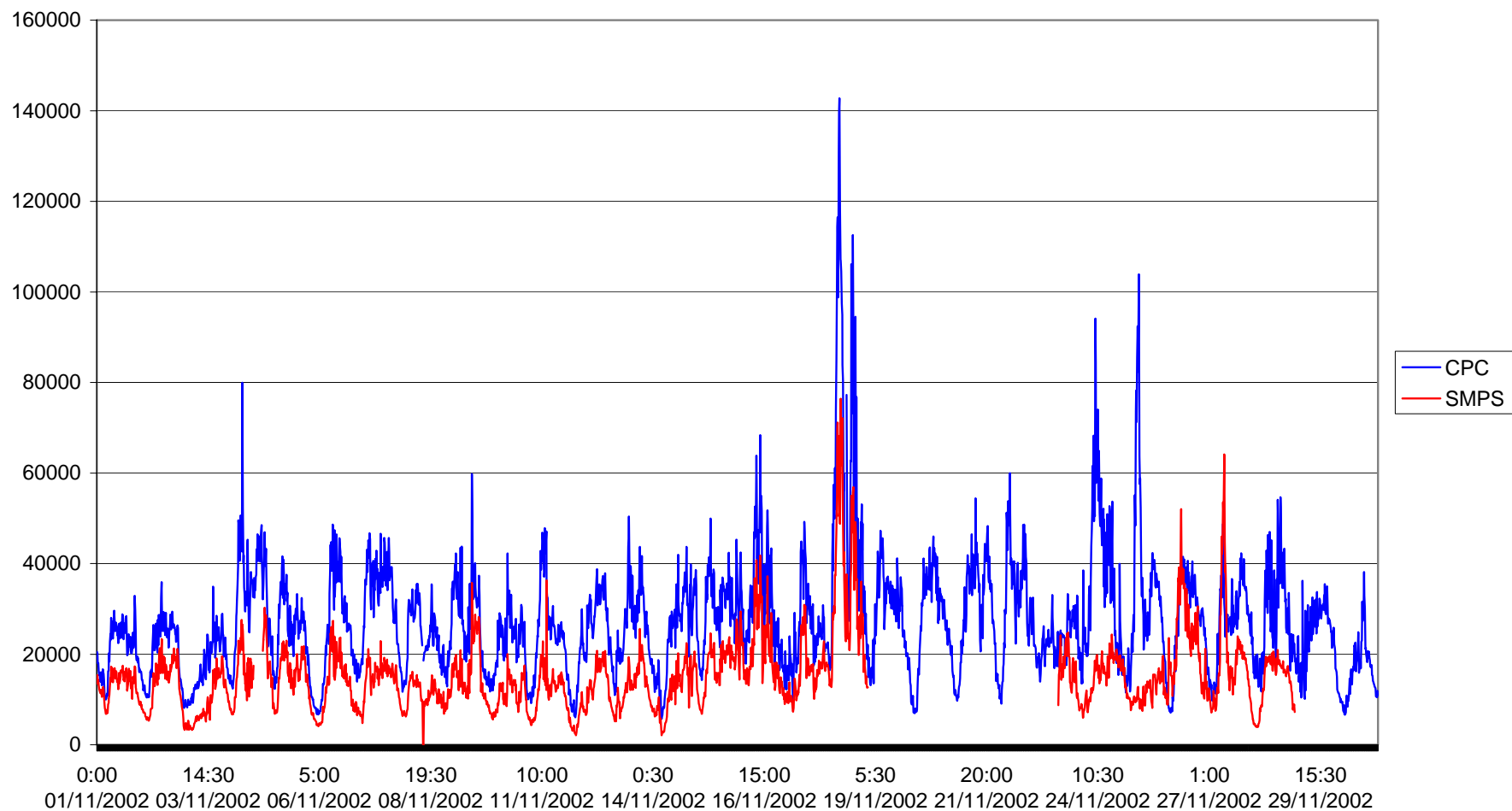
APPENDIX 1

Plots of CPC and SMPS Total Particle Numbers

London Bloomsbury Total Particle Numbers - October 2002



London Bloomsbury Total Particle Numbers - November 2002



London Bloomsbury Total Partical Numbers - December 2002

