NPL Report COAM 13

London Air Quality Network: Ratification Report for January to June 2002

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CONTENTS

Page

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by

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1. INTRODUCTION

This report has been prepared for the Department for the Environment, Food and Rural Affairs by NPL under contract EPG 1/3/123. It covers the ratification of data in the London Air Quality Network relating to the period January to June 2002. The ratified data capture percentages and specific problems at sites are presented. During this period two sites, namely Sutton 1 and Sutton 3, were withdrawn from the Network.

2. RATIFICATION PROCEDURE

The data received by NPL from the CMCU were processed and scaled according to calibrations carried out by the Local Site Operators every two weeks, and by NPL on a three monthly basis. The results of these NPL field calibrations are reported to the Department separately.

During an NPL intercomparison ozone analyser accuracy is quantified with a transfer standard photometer certified against the NPL primary photometer, while NO_x, CO and SO_2 analyser calibration responses are measured with gas mixtures certified against primary standard gases at NPL. Analyser linearities are determined by multi-point dilution of a high concentration mixture with zero air. Particulate analysers are calibrated with traceable pre-weighed masses, and sample and bypass flow rates are measured.

The data ratification process takes account of all relevant data from LSO, NPL and Equipment Service Unit calibrations. The optimum time-varying set of analyser response functions are determined and then applied to raw data to produce the ratified data set. The causes of gaps in the new data set are identified and periods for which analyser responses are seen to be unstable or changing rapidly are deleted.

3. DATA CAPTURE

The percentage data capture at each site for each pollutant is given in Table 1. For the period covered by this report the overall Network Mean data capture is 95%. Excluding the two Sutton sites, this figure would be 94%.

Table 1: Data capture for January to June 2002

	Percentage Data Capture by Pollutant					
Site Name	**O_3**	**NO_x**	**SO_2**	**CO**	**PM_{10}**	**Mean**
Bromley		96		**85**		91
Camden		94			99	97
Eltham	97	98	95		90	95
Hackney	**86**	**81**		**81**		83
Haringey 1		98			98	98
Haringey 2	99					99
Hounslow		95		96		96
Kensington and Chelsea	99	98	99	93	98	97
Lewisham	**73**	**87**	93			84
Marylebone Road	95	99	96	96	97	97
Southwark 1	99	98	94	98		97
Southwark 2		90	**88**	**87**		88
Sutton 1*		99	99	98	98	99
Sutton 3*	99	99				99
Tower Hamlets		99		98		99
Wandsworth 2	99	97				98
Mean	94	95	95	92	97	

***** Values given for both Sutton sites are percentages of available data, as both were decommissioned in mid-April

Percentages below 90% are highlighted.

4. GENERIC REASONS FOR ABSENT RATIFIED DATA

Two general categories for ratified data loss are distinguished:

4.1 ABSENT UNRATIFIED DATA

During periods of power failure, telecommunications failure, instrument calibration and repair, or other similar circumstances, clearly there is no "raw" data to ratify, and this will be reflected directly in the data capture. Such instances are described below as periods for which the QA/QC Unit did not receive data. Typically the reasons are not investigated, as this is more of a matter for the CMCU.

4.2 UNRATIFIABLE DATA

From time to time most sites will produce data that cannot be ratified with sufficient confidence due to an analyser malfunction or a peripheral problem such as leaking pipe work. Most problems are apparent to the CMCU as they carry out regular remote checks, and they can initiate repairs promptly, preventing large amounts of data loss. The speed of repair will of course depend on the organisation responsible maintaining the instrument, which will not necessarily be the CMCU for affiliated sites.

The instances described in this Report are those where either the repair took a significant time, or the problem was not readily apparent remotely. In these cases the problem is usually noticed at a visit by the LSO or QA/QC Unit, then reported and remedied. As LSO visits on the London Network are fortnightly (and QA/QC Unit visits quarterly) this can lead to periods of data lasting several weeks being deleted. The crucial elements in minimising data loss are experience in recognising the problems, clear communication of the problem to the CMCU, and prompt remedial action. To a limited extent the experience of these problems can be used to modify LSO, CMCU, ESU or QA/QC Unit procedures, or extend the training of LSOs.

In some instances, the cause of ratified data loss is an underlying problem, which can be predicted to recur, and preventative action can therefore be recommended.

5. SPECIFIC PROBLEMS AT SITES

The sites with data capture of less than 90% for any pollutant are listed here and reasons are given for the absence of the data.

5.1 Bromley (CO 85% data capture)

Unratifiable Data

27th February to 14th March (627 hours). Data were deleted as the analyser sample line was found by the LSO to be disconnected. The problem seems to coincide with the date of the previous LSO calibration. Data were additionally deleted to March 25th as due to a drift in calibrations the analyser span factor could not be determined.

5.2 Hackney (CO 81%, NOx 81% Ozone 86% data capture)

Absent Unratified Data

5th – 27th June (534 hours of all data). During this period there was essential asbestos removal work being carried out on site and for this reason data collection had to be temporarily suspended.

Unratifiable Data

28th May – 5th June (185 hours of NOx and CO data). Between the ESU service and the data suspension outlined above the only calibration performed on either analyser was by the ESU, at the post-service stage. Unfortunately this calibration only recorded analyser front-panel readouts and as there was no way to relate these readings to the values recorded by the site data logger these data had to be deleted.

27th –30th June (84 hours of NOx and CO data). Following the maintenance work outlined above the first reliable calibration was performed on 3rd July. Data therefore had to be deleted to this time.

5.3 Lewisham (NO_x 87%, Ozone 73% data capture)

Absent Unratified Data

1st – 3rd January (61 hours of all data). These data were lost as a result of a power interruption.

21st – 27th May (151 hours of all data). These data were lost owing to an extended power interruption resulting from building work being carried out at the site.

Unratifiable Data

3rd – 17th January (324 hours of ozone data). Following the power interruption outlined above, the ozone instrument's auto-calibration results were observed to be unstable. Data were only accepted after these measurements had stabilised on 17th January.

11th February – 8th March (600 hours of ozone data). These data were deleted because the analyser was found to be sampling internally at an ESU visit.

20th – 28th April (202 hours of NOx data). These data were invalidated as a result of a malfunction with the automatic auto-calibration equipment. Gas from the site calibration cylinder was allowed to contaminate the measured ambient sample by a leaking valve. This fault was apparent from examination of the auto-calibration zero values and was seemingly repaired on April 28th.

6th – 10th July (90 hours of NOx data). These data were deleted as the analyser zero could not be determined.

5.4 Southwark 2 (SO_2 88%, CO 87% data capture)

Absent Unratified Data

15th – 29th May (334 hours of all data). Site power was interrupted owing to a problem with the site air conditioning system.

Unratifiable Data

27th – 31st March (108 hours of data). Owing to a failure in the site air conditioning these data were considered suspect and therefore deleted.

9th – 16th May (145 hours of CO data). Following a power cut on 9th May the analyser zero could not be determined.

6. RECOMMENDATIONS TO IMPROVE DATA QUALITY / CAPTURE

6.1 Site Manifold Sampling Systems

The problems of verifying the integrity of the sampling systems at sites Southwark 1 and Southwark 2 were highlighted originally in the Ratification Report for the period January to June 2001 (NPL COAM 3). We recommend that these sampling systems should be replaced if possible.

7. INVENTORY

The DETR assets held by NPL for this work are shared with the Automatic Rural Network and are given in the corresponding report.