

UK Automatic Rural Network: Ratification Report for July to December 1998

A M Woolley, B P Sweeney
and D M Butterfield

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**A M Woolley, B P Sweeney and D M Butterfield
Centre for Optical and Environmental Metrology**

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

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by D H Nettleton, Head of Centre for Optical and Environmental Metrology

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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 July to December 1998. 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 statistics relating to current EC directives 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 once a month, 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, NO_x 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's, 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.

Table 1. Data capture for July to December 1998

Site Name	Percentage Data Capture by Pollutant				
	O ₃	NO _x	SO ₂	PM ₁₀	Mean
Aston Hill	92	-	-	-	92
Bottesford	98	-	-	-	98
Bush	99	-	-	-	99
Eskdalemuir	95	-	-	-	95
Glazebury	95	-	-	-	95
Great Dun Fell	91	-	-	-	91
Harwell	98	85	97	-	93
High Muffles	98	-	-	-	98
Ladybower	98	98	97	-	98
Lough Navar	97	-	-	97	97
Lullington Heath	86	91	83	-	87
Narberth	91	89	71	89	85
Rochester	98	97	98	81	94
Sibton	95	-	-	-	95
Somerton	99	-	-	-	99
Strath Vaich	95	-	-	-	95
Teddington	93	97	92	-	94
Wicken Fen	95	92	95	-	94
Yarner Wood	85	-	-	-	85
Mean	94.6	92.7	90.4	89.0	93.0

4. GENERIC REASONS FOR ABSENT RATIFIED DATA

We distinguish three 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 ISOLATED INSTRUMENT MALFUNCTIONS

From time to time most instruments will produce some data that cannot be ratified with sufficient confidence due to an analyser problem, leaking pipework etc that is 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 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.

4.3 RECURRENT INSTRUMENT MALFUNCTIONS

In some instances, not common in established sites such as those in the Rural Network, 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.

Harwell: (NO_x 85% data capture)

Absent unratiified data

26-28 July (51 hours) due to a power cut.

Instrument malfunction

12 October - 3 November (532 hours). No calibration of the NO_x analyser was performed by the ESU following a routine service as the site NO standard appears to have been temporarily removed. NO_x data was therefore deleted until the following LSO calibration.

Lullington Heath: (Ozone 86% Data Capture) (SO₂ 83% data capture)

Instrument malfunction

SO₂

8 August - 3 September (632 hours) due to large internal leaks caused by failure of the hydrocarbon kicker. This had the side-effect of causing the auto-calibration zero to drift positive and reduced the analyser's response to elevated concentrations of SO₂. The problem was found after the LSO calibration (2 September) yielded a very low span, combined with zero sample flow, and was quickly repaired.

Ozone

11 September - 1 October (472 hours). An emergency callout was issued on 14 September and a replacement ozone analyser was installed on 15 September by the ESU. However, the spare unit was only calibrated at a single concentration (plus zero) by the ESU and so an accurate instrument response could not be determined for QA/QC purposes. The original unit was reinstalled on 1 October, and thus the QA/QC unit did not see the spare analyser.

Recommendation: ESU photometer calibrations should be made at 6 concentration values (including zero) to provide adequate information for ratification.

Narberth: (NO_x 89% data capture) (PM₁₀ 89% data capture) (SO₂ 71% data capture)

Absent unratified data

11-13 July (54 hours) due to a computer error at the site.
 18-19 October (35 hours) due to a communications problem.
 29-30 October (28 hours) unknown reason.
 1-2, 7-9 November (81 hours) due to a computer error at the site.
 3-5, 20-22 December (117 hours) unknown reason.

Instrument malfunction

PM₁₀

15-17 July, 3-5 November (102 hours) due to clearly unrepresentative ambient data (either zero or full-scale deflection), probably related to other problems at the site.

SO₂

25 September - 13 November (996 hours) due to a highly unstable zero offset. This was apparent from examination of the auto-calibration data and available LSO visit records, and may have been related to other problems at the site.

Rochester (PM₁₀ 81% data capture)

Instrument malfunction

19-21 September (72 hours) due to excessive noise.
 1-29 October (690 hours) due to variable flow problems discovered at the QA/QC visit. The CMCU were informed on the 23 October and the ESU repaired the fault on the 29 October.

Yarner Wood: (Ozone 85% data capture)

Absent unratified data

3-5 July (73 hours) unknown reason, the chart recorder showed there to be no analyser or power problems.
 30 September - 2 October (47 hours) due to a blockage in the analyser which was found at the routine service.

Instrument malfunction

10-30 November (497 hours) due to a sticking/leaky IZS valve in the analyser which did not fully separate zero and ambient air in the sample stream. The effect was noticed by the CMCU and the ESU fixed the problem on 30 November.

6. STATISTICS RELATED TO EC DIRECTIVES

6.1. OZONE (Council Directive 92/72/EEC)

Number of Exceedences of Ozone Limit and Guideline Values

SITE	DATA CAPTURE	POPULATION INFORMATION THRESHOLD. HOURLY AVERAGE >=90 ppb	POPULATION WARNING THRESHOLD HOURLY AVERAGE >= 180 ppb	HEALTH PROTECTION CRITERION 8 HOURLY AVERAGE >55 ppb	VEGETATION PROTECTION CRITERION HOURLY AVERAGE >99 ppb	VEGETATION PROTECTION CRITERION DAILY AVERAGE >31 ppb
Teddington	94	8	0	14	1	52
Strath Vaich	87	0	0	2	0	252
Yarner Wood	86	0	0	20	0	164
Sibton	96	0	0	10	0	77
Rochester	93	7	0	12	4	75
Lough Navar	95	0	0	1	0	55
Lullington Heath	87	2	0	26	0	131
Ladybower	95	0	0	8	0	104
High Muffles	98	0	0	12	0	127
Harwell	96	0	0	12	0	85
Glazebury	92	0	0	2	0	33
Great Dun Fell	93	0	0	5	0	21
Eskdalemuir	96	0	0	5	0	114
Bush	98	0	0	0	0	119
Bottesford	97	0	0	2	0	46
Aston Hill	94	0	0	9	0	176
Wicken Fen	95	1	0	7	0	38
Narberth	89	0	0	3	0	179
Somerton	95	2	0	26	0	134

6.2 NITROGEN DIOXIDE (Council Directive 85/203/EEC)

Statistics for Nitrogen Dioxide Limit and Guide Values (exceedences in **bold**)

	DATA CAPTURE	LIMIT VALUE 98 TH PERCENTILE OF HOURLY MEANS >104.6 ppb	GUIDE VALUE 98 TH PERCENTILE OF HOURLY MEANS > 70.6 ppb	GUIDE VALUE 50 TH PERCENTILE OF HOURLY MEANS > 26.2 ppb
Teddington	98	45.8	45.8	13.7
Wicken Fen	91	24.6	24.6	5.8
Narberth	76	13.3	13.3	2.5
Lullington Heath	79	27.0	27.0	5.2
Ladybower	95	22.8	22.8	4.3
Rochester	90	34.4	34.4	9.4
Harwell	78	34.3	34.3	6.9

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