

**UK Automatic Rural Network:
Ratification Report for
January to June 2000**

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Approved on behalf of Managing Director, NPL
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CONTENTS

	Page
1. INTRODUCTION.....	1
2. RATIFICATION PROCEDURE	1
3. DATA CAPTURE.....	2
4. GENERIC REASONS FOR ABSENT RATIFIED DATA.....	3
5. SPECIFIC PROBLEMS AT SITES.....	4
6. AVAILABILITY OF AUTO-CALIBRATION DATA	7
7. INVENTORY	7
8. RECOMMENDATIONS FOR EQUIPMENT PURCHASES	7

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by

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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 Rural Network relating to the period January to June 2000. There were no significant changes made to the Rural Network during this period.

The ratified data capture percentages and specific problems at sites are presented. An inventory of Department equipment held by NPL, and a list of recommendations for items to be purchased are also given.

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. For the period covered by this report the overall Network Mean data capture is 91%.

Table 1. Data capture for July to December 1999

Site Name	Percentage Data Capture by Pollutant				
	O ₃	NO _x	SO ₂	PM ₁₀	Mean
Aston Hill	99				99
Bottesford	99				99
Bush	87				87
Eskdalemuir	100				100
Glazebury	94				94
Great Dun Fell	47				47
Harwell	97	96	92		95
High Muffles	94				94
Ladybower	96	95	97		96
Lough Navar	81			98	90
Lullington Heath	94	94	98		95
Narberth	90	90	92	83	89
Rochester	85	84	84	76	82
Sibton	98				98
Somerton	90				90
Strath Vaich	93				93
Teddington	99	98	98		98
Wicken Fen	98	89	98		95
Yarner Wood	63				63
Mean	90	92	94	86	

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 are 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 were 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 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 for 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 Rural Network are monthly (and QA/QC Unit visits are 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 that 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.

Bush: (Ozone 87% data capture)

Unratifiable Data

13 – 26 January (329 hours) caused by a leak in the analyser main valve. NPL discovered the fault at a quarterly audit visit and the ESU repaired the analyser the following day.

11 – 18 February (181 hours) due to an analyser fault. The ESU were called out to investigate the fault on 11 February but were unable to identify the problem, which may have been intermittent in nature. Following the observation of further suspect data by the CMCU the ESU returned to fix the fault on 18 February.

Great Dun Fell: (Ozone 47% data capture)

Unratifiable data

1 January – 6 April 2000 (2318 hours). Data were deleted following investigation of suspected manifold damage. The manifold runs underground from the sampling point to the analyser and it is supposed that frost damage has been sustained causing a leak and possible ingress of dirt or water. A second analyser was installed at the site with a separate sample line, and calibrated by the QA/QC unit. Side-by-side trials showed substantial differences between concentrations measured by each analyser, which were attributed to the different manifold arrangements. When all of the available data were considered, it was not found possible to make any adjustment to the data collected using the original analyser, and so these data had to be deleted.

Lough Navar (Ozone 81% data capture)

Unratifiable data

1 January – 1 February (761 hours) resulting from a leak in the analyser. It was determined from the autocalibration data that this fault had started in November 1999, but it remained undiscovered until the QA/QC unit visit on 27 January. The ESU attended the site on 1 February and repaired the leak.

Narberth: (PM₁₀ 83% data capture)Absent Unratified Data

1 – 25 January (596 hours). No data were received from CMCU – this was due to an analyser flow fault.

Rochester: (Ozone 85%, NO_x 84%, SO₂ 84%, PM₁₀ 76%)Absent Unratified Data

1 – 11 January (245 hours of all data). No data were received from CMCU - this was caused by a logger fault and affected all four datasets. The ESU attended the site on 11 January and reconfigured the logger, thereby fixing the problem.

22 - 24 January (42 hours of all data) resulting from a power cut.

20 – 26 June (180 hours of all data). No data were received from CMCU owing to a logging fault.

Unratifiable data

1 – 15 March (349 hours of PM₁₀ data) were deleted as a result of showing excess noise following an LSO calibration. The problem disappeared after the next LSO visit suggesting that the most likely cause was a badly seated filter.

28 – 29 May (37 hours of PM₁₀ data) were deleted due to excessive noise in the analyser response.

Wicken Fen: (NO_x 89% data capture)Absent Unratified Data

5 – 6 April (27 Hours of all data) during which time no data were received from CMCU.

Unratifiable Data

16 April – 2 May (365 hours of NO_x data) were deleted due to excessive drift of the analyser zero.

Yarner Wood: (Ozone 63% data capture)Absent Unratified Data

10 – 15 February (122 hours). No data were received from CMCU due to an analyser malfunction. The ESU attended the site on 15 February, and eventually replaced the defective analyser on 21 February.

Unratifiable Data

21 February – 18 April (1357 hours). The replacement analyser outlined above was not sufficiently calibrated by the ESU, and thus the data were not of sufficient quality to remain in the ratified dataset. Specifically the analyser was only calibrated once, on its installation, using a traceable photometer. Had the analyser been calibrated again - before removal - the data most likely have been able to be satisfactorily scaled.

Action: ESUs to ensure full calibration of replacement analysers – especially in the case of ozone - as these analysers cannot be calibrated by the LSO.

6. AVAILABILITY OF AUTO-CALIBRATION DATA

All relevant instruments within the Automatic Rural Network now have working auto-calibration equipment.

7. INVENTORY

The DETR owned assets used for this work are as follows:

1 PC (486-66)

NPL-developed ratification software

Cylinders, regulators and measurement instruments with individual values of less than £1000

8. RECOMMENDATIONS FOR EQUIPMENT PURCHASES

NPL would recommend that the following items be installed:

1. A Permapure dryer for Harwell NO_x analyser.
2. Chart recorders at Eskdalemuir, Bush, Dunslair Heights, Wicken Fen and Glazebury.
3. Consideration should be given to the installation of new analysers at Lullington Heath.