

## 1. Introduction

This is the second report to DEFRA and indicates the progress made to date, covering the period January to March 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 Marylebone Rd 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 <sub>2.5</sub> Partisol	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> Partisol	PM <sub>10</sub> TEOM	PM <sub>10</sub> Sulphate	PM <sub>10</sub> Carbon	PM <sub>2.5</sub> 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		√		*						√ <sup>(1)</sup>

\* Monitoring equipment operating under AURN contract

(1) Local authority owned equipment

### 3. Data Capture

#### 3.1 TEOM

Data capture statistics for PM<sub>10</sub> and PM<sub>2.5</sub> mass concentrations are presented in Table 2 for each of the monitoring sites.

**Table 2 Monthly particle mass data capture (%)**  
**January - March 2002**

	PM <sub>10</sub>				PM <sub>2.5</sub>			
	LM <sup>(1)</sup>	LB <sup>(2)</sup>	RO <sup>(2)</sup>	HAR	LM	LB <sup>(3)</sup>	RO	HAR
Jan	86	93	99	99	100	91	100	100
Feb	84	100 <sup>(3)</sup>	99	100	100	98 <sup>(3)</sup>	100	99
March	92	99 <sup>(3)</sup>	100	99	100	99 <sup>(3)</sup>	87	100
Quarterly	87	97 <sup>(3)</sup>	99	100	100	96 <sup>(3)</sup>	95	99
Running (Oct 01 – Mar 02)	84	98	99	99	100	98	97	99

(1) PM<sub>10</sub> data from Marylebone Rd is available as part of the London Network, which is operated by SEIPH. Casella Stanger do not report these data directly.

(2) London Bloomsbury PM<sub>10</sub>, Rochester PM<sub>10</sub> and Harwell PM<sub>10</sub> are operated under DEFRA's AURN contract.

(3) Data capture figures adjusted to exclude data losses incurred through relocation of the site.

Data capture from the TEOM instruments was high, with significant losses occurring due to faults at Rochester (PM<sub>2.5</sub>) and Marylebone Rd (PM<sub>10</sub>) only.

During this quarter the PM<sub>2.5</sub> heads were replaced with sharp cut cyclone heads. Dates for the the swap were:

Harwell	23 <sup>rd</sup> Jan 11:35 GMT
Russell Sq	5 <sup>th</sup> March 11:45 GMT (fitted with new head following site move)
Marylebone Rd	25 <sup>th</sup> Jan 13:30 GMT
Rochester	28 <sup>th</sup> Jan 13:30 GMT

### 3.2 SMPS

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

	Bloomsbury <sup>(1)</sup>	Marylebone Rd <sup>(1)</sup>	Harwell
Jan	0	95	90
Feb	1	47	90
Mar	60	98	89
Quarterly	34	80	90
Running (Oct 01 – Mar 02)	29	55	83

<sup>1</sup> Some data unavailable due to routine instrument servicing. This data is not included in data capture statistics.

Data for Bloomsbury at the start of the period was removed due to an instrument flow fault. The instrument was then removed for routine servicing and was not returned until the 1<sup>st</sup> Feb. For this reason there is no valid data for Jan 2002

Following the service, the site was closed between the 4<sup>th</sup> Feb – 5<sup>th</sup> March whilst the cabin was relocated. As the SMPS requires careful de-commissioning and re-commissioning, additional data was lost around this time. Down time due to the relocation and servicing have not been included in the calculations, although in the case of Bloomsbury, this left very little data available.

A problem with the PC at London Bloomsbury lead to data being lost between the 20<sup>th</sup> and 28<sup>th</sup> March. This is due to an inherent problem with the SMPS software.

Marylebone figures exclude the instrument down-time after having been removed for its annual service from 15<sup>th</sup> November until Early January 2002. Additionally, a hard disk fault which was unfortunately not detected quickly, resulted in the loss of some data during February

Harwell generally performed well, maintaining high data capture rates.

### 3.3 CPC

**Table 4 CPC particle count data capture (%) at the seven monitoring sites, January - March 2002**

	CPC						
	LM	Belf	Man Pic	Birm	Port Talbot	Glasgow	N Kens
Jan	95	100	100	99	62	2	79
Feb	47	76	91	83	100	74	-
Mar	98	100	100	100	100	45	100
Quarterly	80	92	96	93	82	39	88
Running (Oct 01 – Mar 02)	84	95	98	97	83	42	94

Data capture is generally good across the network. Figures for all sites excluding Belfast and Glasgow have been amended to take account of “down time” due to routine servicing of the instruments.

The computer at Marylebone Rd suffered from a hard disk error during February, which resulted in loss of data.

Problems with operation of the CPC in Glasgow resulted in very poor data capture during January and lower than average throughout the quarter. The raw data showed large periods of zeros which are likely to be caused by failure to maintain the butanol level in the instrument. This may be due to a leak within the instrument or failure to top up the reservoir by the LSO. This instrument is currently undergoing a service, so any faults should be identified. The Local site operators have been contacted regarding correct maintenance procedures.

### 3.4 Sulphate Partisol

**Table 5 Particulate sulphate data capture (%)**  
**January - March 2002**

	<b>Data capture</b>	<b>Total days sampling</b>	<b>Total period</b>
North Kensington	94.4	85	Jan, Feb, Mar 2002 (90)
Marlyebone Road	51.4	38	Jan, Feb, Mar 2002 (74)
Belfast	98.9	89	Jan, Feb, Mar 2002 (90)
Harwell	72.2	65	Jan, Feb, Mar 2002 (90)

Most data losses occurred due to the failure of the filter exchange mechanism and flow faults.

### **3.5 Particulate Nitrate and Carbon**

It is not appropriate to quote data capture for the Carbon or Nitrate analysers as they have only recently been commissioned fully and validation of the data is not yet complete.

The current status is that all instruments are working and providing data which will be reviewed in next quarter's report.

## 4 Summary Data and Statistics

### 4.1 Particle Mass concentration

**Table 6 Average particle mass concentration ( $\mu\text{g m}^{-3}$ ),  
January - March 2002**

	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>	<b>PM<sub>coarse</sub></b>
Harwell	12.9	10.3	2.6
London Bloomsbury	29.3	13.4	15.9
Marylebone Road	34.4	23.0	11.4
Rochester	15.6	10.6	5

- PM<sub>coarse</sub> is defined as PM<sub>10</sub> – PM<sub>2.5</sub>

Note that the overall concentration and coarse fraction have increased at London Bloomsbury whilst remaining fairly constant at other sites. This is likely to be due to the construction work undertaken close to the site in in Russell Square Gardens throughout February and March.

No sulphate data have been presented in this report as this work is being conducted by the University of Birmingham and will be presented as soon as they are made available.

### 4.2 CPC vs SMPS measurements (Marylebone Rd)

The data collected at the Marylebone road site where CPC and SMPS instruments have been co-located, show that the total particle counts differ by a factor of approximately 1- 2. The reasons for this lie in the size ranges of the instruments, the CPC and SMPS sampling between 7.5 – 1000nm and 11.5 – 450nm respectively.



The SMPS may also undergo particle losses in the classifier, which although corrected for in the software by in-built algorithms, may not account for all the losses observed.

The CPC instrument was successfully relocated to Bloomsbury where it will remain until the end of June. Following this, the CPC will be installed at Harwell. This program is subject to reasonable data capture from both instruments, during the co-location period.

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

**Table 7 Average Total Particle Numbers per Cubic Centimetre  
(Marylebone Rd)**

	<b>CPC</b>	<b>SMPS</b>	<b>Factor</b>
<b>Jan</b>	106,582	68,769	1.5
<b>Feb</b>	82,746	52,704	1.6
<b>Mar</b>	70,738	57,380	1.2
<b>Quarter</b>	84,643	60,892	1.4

From this it is clear that the difference in measurement between the two instruments is variable and may be dependent on a number of factors including those mentioned earlier.

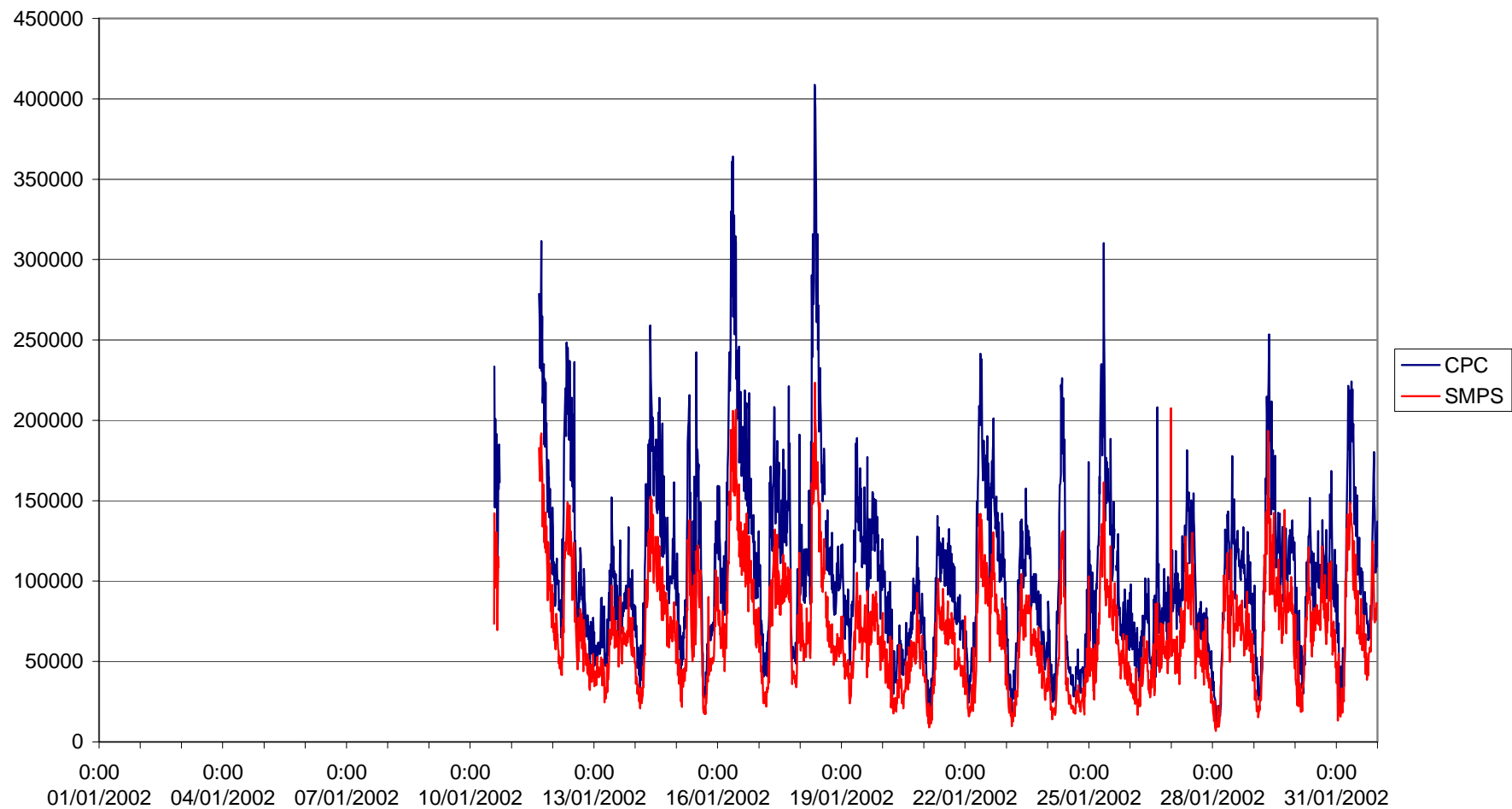
Graphs of CPC and SMPS data during March 2002 are located in APPENDIX 1, and clearly show that both instruments produce a very similar data trend. However, the figures in the table above show that the extent of the SMPS under-reading does not appear constant and varies from month to month.

The effects of site location will be investigated in next quarter's report, when the data from the co-location at Bloomsbury is available.

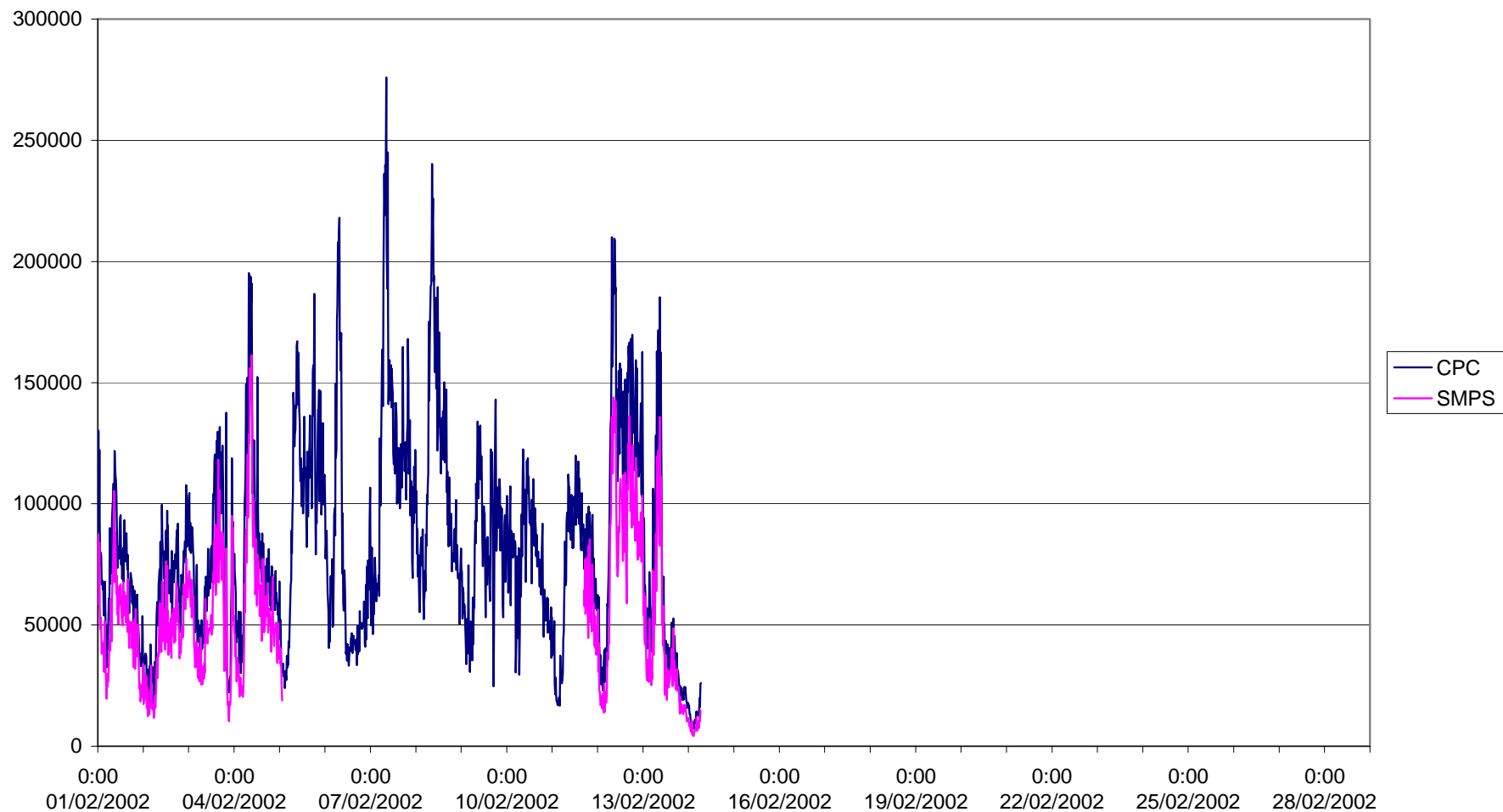
## **APPENDIX 1**

### **Plots of CPC and SMPS Total Particle Numbers**

### Marylebone Rd Total Partical Numbers - Jan 2002



Marylebone Rd Total Particulate Numbers - Feb 2002



### Marylebone Rd Total Particle Numbers - March 2002

