School of
Biomedical &
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Environmental
Research Group

KING'S College LONDON
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UK Automatic Urban Network
London Air Quality Network Affiliated Sites

Management Report
October to December 2009

Prepared for the Department for Environment, Food and Rural Affairs (DEFRA), Scottish Executive, Welsh Assembly Government and the DoE in Northern Ireland

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1 Introduction

This report details the equipment performance for the AURN affiliate sites where the King's College London Environmental Research Group (ERG) is contracted as the Central Management Unit and Control Unit (CMCU) by Defra under contract number EPG 1/3/168. The report highlights issues causing data capture to fall below 90% during the period October to December 2009.

2 Routine Data Handling

The routine handling of data from the air sampling through to the dissemination of verified data to the QA/QC Unit is a multi stage process. Data is stored on site in either an external logging system or in individual, in-built analyser logging systems. This is the first stage of quality control as many loggers and analysers are capable of diagnosing faults and identifying them as non-ambient data. Data is collected every hour from each air quality monitoring site using the MONNET data handling software and transferred to an MS-SQL database. After data collection, files are placed in an import queue to await processing, in practice the processing power of the King's air quality server is such that files are processed in a matter of seconds. During this transfer process raw data is checked against algorithms to ensure data quality and data is scaled according to the last known calibration response. Both scaled and raw measurements are stored in the MS-SQL database, this ensures that data can be rescaled from the raw values if necessary.

Data is disseminated to the DDU on an hourly basis by email. Data collection calls are scheduled to complete within the first 20 minutes of each hour. This enables an email to be automatically assembled and dispatched at 27 minutes past the hour, arriving sufficiently early to update the National Air Quality Archive at 45 minutes past the hour.

Manual verification occurs twice daily, this aims to confirm valid data, record site events, identify and diagnose analyser faults.

Fifteen-minute mean measurements, including those diagnosed as non-ambient, are transferred to the QA/QC Unit at the start of each month in the format required. Data from the automatic overnight calibrations and routine LSO visits are also supplied.

2.1 Data Dissemination Performance

Between October and December 2009, ERG estimate that 99% of hourly emails arrived at the DDU to meet their timetabled requirements. Accurate figures of punctual e-mails can be obtained from the DDU.

3 Quality Control / Quality Assurance (QA/QC)

Sites affiliated to the AURN are operated in accordance with the Network Operations Manual and any additional QA/QC procedures requested. Through close liaison with the local authorities and the LSOs, the QA/QC unit is provided with unrestricted access to the monitoring sites.

3.1 QA/QC Site Audits

There were no audits carried out by the QA/QC Unit (AEA Energy and Environment) at AURN affiliated sites managed by King's during the fourth quarter of 2009.

4 Changes to sites affiliated to the AURN

The AURN is in the process of reorganisation due to the requirements of the EU Directive on ambient air quality and cleaner air for Europe. This resulted in the de-affiliation of several sites from the LAQN at the end of December 2007 and the affiliation of several sites from networks managed by King's. The sites identified for affiliation to the AURN and the current status of each site is shown in Table 1.

Site	Current Status
Horley	Affiliated 21/11/07
Stewartby	Affiliated 26/11/07
London Haringey (NO_X)	Affiliated 29/11/07
Stanford-Le-Hope Roadside	Affiliated 22/01/08
London Bexley ($PM_{2.5}$ FDMS)	Affiliated 25/02/08
London Eltham ($PM_{2.5}$ FDMS)	Affiliated 15/05/08
Sandy Roadside	Affiliated 28/07/08
London Bexley ($PM_{2.5}$ FDMS)	Affiliated 20/10/08
London Harrow Background ($PM_{2.5}$ FDMS)	Affiliated 16/12/08
London North Kensington ($PM_{2.5}$ FDMS)	Affiliated 17/12/08
Sandy Roadside ($PM_{2.5}$ FDMS)	Affiliated 27/01/09
Sandy Roadside (PM_{10} FDMS)	Affiliated 28/01/09
Haringey Roadside (PM_{10} FDMS)	Affiliated 18/02/09
Haringey Roadside ($PM_{2.5}$ FDMS)	Affiliated 18/02/09
Camden Kerbside (PM_{10} FDMS)	Affiliated 19/02/09
Camden Kerbside ($PM_{2.5}$ FDMS)	Affiliated 19/02/09
Marylebone Road ($PM_{2.5}$ FDMS)	Affiliated 20/03/09
Marylebone Road (PM_{10} FDMS)	Affiliated 21/03/09
London North Kensington (PM_{10} FDMS)	Affiliated 31/03/09
Stanford-Le-Hope Roadside ($PM_{2.5}$ FDMS)	Affiliated 01/04/09
Stanford-Le-Hope Roadside (PM_{10} FDMS)	Affiliated 01/04/09
Eastbourne Background	Affiliated 19/05/09
Storrington Roadside	Installed 29/07/09

Table 1: Sites managed by King's which have been identified for affiliation to the AURN

5 Quarterly Data Capture Statistics

Data capture rates for October, November and December are detailed in Table 2, Table 3 and Table 4. The data capture rate for each month was calculated from valid hourly averages, after excluding data lost due to calibration and the faults discussed. The overall data capture for the quarter October to December is detailed in Table 5.

Specific issues affecting data collection and quality at each site are discussed in 5.1 to 5.9. Details of faults are specified where data capture falls below 90% for the quarter.

Site	Data Capture for October 2009					
	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2
Camden Kerbside		99.6		99.3	*73.9*	
Eastbourne				93.4	96.9	
Haringey Roadside		99.6		99.6	99.7	
Horley		99.6				
London Bexley					99.9	
London Eltham		99.9	99.6		99.9	
London Haringey		99.6	99.6			
London Harrow Background					97.7	
Marylebone Road	99.5	99.5	99.6	*78.4*	97.3	99.6
North Kensington	99.5	99.6	99.7	95.7	99.7	99.6
Sandy Roadside		*26.6*		99.3	99.6	
Stanford-Le-Hope Roadside		99.5		99.3	*44.1*	
Storrington Roadside		*34.3*		92.6	*89.3*	
Tower Hamlets Roadside	99.7	99.6				

Table 2 – Hourly data capture for October 2009

Site	Data Capture for November 2009					
	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2
Camden Kerbside		*88.6*		98.3	99.7	
Eastbourne				90.7	99.3	
Haringey Roadside		99.9		99.9	100.0	
Horley		99.6				
London Bexley					100.0	
London Eltham		99.3	*76.4*		99.7	
London Haringey		99.0	99.7			
London Harrow Background					99.6	
Marylebone Road	99.4	99.7	99.7	99.4	99.4	99.7
North Kensington	99.0	99.4	99.6	96.1	99.7	99.6
Sandy Roadside		95.3		99.0	100.0	
Stanford-Le-Hope Roadside		99.6		99.2	*81.4*	*73.8*
Storrington Roadside		99.7		96.0	94.4	
Tower Hamlets Roadside	99.7	99.7				

Table 3 - Hourly data capture for November 2009

Site	Data Capture for December 2009					
	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2
Camden Kerbside		*0*		99.9	*15.6*	
Eastbourne				100.0	100.0	
Haringey Roadside		*56.3*		99.6	99.6	
Horley		99.6				
London Bexley					98.1	
London Eltham		99.7	99.7		100.0	
London Haringey		99.5	99.6			
London Harrow Background					100.0	
Marylebone Road	99.5	99.7	99.6	*76.6*	*58.7*	99.7
North Kensington	99.1	99.3	99.3	98.0	*81.7*	99.2
Sandy Roadside		94.9		99.9	99.6	
Stanford-Le-Hope Roadside		98.3		99.9	97.7	99.6
Storrington Roadside		93.8		99.9	96.6	
Tower Hamlets Roadside	99.7	99.3				

Table 4 - Hourly data capture for December 2009

Site	Data Capture for October to December 2009					
	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2
Camden Kerbside		*62.5*		99.2	*62.7*	
Eastbourne				94.8	98.7	
Haringey Roadside		*85.1*		99.7	99.8	
Horley		99.7				
London Bexley					99.3	
London Eltham		99.6	92.1		99.9	
London Haringey		99.5	99.7			
London Harrow Background					99.1	
Marylebone Road	99.6	99.6	99.6	*84.7*	*85.0*	99.7
North Kensington	99.2	99.5	99.6	96.6	93.7	99.5
Sandy Roadside		*72.0*		99.4	99.7	
Stanford-Le-Hope Roadside		99.2		99.5	*74.3*	*57.7*
Storrington Roadside		*75.7*		96.2	93.4	
Tower Hamlets Roadside	99.8	99.6				

Table 5 - Hourly data capture for October to December 2009

5.1 Camden Kerbside Nitrogen Dioxide — 62.5%

27th November to 8th December 2009 — *264 Hours*

The instrument developed a combination of faults and the measurements became low and unresponsive. A callout was issued to the ESU on 30th November and the engineer attended on 1st December to remove the analyser to the workshop for repair. The instrument was returned to site on 8th December.

8th December 2009 onwards *559 Hours*

Following the calibration of the analyser after its return to site, the nitrogen dioxide measurements were noted to be unexpectedly elevated when compared to other sites. The ESU was contacted for clarification of the results and it was agreed that the zero and span check would be repeated when the ESU was to attend site for another callout. However the visit was delayed due to bad weather conditions.

On 17th and 30th December, the LSO attended site for routine calibrations where it was seen that the calibration response had been unstable. Therefore a callout was issued to the ESU when the latest calibration results were received on 6th January.

5.2 Camden Kerbside $PM_{2.5}$ 62.7%

22nd to 30th October *194 Hours*

The instrument developed a valve position fault. A callout was issued to the ESU on 23rd October. The ESU attended on 26th October but was unable to repair the fault. The analyser was removed for repair and returned on 30th October.

6th December onwards *621 Hours*

The measurements became noisy and erratic. As the ESU was attending for another callout, they checked the $PM_{2.5}$ FDMS whilst on site. This resolved the problem of erratic measurements but after this the volatile measurements became too negative when compared to other sites. A callout was issued to the ESU on 14th December.

Due to a problem with safe access to the roof, the ESU did not attend site for some time. The Local Authority was contacted about the roof access problem. However, due to the ongoing delay in callout attendance, it was agreed that the ESU should perform the leak check at the splitter. This was carried out on 8th January 2010 where a leak was found at the elbow.

5.3 Haringey Roadside Nitrogen Dioxide 85.1%

18th December onwards *563 Hours*

The instrument developed a fault and the measurements became unresponsive around the instrument baseline. A callout was issued to the ESU on 21st December. The ESU attended on 23rd December but was unable to resolve the fault. The ESU was informed on 24th December that the fault was continuing.

The ESU returned to site on 30th December. This resulted in some improvement to the measurements but a fault returned by 1st January. Another callout was issued on 2nd January. The ESU attended on 4th January, following which there were still some intermittent errors flagged and another callout was issued on 7th January. The fault was repaired on 7th January.

5.4 Marylebone Road PM_{10} 84.7%

1st to 7th October *156 Hours*

The measurements became low compared to the VCM corrected TEOM measurements from the site. This was improved after a filter change.

23rd to 30th December *168 Hours*

A HEPA filter was installed to check the instrument baseline. Measurements were excluded while the HEPA filter was in place.

5.5 Marylebone Road $PM_{2.5}$ **85%**

28th to 29th October *17 Hours*

The volatile measurements dipped during a site visit although the exact cause is unknown. It took some time for the measurements to return to normal although no intervention was required.

2nd to 7th December *132 Hours*

The volatile measurements again became too negative when compared to other sites. An LSO was scheduled to change the filter but the volatile reading appears to have recovered by itself shortly before the filter change.

23rd to 30th December *169 Hours*

A HEPA filter was installed to check the instrument baseline. Measurements were excluded while the HEPA filter was in place.

5.6 Sandy Roadside Nitrogen Dioxide **72%**

1st to 23rd October *538 Hours*

As reported in the Management Report for Quarter 3 of 2009, the measurements from the instrument were unexpectedly elevated compared to other sites following a service. The investigation of the problem was complicated by a change in ESU.

Following investigations by the LSO, the previous ESU and the current ESU, the problem was finally traced to a sampling issue whereby the sample line was not sealed in the duct and had been pulled partly into the duct. This was leading to some sampling of the internal cabin air. After sealing the duct, the measurements returned to expected levels.

5.7 Stanford-le-Hope Roadside $PM_{2.5}$ **74.3%**

14th to 22nd October *191 Hours*

Some unusual dips and spikes which were not occurring at other sites had been noted in the measurements for some time. A callout was issued to the ESU to investigate on 12th October. The ESU attended on 14th October to remove the instrument for repair. The instrument was returned to site on 22nd October.

22nd to 29th October *177 Hours*

After the FDMS was returned to site, the measurements were very noisy and erratic. The ESU was asked to go back to investigate on 26th October. The engineer attended site on 29th October to repair and service the instrument, after which the measurements looked improved.

30th October to 1st November *56 Hours*

The volatile measurement was seen to be not matching well with other sites. This improved without any action being taken.

18th to 22nd November *101 Hours*

The measurements became noisy and erratic. The ESU addressed the issue when attending a callout on 20th November for continuing concerns that the volatile measurement was not matching closely enough to other sites. The V seals in the instrument were found to be worn and were replaced. After some settling time, the noisy and erratic measurements were improved.

5.8 Stanford-le-Hope Roadside Sulphur Dioxide — 57.7%

1st to 29th October — *949 Hours*

A PMT temperature fault started on 25th September. A callout was issued on 26th September. The ESU attended on 1st October and removed the instrument for further investigation.

The analyser was returned to site on 29th October. However, on its return, the measurements were drifting downwards with negative dips and therefore excluded. The LSO went to site for a calibration on 5th November and noticed some further flagging of the PMT temperature fault. The LSO issued a callout. The ESU attended on 9th November. The PMT temperature fault and the rapid measurement drift were resolved at this visit.

5.9 Storrington Roadside Nitrogen Dioxide — 75.7%

1st to 20th October — *468 Hours*

There were some unusually elevated readings; particularly the proportion of nitrogen dioxide of the total nitrogen oxides appeared too high. The repair was delayed by an issue of live cables discovered on site following the site installation which needed to be rectified by an electrician before the ESU could attend. There was also a delay with the delivery of the certified nitrogen oxide cylinder.

Following the resolution of the site installation issues, the ESU attended on 20th October to address the problem with the analyser. The original analyser, which had been removed previously, was returned to site, the sample line was shortened and the instrument calibrated to the new gas cylinder. This resulted in the measurements looking more as expected and matching better with other similar sites.

11th to 13th December — *36 Hours*

There was some intermittent flagging of a pressure fault on the instrument. The fault stopped without any intervention.

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