

London Air Quality Network: Ratification Report for January to June 2000

A M Woolley and B P Sweeney

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A M Woolley and B P Sweeney
Centre for Optical and Environmental Metrology

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National Physical Laboratory
Queens Road, Teddington, Middlesex, TW11 0LW

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Approved on behalf of Managing Director, NPL
by D H Nettleton, Head of Centre for Optical and Environmental Metrology

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by

A M Woolley and B P Sweeney

1. INTRODUCTION

This report has been prepared for the Department of the Environment, Transport and the Regions 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 2000.

The ratified data capture percentages and specific problems at sites are presented, and the benefits of autocalibration data, which are not available for all instruments, are highlighted.

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 SO₂ 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. The overall mean data capture for the LAQN in this period is 94%.

Table 1: Data capture for January to June 2000

Site Name	Percentage Data Capture by Pollutant					
	O ₃	NO _x	SO ₂	CO	PM ₁₀	Mean
Bromley		98		99		99
Camden		92			97	95
Eltham	97	98	91		88	94
Hackney	95	82		95		91
Haringey 1		82			90	86
Haringey 2	99					99
Hounslow		95		94		95
Kensington and Chelsea	96	96	96	94	95	95
Lewisham	80	87	89			85
Marylebone Road	99	99	93	93	98	96
Southwark 1	96	97	96	97		97
Southwark 2		87	87	96		90
Sutton 1		94	99	99	99	98
Sutton 3	99	99				99
Tower Hamlets		96		99		98
Wandsworth 2	99	99				99
Mean	96	93	93	96	95	

Percentages below 90% are highlighted.

4. GENERIC REASONS FOR ABSENT RATIFIED DATA

We distinguish two general categories for ratified data loss:

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 data was not received by the QA/QC Unit. 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 pipework. 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.

Eltham (PM₁₀ 88 % data capture)

Instrument malfunction

5 – 11 January, 2 – 6 March, 5 – 11 May, 16 – 21 June (515 hours in total) data deleted due to excess analyser noise. These incidences were most likely caused by a badly seated internal filter, which is usually changed at the LSO visit.

Hackney (NO_x 82% data capture)

Instrument Malfunction

2 February – 2 March (687 hours) caused by an analyser leak and subsequent analyser instability. The initial fault was discovered at the QA/QC unit audit on 17 February and fixed by the ESU on 22 February. Following this, however, the analyser response became unstable and the instrument was eventually replaced on 1 March.

Haringey 1 (NO_x 82% data capture)

Instrument Malfunction

10 May – 9 June (713 hours) caused by a faulty analyser chopper motor. The analyser response was unreliable from 10 May, but the analyser did not fully break down until 21 May. The ESU repaired the fault on 8 June.

Lewisham (O₃ 80%, NO_x 87%, SO₂ 89% data capture)Instrument Malfunction

1 - 24 February (563 hours of ozone data) resulting from a loose connection between the analyser and logger. The ESU attended the site on 24 February to fix the fault.

23 – 31 March (207 hours of NO_x and SO₂ data) following an ESU service visit. The NO_x analyser showed unstable autocalibration span data, and the SO₂ analyser had suffered a lamp failure. Both faults were repaired at the ESU visit in 31 March.

5 – 8 June (78 hours of NO_x data) were deleted as a result of an analyser malfunction. The fault was attended on 8 June.

Unratifiable Data

20 – 30 June (253 hours of all data) were deleted. This was due to a major leak in a newly installed manifold and was not discovered until a QA/QC unit visit in August 2000, although it was apparent upon examination of the ambient data.

Southwark 2 (NO_x 87%, SO₂ 87% data capture)Absent Unratified Data

5 - 7 June (50 hours of all data) were not received from CMCU as a result of the logging system being replaced.

Instrument malfunction

1 January – 19 January (440 hours of SO₂ data) were lost as a result of a sample line problem. Confusion arose over the correct inlet connections and thus the analyser was effectively not connected over this period. This situation has been improved by labelling the sample lines and is therefore unlikely to recur.

14 – 19, 21 – 31 January (375 hours of NO_x data in total) were deleted. This was caused by a recurring chopper fault.

11 – 15 February (95 hours of NO_x data) due to internal sampling. This resulted from the analyser not being properly connected to the manifold following a QA/QC unit visit.

6. AVAILABILITY OF AUTO-CALIBRATION DATA

As seen from section 5, there was one instance where an analyser malfunction was detected upon examination of the available autocalibration data. The majority of sites in the LAQN now have full auto-calibration facilities, but the two Southwark sites are only partially equipped. As such the QA/QC unit do not have as much information on which to base the ratification of the final datasets.

Table 2: Sites in the LAQN with valid auto-calibration data January – June 2000

Site Name	Pollutant of Interest			
	Ozone	NO _x	SO ₂	CO
Southwark 1	y	n	n	n
Southwark 2	-	y	n	y

y = valid auto-calibration data.

n = no valid auto-calibration data were received.

zero only = the auto-calibration data contained no valid spans.

- = not applicable to this site.

The reasons for absent autocalibration data in these cases are not known, and may be due to a number of factors such as empty permeation tubes or unsuitable logger configuration. We would recommend that the availability of autocalibration data is restored where practical.

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.