

Data Review & Validation QA Plan for Continuous Gaseous & Non-  
Speciated Particulate Monitors  
Section IV

Raleigh Central Office Responsibilities

### Approval Sign-Off Sheet

I certify that I have read and approve of the contents of this version of the "Data Review & Validation QA Plan for Continuous Gaseous & Non-Speciaterd Particulate Monitors, Section IV, Raleigh Central Office Responsibilities" with an effective date of October 15, 2014.

Joette Steger, PPB Supervisor: Joette Steger 11/3/2014

Donnie Redmond, Ambient Monitoring Section Chief: Donnie Redmond 11/3/14

Vitaly Karpusenko, Statistician: Vitaly Karpusenko 10/22/14

Dave Willis, DAS Manager: Dave Willis 10/22/14

Carlton Blakley, Central Office Lead: Carlton Blakley 10/15/14

## Table of Contents

2.41.4	Data Reporting, Validation and Quality Assurance: Division of Air Quality Ambient Monitoring Section Responsibilities.....	4
2.41.4.1	General Guidance .....	4
2.41.4.2	Automatically Reported Data .....	13
2.41.4.3	Manually Reported and Corrected Data .....	14
2.41.4.4	Accuracy Audits and Reporting.....	15
2.41.4.5	Quarterly Calibration Review.....	17
2.41.4.6	NCore Instrument Method Detection Limit (MDL).....	17
2.41.4.7	Precision Checks and Reporting.....	18
2.41.4.8	Determination of the Agency Pooled Precision and Accuracy .....	19
2.41.4.9	Interagency Auditing .....	19
2.41.4.10	Systems Auditing.....	20
2.41.4.11	Data Certification.....	20

## List of Tables

Table 1	Reporting Units and Rounding Conventions for Polled Data .....	5
Table 2	Performance Acceptance Criteria.....	6
Table 3	DAQ and EPA Audit Accuracy Criteria.....	15
Table 4	Handling of Annual Performance Evaluation Data for Continuous Gaseous Monitors	31
Table 5	Handling of 1-Point Quality Assurance Data for Carbon Monoxide, Nitrogen Dioxide and Reactive Oxide of Nitrogen .....	32

## List of Figures

Figure 1	SO <sub>2</sub> Exceedance Report.....	22
Figure 2	RCO Data Handling Procedures .....	33
Figure 3	Data Management Processes and Products .....	34
Figure 4	Data Management Processes and Products .....	35

## List of Appendices

Appendix 1	Monthly Format Report .....	23
Appendix 2	Supplemental Data Reports.....	23
Appendix 3	Trace Level MDL Procedure .....	27
Appendix 4	TEOM Download Procedure .....	28

## 2.41.4 Data Reporting, Validation and Quality Assurance: Division of Air Quality Ambient Monitoring Section Responsibilities

**Note:** The following is a list of "significant changes" from Revision 1.5.

- 1) QA updated per QAP/SOP 2.39 "Standard Operating Procedure (SOP) for Preparing Quality Assurance Plans/SOPs".
- 2) New procedures for reviewing the monthly data.
- 3) New precision reporting procedure for ozone and sulfur dioxide.
- 4) Electronic Data Acquisition System replaced by AirVision.
- 5) Back-up data logger references removed.
- 6) Nitrogen dioxide Performance Acceptance and EPA Audit Accuracy criteria added.
- 7) AQS Null Data Codes list updated.
- 8) Job title changes and new assignments.

### 2.41.4.1 General Guidance

Once the site specific ambient air pollutant monitoring and reporting system at a monitoring site has been established, calibrated, and documented to be performing within QA/SOP data acceptance criteria, the regional operator will notify the Data Acquisition System (DAS) Manager that the system is performing within data acceptance criteria. This is accomplished via the submittal of the Site Specific Startup Form to the DAS Manager.

Upon receipt of the Site Startup notification, the DAS Manager shall begin electronic capture of the data collected on the Primary Data Logger (PDL) located at the site. The data will be collected and reported to the Air Quality System (AQS) with the units and decimal places truncated as specified in **Table 1**, pg.5. Also at this step, the DAS manager must add the new site and site related information to the IBEAM database (the function is listed under the Ambient Monitoring, Ambient Site menu). Afterwards, an email will be sent to DENR.DAQ.Ask\_IBEAM@lists.ncmail.net containing the site information (Logger ID, Logger Description, Site Name, and AQS ID) so the IBEAM database can be linked to the AirVision upload files.. After the information is updated in the database, the DAS manager will check the NC DAQ webpage ([www.ncair.org](http://www.ncair.org)) to ensure that the real time data is displayed and that the monitoring maps have been updated to reflect the changes. Upon receipt of the Site Shutdown Notification, the DAS manger will email [DENR.DAQ.Ask\\_IBEAM@lists.ncmail.net](mailto:DENR.DAQ.Ask_IBEAM@lists.ncmail.net) to ensure

that the site is marked as inactive in the IBEAM database and that the site is removed from the webpage and maps.

The DAS Manager is responsible for maintaining a working record of this electronically captured data. The Statistician is responsible for providing daily and monthly reports of the quality assurance site specific air pollution data to both the Regional and Central Office staff for review. The Statistician shall also assist in the development of additional reports and data calculations.

**Table 1 Reporting Units and Rounding Conventions for Polled Data**

<b>Pollutant</b>	<b>Standard Reporting Units</b>	<b>Rounding convention for data reported to AQS</b>
Ozone	Parts per million	3 places after decimal with digits to right truncated
Carbon Monoxide (NAAQS)	Parts per million	1 decimal place
Nitrogen Dioxide, Nitrogen Oxide, and Oxides of Nitrogen	Parts per billion	1 place after decimal with digits to right truncated
Sulfur Dioxide	Parts per billion	1 place after decimal with digits to right truncated
Fine particle (BAM and TEOM)	µg/m <sup>3</sup> at ambient temp/pressure (PM <sub>2.5</sub> )	to one decimal place, with additional digits to the right being truncated
PM <sub>10</sub> Continuous (BAM and TEOM)	µg/m <sup>3</sup> at standard temperature and pressure (STP)	nearest 10 µg/m <sup>3</sup> (> 5 round up)
Reactive Oxides of Nitrogen and Nitrogen Oxide	Parts per billion	1 place after decimal with digits to right truncated
Ammonia and Nitrogen Oxide	Parts per billion	1 place after decimal with digits to right truncated
Trace Level Carbon Monoxide	Parts per billion	digits to right of decimal truncated

The quality assurance review reports include but are not limited to the following:

1. Daily Polling Reports include the hourly air pollutant concentrations, hourly average temperatures, missing data due to site activities, and site daily autocalibration check results
2. Daily Calibration Check Reports
3. Monthly site and pollutant specific hourly concentration reports
4. Monthly site specific hourly temperature reports
5. Monthly site sulfur dioxide 5 minute average concentration reports
6. Monthly site and pollutant specific calibration check reports
7. Monthly Precision Reports

The Regional and Central Office staffs are responsible for reviewing the Daily Polling and Daily Calibration Check reports to evaluate the apparent ongoing satisfactory performance of air pollutant monitoring systems. This performance evaluation must be performed as soon as possible following the availability of the Daily Reports from the DAS Manager and Statistician. This daily review prevents the reporting of ambient air quality data which does not meet data acceptance criteria and identifies monitoring systems that require immediate attention and/or repair. This essential ongoing performance evaluation of air pollutant monitoring systems greatly enhances the reporting of high quality ambient air pollutant data via the identification of site specific operational problems. The regional office and the central office ambient air monitoring staff are required to notify each other of site specific data reports that do not meet data acceptance criteria and any operational problems found during the daily review process.

When the primary data logger has been shown to be obtaining acceptable data, the Raleigh Central Office telemetry computer using polling routines will automatically acquire the data. The actions required by the Regional Office staff are to report reasons for missing data; identify invalid data; identify data to be changed by Raleigh Central Office; validate the data; and document any unusual monitor performance.

Continuous analyzer data will be stored on the site computer. The Regional Ambient Monitoring Coordinator is responsible for assuring that as much data values are collected as possible. When the primary data logger does not acquire data or the data are invalid for a reason related to the primary data logger, the Regional Ambient Monitoring Coordinator should review the site computer data and any associated memo flags (i.e. open, chart stamp, and calibration memos) and impute the missing hourly data values from the site computer minute data in hours using AirVision software.

Raleigh Central Office Chemists review the daily polled data each workday. The Regional Ambient Monitoring Coordinator provides feedback and makes inquiries to the appropriate regional operator when data questions arise. Automated daily polling usually occurs in the early hours of the morning so that the electronic files are available for review at the start of the workday.

**Table 2 Performance Acceptance Criteria**

Ozone Criteria

<b>250 ppb Range</b>						
Theoretical Concentration (ppb)	Calibration		Auto - Cal Check		Manual Cal Check	
	Calibrator	Monitor	Calibrator	Monitor	Calibrator	Monitor
0	≤ ± 2 ppb	≤ ± 2 ppb	≤ ± 3 ppb	≤ ± 3 ppb	≤ ± 2 ppb	≤ ± 2 ppb
70	≤ ± 2 ppb	≤ ± 2 ppb	≤ ± 3 ppb	≤ ± 3 ppb	NA	NA
120	≤ ± 2 ppb	≤ ± 2 ppb	NA	NA	NA	NA
225	≤ ± 2 ppb	≤ ± 2 ppb	≤ ± 3 ppb	≤ ± 5 ppb	≤ ± 2 ppb	≤ ± 5 ppb

SO<sub>2</sub> Criteria

<b>500 ppb Range</b>			
Theoretical Concentration (ppb)	Span	Calibration	Daily Auto - Cal Check
		DAQ Acceptance ±	DAQ Acceptance ±
0	0	2 ppb	3 ppb
45	S-3	3 ppb	3 ppb
100	S-2	5 ppb	NA
400	S-1	20 ppb	20 ppb
<b>100 ppb Range (NCore Trace Level)</b>			
0	0	2 ppb	2 ppb
7	S-3	2 ppb	2 ppb
45	S-2	3 ppb	NA
85	S-1	3 ppb	3 ppb

## Carbon Monoxide Criteria

<b>5000 ppb Range</b>			
Theoretical Concentration (ppb)	Span	Calibration	Daily Auto - Cal Check
		DAQ Acceptance ±	DAQ Acceptance ±
0	0	35 ppb	35 ppb
250	S-3	24 ppb	25 ppb
2000	S-2	100 ppb	NA
4000	S-1	160 ppb	320 ppb

## Reactive Oxides of Nitrogen Criteria

<b>200 ppb Range</b>			
Theoretical Concentration (ppb)	Span	Calibration	Daily Auto - Cal Check
		DAQ Acceptance ±	DAQ Acceptance ±
0	0	0.5 ppb	1 ppb
35	S-3	10%	15%
100	S-2	3%	NA
180	S-1	3%	6%

Nitrogen Dioxide Criteria

<b>500 ppb Range</b>			
Theoretical Concentration (ppb)	Span	Calibration	Daily Auto - Cal Check
		DAQ Acceptance ±	DAQ Acceptance ±
0	0	1 ppb	1 ppb
60	S-3	3%	8%
175	S-2	4%	NA
425	S-1	5%	8%

**2.41.4.1.1** Hourly data must be reported in Eastern Standard Time year-around, EST = Eastern Daylight Time-1hour, = UTC (Coordinated Universal Time) + 5 hours

**2.41.4.1.2** Hourly data are reported at the start of the hour (1:00-1:59 is time stamped as 01:00).

**2.41.4.1.3** The regional operator must account for all missing or invalid data by identifying the reasons for missing or invalid data on the monthly data review form using proper null codes.

**2.41.4.1.4** The Regional Ambient Monitoring Coordinator initials, dates and submits the monthly data forms to Raleigh Central Office within 10 days from the end of the collection month and must submit them within 15 workdays.

**2.41.4.1.5** The Regional Ambient Monitoring Coordinator initials, dates and submits the monthly electronic logbooks to Raleigh Central Office within 15 working days. E-logs are used as tools in the data review/validate process.

**2.41.4.1.6** All data, including any supporting documentation, must be kept for three calendar years. Exceptions to this are discussed elsewhere in this SOP.

**2.41.4.1.7** Completeness - Data are considered complete if 75 percent or more of the total possible number of observations are present. Continuous measurement criteria for completeness are shown below:

<u>Time Interval</u>	<u>Minimum Number of Observations</u>
Hour Average	45 minute averages
3-hour average	3 consecutive hourly observations
8-hour running average	6 hourly observations
24-hour	18 one-hour averages
Monthly	21- 24 daily averages
Quarterly	3 consecutive monthly averages
Yearly	8 month average with at least 2 monthly averages per quarter for monitors that run 12 month

*seasonal* for monitors that operate less than 12 months,  
at least 2/3 of the data for each quarter operated during the  
monitoring season should be available

*3 year* 90% of the ozone data

**2.41.4.1.8** Representativeness - Data collected must be representative of the conditions existing at the time of the sample collection. The notes of unusual conditions made by the operator should be considered in validating questionable data. The integrity of the sample and analysis delivery system is extremely important in determining the representativeness of the data.

#### **2.41.4.1.9** Flagged Data Review

Certain flags (symbols) can be assigned to specific data automated in AirVision to indicate their validity. If no flag follows a value, the datum is assumed to be accurate and valid unless invalidated for other reasons not detected by AirVision. These data are used in calculating all appropriate statistics.

Instruments on 8816/8832 data loggers:

Codes used to indicate invalid data are as follows:

<u>Code</u>	<u>Meaning</u>
<	signifies a power interruption of <i>more than</i> 15 minutes during an hour
T	"out of Control"

Codes that do not invalidate data are as follows, listed in descending priority order:

<u>Code</u>	<u>Meaning</u>
H, h	"High-high" or "high" alarm
L, l	"Low-low" or "low" alarm
R	"Rate-of-change" alarm
P	"Power Failure"
D	"Disabled"
B	"Bad status input"
C	"Calibration"
U	"Analog Underrange"

Data accumulated under the above condition will be flagged automatically in AirVision and considered valid. If data from "D", "B" and "C" indications exceed the threshold level, the average data for that time interval will be so flagged and not used in calculating the next valid larger time interval. The auditor needs to validate these hours by checking that the minute values are similar and thus the data appear valid. If one of these flags shows up and there are more than 45 valid minutes, invalidate only the affected minute data.

#### **TEOM instruments**

TEOM monitors do not deliver one-minute averages to the analog data logger. Therefore, there is no meaningful way to automatically generate a "<" code. Some subhourly averages are

available, but our TEOMs are programmed to store 30-minute averages and allow the 8816/8832 data logger to capture 60-minute averages. Qualifier codes that describe invalid data conditions are therefore *assumed* to have been in effect for more than 15 minutes.

Codes used to indicate invalid data are as follows, listed in descending priority order:

<u>Flag</u>	<u>Meaning</u>
<	signifies a power interruption of <i>more than 15 minutes</i> during an hour. (This code is not generated by the data logger, but can and may be manually inserted at a QA editor's discretion to make accompanying codes compatible with the continuous monitors capable of reporting 1-minute averages.)
P	"Power Failure"
D	"Disabled"
C	"Calibration"
B	The normal meaning of this code is "Bad status input", but AirVision operators frequently insert it manually for QA purposes to signify "Suspect data" for AirNow and IBEAM reporting purposes.
E	Manually Edited
T	"out of Control"

Codes that do not invalidate data are as follows, listed in descending priority order:

<u>Flag</u>	<u>Meaning</u>
Z	TEOM Main Flow rate exceeds 3.2 l/m (liters per minute)
H, h	"High-high" or "high" alarm
L, l	"Low-low" or "low" alarm
R	"Rate-of-change" alarm
U	"Analog Underrange"

Data acquired under the above conditions will be flagged automatically in AirVision and considered valid. However, filter overload conditions that do invalidate the data are detected by programming the main flow rate to report 5.0 l/m, and the Z qualifier signals it.

If data from "D", "B" and "C" indications occur, the average data for the affected time period will be so flagged and not aggregated with other averages in calculating the next longer time interval average. The auditor needs to validate these hours by checking that the TEOM Download file values are similar (see **Appendix 5, TEOM Download Procedure**) and thus the data appear valid.

### **BAM Instruments**

The Met One Instruments BAM monitor does not produce subhourly concentrations and does not generate "flags" *per se*. Instead, there is an artificial concentration signal at slightly less than the instrument range, and we have programmed 8816/8832 data loggers to translate this concentration as "c" flags.

Codes used to invalidate data are as follows:

<u>Flag</u>	<u>Meaning</u>
D	"Disabled"
B	The AirVision operator may insert this manually for QA purposes to signify "Suspect data" for AirNow and IBEAM reporting and compatibility with other continuous monitors.
I	"Invalid data". The AirVision operator may insert this manually for QA purposes for IBEAM reporting and compatibility with other continuous monitors.
E	Manually Edited
T	"out of Control"
c	"Ceiling", as in the highest possible reading.

Codes generated by the BAM monitor that do not invalidate data are as follows:

H, h	"High-high" or "high" alarm
------	-----------------------------

Note that an AirVision operator can attach any other AirVision QA codes manually to data values. If data from "D", "B", "T" and "c" indications occur, the average data for the affected time period will be so flagged and not aggregated with other averages in calculating the next longer time interval average.

### Data Flag Definitions

<	Less than 75% required for valid average, shows a power interruption of 15 minutes or more, does not meet requirement for valid average
H, h	high-high or high alarm limit exceeded, numerical value, main flow and/or auxiliary flow outside limits (TEOM); if average is equal to or exceeds this value
L, l	low-low or low alarm limit exceeded, numerical value, main flow and/or auxiliary flow outside limits (TEOM); if average is equal to or less than this value
R	rate of change limit exceeded, numerical value; if difference between the previous reading and the current reading is equal to or exceeds this value
P	power failure of > 1 minute
D	channel disabled (marked offline), maintenance and repairs, includes filter change, precision checks, and audits
B	bad status detected, power to monitor is out for a short time, data logger is still working
C	maintenance and repairs, includes filter change, precision checks, and audits
T	out-of-control tolerance exceeded (calibration data), equipment malfunction
U	analog under range, signal is reading below low signal input/output set range (4 – 20Ma), data not included in the averaging

### AQS Null Data Codes

The "NULL" qualifier type is used when a null value (i.e., no data point) is reported to AQS.

<u>Code</u>	<u>Code Description</u>	<u>Code</u>	<u>Code Description</u>
AC	Construction/Repairs	AX	Precision Check

AD	Shelter Storm Damage	AY	Q C Control Points (zero/span)
AE	Shelter Temperature Outside Limits	AZ	Q C Audit
AH	Sample Flow out of Limits	BA	Maintenance/Routine Repairs
AJ	Filter Damage	BC	Multi-point Calibration
AK	Filter Leak	BE	Building/Site Repair
AN	Machine Malfunction	BF	Precision/Zero/Span
AO	Bad Weather	BJ	Operator Error
AP	Vandalism	BK	Site Computer/Data Logger Down
AS	Poor Quality Assurance Results	BL	QA Audit
AT	Calibration	DL	Detection Limit Analysis
AV	Power Failure	SA	Storm Approaching
AW	Wildlife Damage		

**AQS Qualifier Codes**

<b>Qualifier Codes</b>	<b>Descriptions</b>	<b>Applicable Pollutants</b>
1	Deviation from a CFR/Critical Criteria Requirement	CO, SO <sub>2</sub> , NO <sub>2</sub> , O <sub>3</sub> , BAM, NO <sub>3</sub> , BC, SO <sub>4</sub> , TEOM
2	Operational Deviation	SO <sub>2</sub> , O <sub>3</sub> , BAM, NO <sub>3</sub> , BC, SO <sub>4</sub> , TEOM Adj Only
3	Field Issue	CO, SO <sub>2</sub> , SO <sub>2</sub> Max 5 min ave, NO <sub>y</sub> , NO, NO <sub>2</sub> , NH <sub>3</sub> , O <sub>3</sub> , BAM, NO <sub>3</sub> , SO <sub>4</sub> , TEOM,
5	Outlier	BAM, NO <sub>3</sub> , BC, SO <sub>4</sub> , TEOM
6	QAPP Issue	BAM, NO <sub>3</sub> , BC, SO <sub>4</sub> , TEOM Adj Only, CO, NO <sub>2</sub>
9	Negative value detected - zero reported	CO, SO <sub>2</sub> , SO <sub>2</sub> Max 5 min ave, NO <sub>y</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , O <sub>3</sub> , BAM, NO <sub>3</sub> , SO <sub>4</sub> , TEOM Raw Only
EH	Estimated; Exceeds Upper Range	CO, SO <sub>2</sub> , SO <sub>2</sub> Max 5 min ave, NO <sub>y</sub> , NO, NO <sub>2</sub> , NO <sub>x</sub> , NH <sub>3</sub> , O <sub>3</sub> , BAM, NO <sub>3</sub> , BC, UVC, SO <sub>4</sub> , TEOM

**2.41.4.1.10** The DAS Manager and Statistician are responsible for the daily polling and reporting of all air monitoring data. Any questions of data validity are checked by the PPB supervisor. The Chief shall assure that all quality assured data, including all forms, are properly retained for future reference.

**2.41.4.1.11** Daily Continuous Data Polling Procedures from the Ambient Monitoring Network

1. Daily AirVision auto-polling of the ambient network by the central office for hourly data

starts a few minutes after 4:00 am and continues until it is completed. Electronic documents on the internal web page appear at 5:30 and are refreshed at 7:30 and 9:30 (this takes advantage of auto-polls that occur for other reasons, in case of polling failures during the 4:00 am session). Minute data are polled twice a day (morning and evening).

2. The DAS Manager and Statistician will check these reports each morning to see that all expected active sites have been polled. If any required sites are not present, the Statistician and DAS Manager (as backup) will re-poll the site and provide results to the review chemist as soon as possible, for hourly data, and to the PPB supervisor for minute data. The DAS Manager and Statistician provide the reports for hourly data to the review PPB chemist each morning via e-mail. If the poll is not available, use IBEAM to check to expedite review. Minute data are stored on the p:\ambient drive at the end of each month as txt csv files by site and by month.
3. Normally, at a minimum, the ozone automatic zero, level 2 (precision) span and level 4 span are available. If automatic polling is not able to recover the zero and span points, then the Statistician and DAS Manager (as backup) must attempt to recover the calibration table with a separate manual polling software by 9:00 am. This manual polling approach will deliver all 3 calibration points, and then it may be unnecessary for this site to be included in the special re-polling described in the next paragraph.
4. Data capture must go back as many days as necessary to ensure a continuous, complete record. When manual polling is needed, it is performed ad hoc, at the earliest convenient time.
5. The completed report is to be captured in an electronic file by 3:00 pm on the days polled and emailed to the reviewing chemist.
6. If auto zero-span tables for pollutants other than CO or Ozone are missing or any continuous monitoring sites still remain outstanding, the reviewing PPB Chemist will request action of the Statistician and DAS Manager (as backup) to acquire the missing data through manual polling.

#### **2.41.4.2 Automatically Reported Data**

**2.41.4.2.1** The process begins on the first day (if possible) and must be completed within the first 4 or 5 business days; the Statistician will create the monthly data review report for each pollutant and site. The Statistician will post the reports on the group drive <P:\Ambient\PUB\RegOffices.NC> and e-mail the appropriate regional offices alerting them that the reports are ready for review. Refer to "**Appendix 1 Monthly Format Report**" for procedure.

**2.41.4.2.2** The PPB staff, upon receiving the monthly data review reports from the regional offices, will check each form for completeness, correctness, unusual data (such as lower or

higher data values than typically occurring for that time of day), flagged data, data that are greater than full scale range of the analyzer, and data to have negative values, down to the negative of the minimum detection limit value.

**2.41.4.2.3** The RCO Chemists will ensure that reasons for all missing data have been recorded on the monthly data review reports. When data are missing, the RCO Chemists will contact the regional operators to obtain reasons for the missing data.

**2.41.4.2.4** The Statistician takes the reviewed monthly file data reports and prepares files to upload to AQS.

**2.41.4.2.5** The Statistician will file all monthly data review reports and Monthly File Reports by region and data logger in the data management monthly files folders located in file: <P:\Ambient\Incoming\RegOffices.NC>.

### **2.41.4.3 Manually Reported and Corrected Data**

**2.41.4.3.1** On a daily basis, the PPB staff review the hourly average data generated by all continuous PM monitors (TEOM and BAM) and all continuous SO<sub>2</sub> and O<sub>3</sub> monitors. When questionable data is observed, the PPB staff will notify the Environmental Program Consultant who will update AirVision.

**2.41.4.3.2** PPB staff may perform special statistical evaluations of questionable data when necessary or appropriate. These evaluations may include, but not be limited to, the following:

- (1) Statistical analysis to determine if the questionable value is a statistical outlier. (See Quality Assurance Handbook for Air Pollution Measurement Systems Vol. I, Principles, EPA-600/9-76-005)
- (2) A full investigation as to possible causes at the site, including how well the standard operating procedures were followed by those collecting the data,
- (3) Rejection of the data found to be unsatisfactory and identification of the unusual acceptable values perceived to be unusual (determined from e-log review, unusual regional activity or events, equipment failure),
- (4) When it is necessary to synchronize IBEAM with manually corrected data acquired more than twelve (12) months in the past IBEAM can be updated by sending an email message to [NCDENR.DAQ.Ask\\_IBEAM@lists.ncmail.net](mailto:NCDENR.DAQ.Ask_IBEAM@lists.ncmail.net) to request a "special update".

**2.41.4.3.3** From the hourly data, "supplemental summary reports" are generated by the Environmental Program Consultant and these reports are typically distributed internally within DAQ, to the USEPA and to local air monitoring agencies. Refer to **Appendix 2 "Supplemental Data Reports"** for additional details.

**2.41.4.4 Accuracy Audits and Reporting**

Accuracy audits for continuous gaseous monitors are performed and reported to Raleigh Central Office by ECB staff on an AQ-121 form. 40 CFR 58 Appendix A requires at least one quarter of the monitors running in a network to be audited each quarter and every monitor to be audited at least once each year.

**2.41.4.4.1** For the continuous monitors CO, NO<sub>y</sub>, and NO<sub>2</sub>, the ECB must not perform checks or audits between 6:00 AM and 9:00AM "Local Standard Time". This is an important data collection period. For ozone monitors, if the ozone AQI forecast is 90 or greater, then the ECB must not perform checks or audits.

The calibrators used for auditing SO<sub>2</sub>, CO, NO<sub>y</sub>, and NO<sub>2</sub> are different than the calibrator used for calibration and spanning. The 146C and T700U "audit calibrators" must be certified for nine months.

The auditor must not be the same operator who conducts the routine monitoring, calibrations, and analysis. The audit is conducted before making any monitor or data logger adjustments.

The monitor must operate in its normal sampling mode, and the audit gas must pass through the existing particulate filter.

**2.41.4.4.2** ECB completes the audit, completes the report form, reviews the report and forwards the information to the Section Chief of Ambient Monitoring within 15 workdays of conducting the audit.

**2.41.4.4.3** Within 10 workdays, the Section Chief of Ambient monitoring will review audit report and forward the AQ-121 audit forms to the PPB Supervisor.

**2.41.4.4.4** The PPB Supervisor will review the AQ 121 and indicate if the audit is acceptable or if corrective actions need to be taken by the regional or ECB office. Under extreme cases, data may need to be further questioned and invalidated if the site operational checks by the operator are found to be unacceptable. At the end of the quarter the PPB Supervisor will confirm that all the AQ 121 forms were received and entered into AQS.

**Table 3 DAQ and EPA Audit Accuracy Criteria**

Ozone Criteria

250 ppb Range					
EPA Audit Level		DAQ Acceptance ±		EPA Acceptance ±	
#	ppb	Audit Device	Monitor	Percent	ppb
0	0	± 2 ppb	≤ ± 3 ppb	NA	NA
4	40	≤ ± 2 ppb	≤ ± 3 ppb	15%	≤ ± 6 ppb
5	80	≤ ± 2 ppb	≤ ± 5.6 ppb	15%	≤ ± 12.0 ppb
7	120	≤ ± 2 ppb	≤ ± 8.4 ppb	15%	≤ ± 18.0 ppb
10	210	≤ ± 2 ppb	≤ ± 14.7 ppb	15%	≤ ± 31.5 ppb

SO2 Criteria

<b>500 ppb Range</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	Percent	Percent
0	0	2 ppb	NA
2	4	10%	15%
6	75	10%	15%
9	375	10%	15%

SO2 Trace Level Criteria (plus continuous Sulfate)

<b>100 ppb Range</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	ppb / Percent	ppb / Percent
0	0	2 ppb	NA
2	4	1.5 ppb or 15 %	1.5 ppb or 15 %
5	40	10%	15%
6	75	10%	15%

Carbon Monoxide Criteria

<b>5000 ppb Range</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	ppb / Percent	ppb / Percent
0	0	35 ppb	NA
3	190	10%	15%
4	1000	10%	15%
5	4000	10%	15%

Reactive Oxides of Nitrogen Criteria

<b>200 ppb Range</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	ppb / Percent	ppb / Percent
0	0	1 ppb	NA
2	4	10%	NA
5	22	10%	NA
7	160	10%	NA

Nitrogen Dioxide Criteria

<b>500 ppb Range (NO/NOx)</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	ppb / Percent	ppb / Percent
0	0	1 ppb	NA
6	60	10%	15%
7	175	10%	15%
8	425	10%	15%

<b>500 ppb Range (NO/O3)</b>			
EPA Audit Level		DAQ Acceptance ±	EPA Acceptance ±
#	ppb	ppb / Percent	ppb / Percent
0	0	1 ppb	NA
3	10/5	10%	15%
6	70/50	10%	15%
8	425/405	10%	15%

**2.41.4.4.5** Once the audit is accepted, the PPB Supervisor will forward the report to the P:\Ambient\PUB\RegOffices.NC\AQS\Manual Upload Files directory. The Statistician or DAS Manager will ensure the appropriate site identifiers and audit information are entered into the EPA AQS database.

**2.41.4.4.6** The PPB Supervisor will scan the documents, and file the hard copies in the file cabinet.

**2.41.4.4.7** The PPB Supervisor will e-mail the scanned forms to the people named on top of the forms and upload them to the general documents work module.

**2.41.4.5 Quarterly Calibration Review**

Quarterly, PPB personnel will obtain minute data from the DAS manager that brackets calibrations to ensure sufficient time is allocated to allow readings to stabilize. Results of the review are stored in the P:\Ambient\Incoming\RegOffices.NC directory.

**2.41.4.6 NCore Instrument Method Detection Limit (MDL)**

**2.41.4.6.1** NCore Instrument MDL audits CO-TLE, SO<sub>2</sub>-TLE and NO<sub>y</sub>-TLE Method Detection Limit (MDL) determinations for continuous trace level gaseous monitors are performed and reported (MDL spreadsheet) to Raleigh Central Office by ECB staff.

The NCore Instrument MDL is calculated as the standard deviation of the response values times the Student's *t*-distribution value for the number of test measurements (40 CFR Part 136, Appendix B) of the trace level monitors. MDL values are reported to the DAS Manager so that AQS can be updated with the new information.

EPA advocates the assessment of MDLs at NCore sites prior to monitoring and on an annual frequency. Refer to **Appendix 3 "Trace Level MDL Procedure"** for upload details.

#### **2.41.4.7 Precision Checks and Reporting**

One-point QC checks are performed for CO, NO<sub>y</sub> and NO<sub>2</sub> and reported to the Raleigh Central Office via the AQ98 form by the regional staff. 40 CFR 58 Appendix A requires a one-point check to be performed every 14 days or less.

**2.41.4.7.1** For the continuous monitors CO, NO<sub>y</sub> and NO<sub>2</sub>, the operators must not perform manual checks or calibrations between 6:00 AM and 9:00 AM "Local Standard Time". This is an important data collection period.

**2.41.4.7.2** The one-point QC Check analysis for ozone and sulfur dioxide continuous monitors is incorporated using the daily autocalibration check. For all ozone sites except for the mountain top monitoring sites the ozone precision point check occurs between 3 and 4 am each day. For the mountain top ozone monitoring sites the ozone precision point check occurs between 12 and 1 pm each day.

For each ozone and sulfur dioxide monitoring site, the site operator and Regional Ambient Monitoring Coordinator will review the Monthly Daily Calibration Check Report provided electronically by the Statistician for the regions within 10 days of the end of the month. This report must be reviewed for accuracy and detail any values in the Calibration Check Report that should be invalidated and any missing calibration check data. Any and all invalidated values and missing data must be supported by documentation and explanation. The reviewed Calibration Check Report must be submitted to the assigned Raleigh Central Office chemist for review by the end of the month.

**2.41.4.7.3** At the end of the quarter, the operator will complete a precision report form (AQ 98) for all pollutants except ozone and sulfur dioxide and forward the form to the Regional Ambient Monitoring Coordinator for further review and submittal to Raleigh Central Office. The operator must review the precision findings and take appropriate actions based on the Operator's section of this procedure. The Regional Ambient Monitoring Coordinator must submit the precision forms to the Raleigh Central Office within 10-15 working days after the end of the quarter. The PPB Supervisor follows up with the regions to ensure that the regions submit the precision data. The PPB supervisor reviews the forms and submits the forms to the P:\Ambient\Pub\RegOffices.NC\AQS\Manual Upload Files directory. The Statistician or DAS Manager uploads the data to AQS.

**2.41.4.7.4** The Raleigh Central Office chemist reviews the submitted Monthly Ozone and sulfur dioxide Calibration Check Reports and determines if provided documentation is complete to justify the invalidation of and/or missing Daily Calibration Check Data. The Raleigh Central Office chemist then submits the forms to the Statistician. .

**2.41.4.7.5** The Statistician will enter the Precision Point analysis results from the approved Monthly Ozone Calibration Check Report with the appropriate site identifiers into the EPA AQS Database. The DAS Manager will also load the appropriate site identifiers and audit information for the other pollutants into the EPA AQS database.

**2.41.4.7.6** During the annual systems audit the RCO Chemist will review the AQ-98 and AQ-99 forms to ensure that the data in the forms matches the data in the e-logs and will have the regions correct and resubmit any incorrect data.

**2.41.4.8 Determination of the Agency Pooled Precision and Accuracy**

After monitoring data are sent to AQS, AQS will calculate the agency pooled precision and accuracy using the % CVs at the 90 % and 95 % confidence intervals. The Chemist III will run these reports annually to enable the Section Chief to complete the required annual data certification.

Percent Difference - All measurement quality checks start with a comparison of an audit concentration or value (flow rate) to the concentration or value (flow rate) measured by the analyzer and use percent difference as the comparison statistic as described in equation 1 of this section. For each QC check, calculate the percent difference,  $d_i$ , as follows:

$$d_i = \frac{\text{meas} - \text{audit}}{\text{audit}} \times 100 \quad \text{Equation 1}$$

Where, "meas" is the concentration indicated by the monitoring organization's instrument and "audit" is the concentration of the standard used in the QC check being measured.

Precision Estimate - The precision estimate is used to assess the one-point QC checks for SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, or CO. The precision estimator is the coefficient of variation upper bound and is calculated using:

Where:

$$CV = \sqrt{\frac{n \sum_{i=1}^n d_i^2 - \left(\sum_{i=1}^n d_i\right)^2}{n(n-1)}} * \sqrt{\frac{n-1}{X_{0.1,n-1}^2}} \quad \text{Equation 2}$$

where,  $X_{0.1,n-1}^2$  is the 10<sup>th</sup> percentage point of a chi-squared distribution with  $n-1$  degrees of freedom [this number can be looked up in Excel using CHIINV(0.10, $n-1$ )].

**2.41.4.9 Interagency Auditing**

The State of North Carolina will participate in the EPA National Performance Evaluation Programs (NPAP) when possible as required by 40 CFR 58.A.2.4. Monitoring plans or the QAPP shall provide for the implementation of a program of independent and adequate audits of all monitors providing data for SLAMS and PSD including the provision of adequate resources

for such audit programs. A monitoring plan (or QAPP) which provides for monitoring organization participation in EPA's National Performance Audit Program (NPAP) program and which indicates the consent of the monitoring organization for EPA to apply an appropriate portion of the grant funds, which EPA would otherwise award to the monitoring organization for monitoring activities, will be deemed by EPA to meet this requirement. For clarification and to participate, monitoring organizations should contact either the appropriate EPA Regional Quality Assurance (QA) Coordinator at the appropriate EPA Regional Office location, or the NPAP Coordinator at the Air Quality Assessment Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency in Research Triangle Park, North Carolina.

**2.41.4.9.1** The Section Chief or PPB Supervisor will coordinate EPA audits. An evaluation will be made of the results and corrective action taken as necessary. The PPB Supervisor shall initiate any corrective actions and will send results to the regional offices.

#### **2.41.4.10 Systems Auditing**

A systems audit (qualitative appraisal of the total measurement system) should be conducted once per year. The State Agency Raleigh Central Office will evaluate the monitoring activities of each local agency and the state's operations using current state developed forms. Procedures will be checked for methods and equipment; installation of equipment; calibration; zero/span checks; operational checks, frequency of checks; control limits for zero, span, and other checks; maintenance, quality control for episodes; data validation and recording; and quality control documentation. For the annual audit, EPA will then review the findings of the State Agency.

#### **2.41.4.11 Data Certification**

Two levels of reporting are necessary:

- 1) Quarterly reports to the Ambient Monitoring Section Chief defining the status and results of the QA Program: for ozone, carbon monoxide, sulfur dioxide, oxides of nitrogen, and nitrogen dioxide (AMP350 raw data, AMP251 quality assurance data and AMP430 completeness report).
- 2) Annual report certifying the quality of the data to EPA (cover letter, quick look report, and AMP600 report),

**2.41.4.11.1** The Chemist III shall submit to the Section Chief the quality assurance reports AMP350 (raw data listing), AMP251 (QA data listing), AMP256 (QA Data Quality Indicator Report), and the AMP430 completeness report after all quarterly data and QA records have been entered into AQS for ozone, sulfur dioxide, carbon monoxide, reactive oxides of nitrogen, nitrogen dioxide, and continuous particle data.

**2.41.4.11.2** The Section Chief reviews these reports to verify that the data, precision, accuracy and completeness of all raw data requirements have been met for the quarter.

**2.41.4.11.3** When the data are correct, the Chief will prepare the quarterly data submittal letter to send to the EPA Region 4 Office.

**2.41.4.11.4** The Chief, as delegated by the Director, will sign the letter certifying the air quality data for that reporting quarter -including the date on which AQS data entry was fully completed.

**2.41.4.11.5** The Chief must submit the quarterly data and data assessments (for SLAMS and SPM monitors) within 90 days after the end of the quarter being reported. If a monitor will fail to meet the 75 percent completeness requirement for the quarter, the Chief should report this to EPA within 45 days after the end of the quarter.

**2.41.4.11.6** Other reports such as results of systems audits, identification of any problems or problem areas, corrective action plans, discussions of internal or interagency quality assurance tests, or the suitability of data for an intended purpose are submitted to the Section Chief as requested.

**2.41.4.11.7** Data certification by the Section Chief is due to EPA annually as specified in 40 CFR 58.15 (due dates may vary by monitor).

### Figure 1 SO2 Exceedance Report

North Carolina SO2 Exceedance Report



Biweekly Report for:	
June 6, 2011	June 19, 2011

**Comments**

On June 2, 2010, the US EPA strengthened the primary National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO2). The revised SO2 standard includes a new "form." While the old form included 24-hour and annual standards, they have been replaced by a 1-hour standard. Specifically, the new form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. An average greater than 75.5 parts per billion (ppb) violates the NAAQS.

EPA also revised the ambient air monitoring requirements for SO2. In addition to the existing sites, North Carolina will be required to operate five new sites by January 1, 2013. The new sites are expected to be located in Asheville, Charlotte-Gastonia-Concord, Durham-Chapel Hill, Greensboro-High Point, and Hickory.

Table 1 shows current operating monitors and any exceedances of the SO2 standard during the past two weeks.

Table 2 provides cumulative statistics for any monitors operated during the past three years, and an indication of whether they violated the standard. EPA anticipates designating areas based on 2009-2011 monitoring data. The 2008-2010 statistics are provided for historical perspective; the 2009-2011 statistics are projections based on data acquired to date. This report will be published every other Monday by DAQ's Tahmina Islam. If you have questions, please contact Donnie Redmond at 919-733-1487 or donnie.redmond@ncdenr.gov.

**Table 1. List of exceedances in this period (unvalidated data)**

Site Name	County	AQS ID	Valid days sampled	Date	Hour	Conc. (ppb)
Bayview	Beaufort	370130151	14	none		
New Hanover	New Hanover	371290006	14	none		
Bethany	Rockingham	371570099	14	none		
Millbrook	Wake	371830014	14	none		
Pittsboro	Chatham	370370004	14	none		
Hattie Ave.	Forsyth	370670022	14	none		
Garinger	Mecklenburg	371190041	14	none		

**Disclaimers**

These data are not quality assured. These are preliminary readings which are subject to change. DAQ does not certify these data as accurate, complete, or usable. DAQ discourages the use of preliminary data for any purpose and will take no responsibility for their use.

**Table 2. 99<sup>th</sup> Percentile Statistics and NAAQS Violation Status. Percentages >100 indicate violation of the NAAQS.**

Site Name	County	AQS ID	Valid days	99 <sup>th</sup> percentile concentration (ppb)					Percent of NAAQS (75 ppb)	
				YTD 2011	YTD 2011	CY 2010	CY 2009	CY 2008	2009-2011 projected*	2008-2010
Bayview	Beaufort	370130151	142	30.0	A	A	A	NA	NA	NA
Aurora	Beaufort	370130007		A	28.0	27.0	39.0	NA	NA	41%
Jamesville	Martin	371170001		A	6.0	A	A	NA	NA	NA
New Hanover	New Hanover	371290006	169	49.9	114.0	99.0	117.0	116%	NA	147%
Bethany	Rockingham	371570099	161	17.5	A	A	A	NA	NA	NA
Millbrook	Wake	371830014	170	12.0	12.4	15.0	15.0	17%	NA	19%
Pittsboro	Chatham	370370004	169	17.8	A	A	22.0	NA	NA	NA
Golfview	Cumberland	370511003		A	A	10.0	A	NA	NA	NA
Hattie Ave.	Forsyth	370670022	167	9.3	15.0	18.0	27.0	19%	NA	27%
Garinger	Mecklenburg	371190041	159	9.9	19.8	26.1	73.3	24%	NA	52%

**Notes**

\*Violation Level percentages for 2011 are provisional and have a margin of error up to 0.22 x Projected Percent

- A. No SO2 monitor was operated.
- B. Sample size is too small to meet statistical standards for reliability.
- M. Unable to acquire data for this report.
- NA. A valid datum or estimate is not available.
- Z. Reported sample concentration is within the margin of error for a "zero" measurement ("method detection limit").

## Appendix 1 Monthly Format Report

### 1. Create Text Format Monthly Reports

Statistician stores text files to be made into QA Worksheets in subfolders of file P:\Ambient\PUB\RegOffices.NCMonthly Rpts. The subfolders usually contain "Monthly Reports" or "Monthly Rpts" as part of the folder name. Create Excel spreadsheets suitable for mark-up by reviewers (this original raw data workbook is unedited and write protected).

2. Copy Excel files to network drive for reviewer access (spreadsheets for data review by the regional chemist and staff are stored in subfolders of file: //P:\Ambient\PUB\RegOffices.NC). E-mail message to the regional chemist(s) to request review of the monthly data. Send email to Statistician when done. Statistician will subsequently notify the RCO chemist(s).

3. E-mail message to the RCO chemist (s) to request review of the monthly data.

1. Open workbook 2 and save as workbook 3 and write protect (see below)
2. Make changes, highlight changes
3. Include any notes and initials/date of review below data in the spread sheet
4. Send e-mail to Statistician when done.
5. All workbook files are converted to txt. files and uploaded to AQS.

**To Write Protect:** Right click on workbook file. Select "properties". Click on "Attributes/Read only" and then click "Apply", then "OK".

## Appendix 2 Supplemental Data Reports

### Continuous Non-Speciated Particulate (PM) Monitors

On a daily basis, the Project and Procedures Branch (PPB) personnel review a summary of the hourly average data generated by all continuous PM monitors (TEOMs and BAMs) from the previous day. On a monitor by monitor basis all hourly average data points that are deemed to be suspect are noted by date and hour and summarized weekly. This weekly summary is submitted electronically to the Statistician. The Statistician then removes these data points from a data base and may generate if necessary a weekly summary report that presents the 24 hour averages (daily average) by monitor for the previous 7-day period. This summary report when generated is typically distributed internally within DAQ, to the USEPA and to local air monitoring agencies. All data presented in either of these data reports are not quality assured and are subject to a future data validation process.

### Sulfur Dioxide (SO<sub>2</sub>) Monitors

On a daily basis, the Project and Procedures Branch (PPB) personnel review a summary of the hourly average data generated by all continuous SO<sub>2</sub> monitors from the previous day. On a monitor by monitor basis all hourly average data points for a given day that are deemed to be suspect are noted by date and hour. When eighteen or more valid hourly averages for a given day are available, the maximum hourly average concentration observed (in parts per billion) for that day for that monitor is recorded in a spread sheet. Also recorded are any observed exceedances of the NAAQS (any hourly concentration of 75 ppb or greater) on a day by day basis. On a as needed basis, the Statistician may generate a summary report (see **Figure 1**, pg. 22) that provides the year to date observed 99<sup>th</sup> percentile SO<sub>2</sub> concentration and any observed exceedances by monitor. This summary report is typically distributed internally within DAQ, to the USEPA and to local air monitoring agencies.

### Ozone (O<sub>3</sub>) Monitors

#### Daily Ozone Site Reports

The PPB personnel review the Statistician provided Daily Hourly Ozone Monitor Report for each ozone monitoring site. This report is available each day for the previous monitoring day from all operating ozone sites. This essential site performance quality assurance document is obtained and reported by the Statistician each morning. The report contains the following critical information.

1. The Site Name and AQS site number
2. The Reporting Date and the Date of the Concentration Data being Reported
3. The Site Primary Data Logger two letter Code.
4. The pollutant being reported which in this case is Ozone
5. The hourly truncated average concentration in parts per billion.
6. The hourly average monitoring shelter temperature.
7. The Maximum, Minimum, and Mean hourly average ozone concentration and monitoring shelter temperature for the reporting day.
8. The appropriate data flags (if known) for missing hourly ozone concentration data.
9. The Daily Ozone Monitor Auto-Calibration and Precision Point Analysis Report titled Calibration Report
  - a. The Calibration Report includes the Phase Concentration Averages for the Zero Phase, Level 4 Phase and the Level 2 Phase (Precision Point).
  - b. The reported phase average concentrations are for both the site specific O<sub>3</sub> (site ozone monitor) and CPS Site Primary Ozone Standard
  - c. Calibration Value which is the reported concentrations from both the CPS and O<sub>3</sub>. The O<sub>3</sub> values are compared to the CPS Values during the site performance evaluation.

- d. The Expected Value which is the theoretical value for the on site Primary Ozone standard. The CPS values are compared to the Expected Values during the site performance evaluation.
- e. The Drift which is the percent difference between the Expected Value and the CPS values reported and the Expected Value and the O3 Value.

Note: The more detailed explanation of the Acceptance Criteria for the evaluation of the Daily Ozone Auto-Calibration and Precision Point Analysis is provided in **Table 2** (pg 6).

Following the PPB evaluation of the Daily Hourly Ozone Monitor Report the Regional Office Ambient Monitoring Coordinators and DAS Manager are notified of any identified ozone monitoring site performance issues. The daily ozone monitoring site hourly concentration data that meet data acceptance criteria is then used to calculate the Maximum Daily 8-Hour Average Ozone Concentration by Statistician for comparison to the National Ambient Air Quality Primary Ozone Standard. If the site specific reported Maximum Daily 8-hour Ozone Concentration is greater than the Primary Ozone Standard it is classified as an exceedance.

#### Daily Ozone Network Auto-Calibration Precision Point Analysis Reports

Statistician provides a Consolidated Daily Auto-Calibration and Precision Point Analysis report for all ozone monitoring sites to PPB and the regional offices. This report consolidates the results from all ozone monitoring sites of the Daily Auto-Calibration and Precision Point Analysis results reported on the Daily Ozone Site Reports. This daily auto-cal report site auto-calibration results to the Data Acceptance Criteria and determines if these results Pass or Fail to meet those data acceptance detailed in **Table 2** (pg 6). Also, this daily network report evaluates the reported hourly average temperature from each monitoring site to the EPA monitoring shelter temperature requirement.

#### Weekly Ozone Network Report

DAS Manager produces a Weekly Ozone Report for widespread distribution within DAQ and externally to ozone researchers, environmental groups, regional organizations, the EPA, and local air pollution monitoring programs in North Carolina. The data presented in this report is considered to be preliminary and not a certified data report because a full in depth ozone monitoring instrumentation systems, support equipment, data reporting, independent site specific performance audits, and all supportive documentation for all site and lab activities has not yet been performed. This weekly summary ozone report is produced following the review and verification by PPB of the daily ozone reports from all monitoring sites reporting ozone concentration data. This report in some cases does include consideration for independent ozone monitor performance evaluations performed by the Electronics and Calibration Branch of the Ambient Monitoring Section and/or the EPA as that data becomes available.

This valuable 3 part report is normally issued in the first part of the week immediately following the week in which the ozone data was reported and details the following;

1. The week that the report represents.
2. The number of Maximum Daily 8-Hr Ozone Concentration Averages that are Greater than the Primary Ozone Standard for the week being reported.
3. The Highest Daily Maximum 8-Hour Average Ozone Concentration reported for that week and the ozone monitoring site reporting this maximum value.
4. The Year-To-Date (April 1<sup>st</sup> through the week of the data being reported)
  - a. Total Number of Maximum Daily 8-Hour Ozone Averages greater than the Primary Ozone Standard
  - b. Total Number of Days reporting a Maximum Daily 8-Hour Average Ozone Concentration Greater than the Primary Ozone Standard.
5. The monitoring site names, the county or local program where the monitoring site is located, and the site specific AQS number.
6. The Daily Maximum 8-Hour Average ozone concentration reported for each day in the reporting period at each ozone site.
7. The number of reported Daily Maximum 8-Hour averages that exceed the Primary Ozone Standard by the Reporting Date.
8. The Weekly Maximum 8-Hour Maximum Daily Average Ozone Concentration reported from each site.
9. An additional Data Table details the Site Name, site specific County or Local Program where the site is located, site specific AIRS number, and the Maximum Daily 8-Hour Average concentrations than exceed the Primary Ozone Standard.
10. An additional site specific data summary presents the following:
  - a. Maximum 8-Hour Average for the reporting period.
  - b. The 4<sup>th</sup> highest maximum 8-Hour Average concentration reported Year-To-Date.
  - c. The count of Maximum Daily 8-Hour Average Concentrations greater than the Primary Ozone Standard for the weekly reporting period.
  - d. The running 3 Year Average of the 4<sup>th</sup> Highest Maximum Daily 8-Hour Average for each site is updated with each weekly report generated by DMSSB. This weekly update of the 3 year average is calculated using the 4<sup>th</sup> highest Maximum Daily 8-Hour Average ozone concentration from the two immediately prior years and the 4<sup>th</sup> Highest Maximum Daily 8-Hour average ozone concentration for the current year through the reporting period included in this weekly period.
  - e. This report includes a count of the number of sites where the 3 year average of the 4<sup>th</sup> Highest Daily maximum 8-hr average is greater than the Primary Ozone Standard.

- f. The Year-To-Date count of reported Maximum Daily 8-Hour Average ozone concentrations greater than the Primary Ozone Standard from each site and the total count across the state.

### Appendix 3 Trace Level MDL Procedure

1. Copy MDL Test spreadsheet files received to C:\wlc\QASOP\  
2. Edit records into "C:\wlc\QASOP\AltMDLspecs.xls". This file is referred to as the "worksheet" in the notes below. The MDL Test spreadsheet is referred to as the "MDL Test spreadsheet".  
3. This is a list of the worksheet columns (field names) and how the cells are populated.
  - . **Logger** [populate with either a 2-letter site ID code or if it's not at a site, the name of the ECB tester]
  - . **Site** [name of the test location]
  - . **Serial Nr.** [found in a block near the top of the MDL Test spreadsheet; for some reason the MDL Test spreadsheets use two merged cells and center this datum across them]
  - . **Pollutant** [from CO, SO<sub>2</sub>, NO, NO<sub>2</sub>, NO<sub>x</sub>]
  - . **State** [FIPS code of site where the monitor resides]
  - . **County** [FIPS code of site where the monitor resides]
  - . **Site** [AQS CODE code of site where the monitor resides]
  - . **Monitor** [AQS CODE of the parameter recorded on this line]
  - . **POC** [AQS CODE]
  - . **Method** [AQS CODE]
  - . **Unit** [AQS CODE]
  - . **Date effective** (test date copied from MDL Test spreadsheet. Use the second date on row 3, reasoning that the new MDL cannot apply until the test it comes from is completed.)
  - . **Date ended** (the logical way to handle it is to use the day immediately before the Date Effective of next year's MDL test on that same instrument.)
  - . **Alt MDL** (result copied from MDL Test spreadsheet, 43c:(SO<sub>2</sub>T)G44; NOT: (NOT)F48,(NO<sub>2</sub>T)F75,(NO<sub>y</sub>T)F93; 48i:(COT)F44. In the MDL Test spreadsheet it is a cell with a formula, so to transfer it requires "Paste-Special, paste as values" or one of these hot-key sequences, "Alt-E S V" or "Alt-H V V"
  - . **Fed MDL** [AQS DEFAULT values.]
4. There are a few "reference" rows at the beginning of the worksheet. Their information can be copied into data rows so that you don't have to look the information up in AQS or

another external source. This information can be updated on an ad hoc basis whenever it is expedient to do so.

5. Format data values as fixed numbers with 4 decimal places, to align them for easiest reading, as well as being the most you can load in AQS.
6. MDL values need to be conveyed to the DAS Manager so they can be incorporated into AQS Raw Data transaction records, which is a manual editing process using AirVision.

## **Appendix 4 TEOM Download Procedure**

### **Downloading Raw Data**

The PC (or lap top) that is used to download data must have the R&P RPCOMM software **version 1.41** loaded on the hard drive to communicate with the TEOM unit. The RPCOMM software should be installed to create RPCOMM directories. The RPCOMM software files are copied from the "Master" cd to the RPCOMM directory on the C drive. Create an independent folder for PM2.5 downloads called RPCOMM25.

### **Field Computer Set-Up**

The RPCOMM program must be setup to match the TEOM RS232 parameters. If the PC is off turn it on. After the PC is finished booting up go to the directory to match the TEOM unit you are going to access. To execute the program type in RPCOMM after the C:\RPCOMM prompt and the program should execute to the RPCOMM software main screen.

The settings for RP comm. are:

**Baud to = 9600**

**Parity to = none**

**Data to = 8 bits**

**Stop to = 1 bit**

**Hardware handshake to = none**

**Flow control to = none**

**Connection to = direct**

**COM port to = the COM port that the serial cable is connected to (usually COM1).**

**COM settings to = the same as the COM port settings in the 'control panel' ports listing found in windows.**

**Telephone number to = 0**

**Modem to = There is no entry here.**

To download the data, the TEOM control unit must be set on the appropriate RS-232 mode.

Display the mode by pressing the <RS232> key. Select the correct RS232 mode:

<**AK protocol**> (as opposed to <None> <Print on line> <German protocol> <Store to print>)

Connect the 9-pin to 9-pin serial cable to the RS 232 serial port located on the front panel of the TEOM control unit. Connect the other end to the PC's serial port. The PC can now be turned on

to boot it up. When the PC is finished booting up go to the DOS prompt or C:\ drive. Change the directory to match the TEOM unit you are going to download. Care must be taken not to download any data into the wrong RPCOMM directory. If data is downloaded into the wrong RPCOMM directory, the file can be copied into the correct directory. Make sure to delete the file that is in the wrong directory. To execute the program type in RPCOMM and the program should execute to the RPCOMM main screen.

The stored data is downloaded by moving the main screen command line to the “download storage” line and pressing the enter key. A text line appears that requests the number of records to download with a (A=All) at the end. Press the enter key and this allows all records to be downloaded starting at the end point of the last download. A text line requesting a file name appears. Enter the TEOM ID and the date of the download as the file name in the following form: 25DA071511 (for PM2.5 data from Durham Armory downloaded on 07/ 15/ 11). Press the enter key to start the download. All records since the last download are then downloaded and confirmed at the end of the download. This file will be saved in the RPCOMM directory that is used to download the file. Again, use the correct RPCOMM directory to match the TEOM unit. This insures the TEOM data is stored in the correct RPCOMM directory and TEOM databases are not mixed.

The TEOM allows for up to eight (8) parameters to be selected for downloading. To view the current list, go to the TEOM <Set Storage Screen> (see Section 6.5 of the R&P manual, if available). To add/delete/change a parameter, refer to Appendix A of the R&P manual to select the specific parameter and enter the corresponding three (3) digit “Program Register Code”.

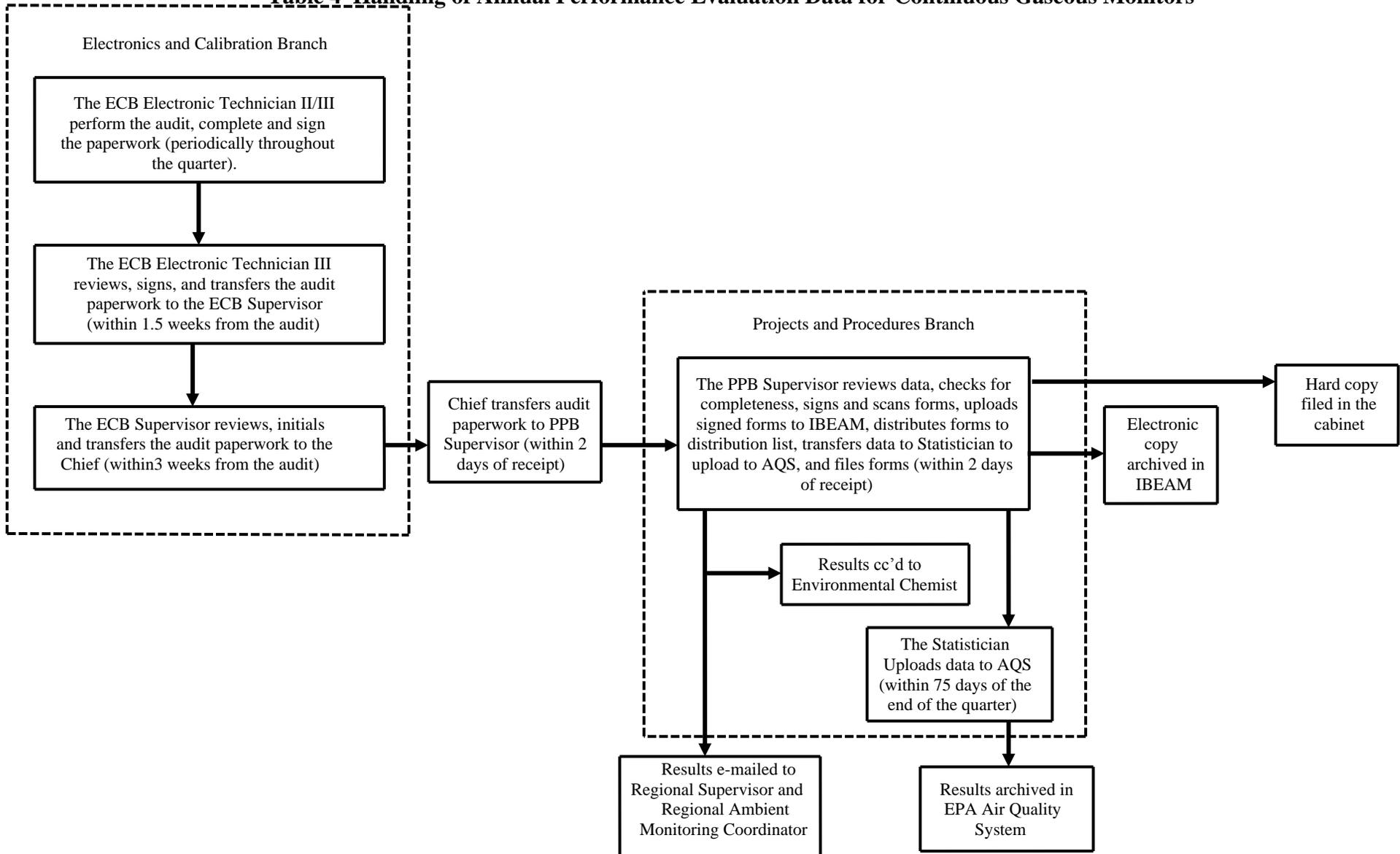
Data parameters that are currently selected for download include the following:

<b><u>Parameter</u></b>	<b><u>Program Register Code</u></b>
• Raw data	008
• 30 minute data	057
• 1-hour data	058
• Filter Loading	035
• Total Mass	009
• Main Flow	039
• Aux Flow	040
• Sample Air Temperature (below the filter, 50° C)	026

Move the command line to the “exit program” line and press enter to exit. The program will close and the PC returned to the main screen. Any subsequent data download requires that only the RPCOMM program to be opened. The setup for the RS232 communications is saved in the program and does not need to be re-entered. Remove the 9 to 9 pin serial cable from the PC and the control unit. A good practice would be to verify that the download was completed by opening the saved file to see that the data does reside on the computer. The PC can now be turned off.

The site can also be accessed using the AirVision data logger software. The site data logger records main flow (25M), hourly average concentration (25C in ug/m<sup>3</sup>), filter loading (25F, % full), “FRM Like” hourly average concentrations (FRM1HR) and twenty-four hour running average concentrations (FRM24). The site data logger should be checked remotely on a daily basis to verify the TEOM monitor operational status and that the data collection is valid and there are no problems with the site operations. This is of particular importance during “high particulate” periods, when the filter loading should be checked daily.

**Table 4 Handling of Annual Performance Evaluation Data for Continuous Gaseous Monitors**



**Table 5 Handling of 1-Point Quality Assurance Data for Carbon Monoxide, Nitrogen Dioxide and Reactive Oxide of Nitrogen**

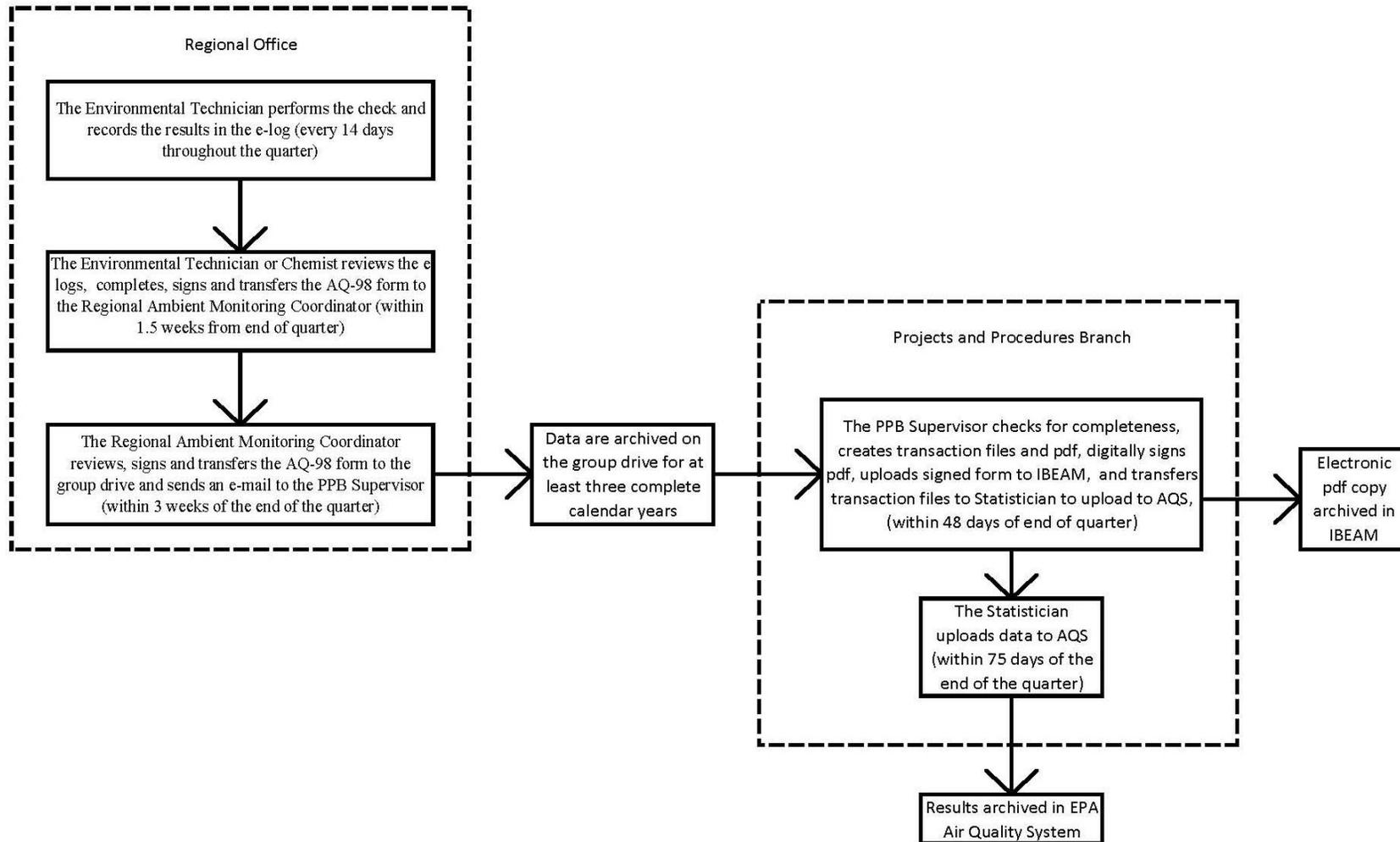
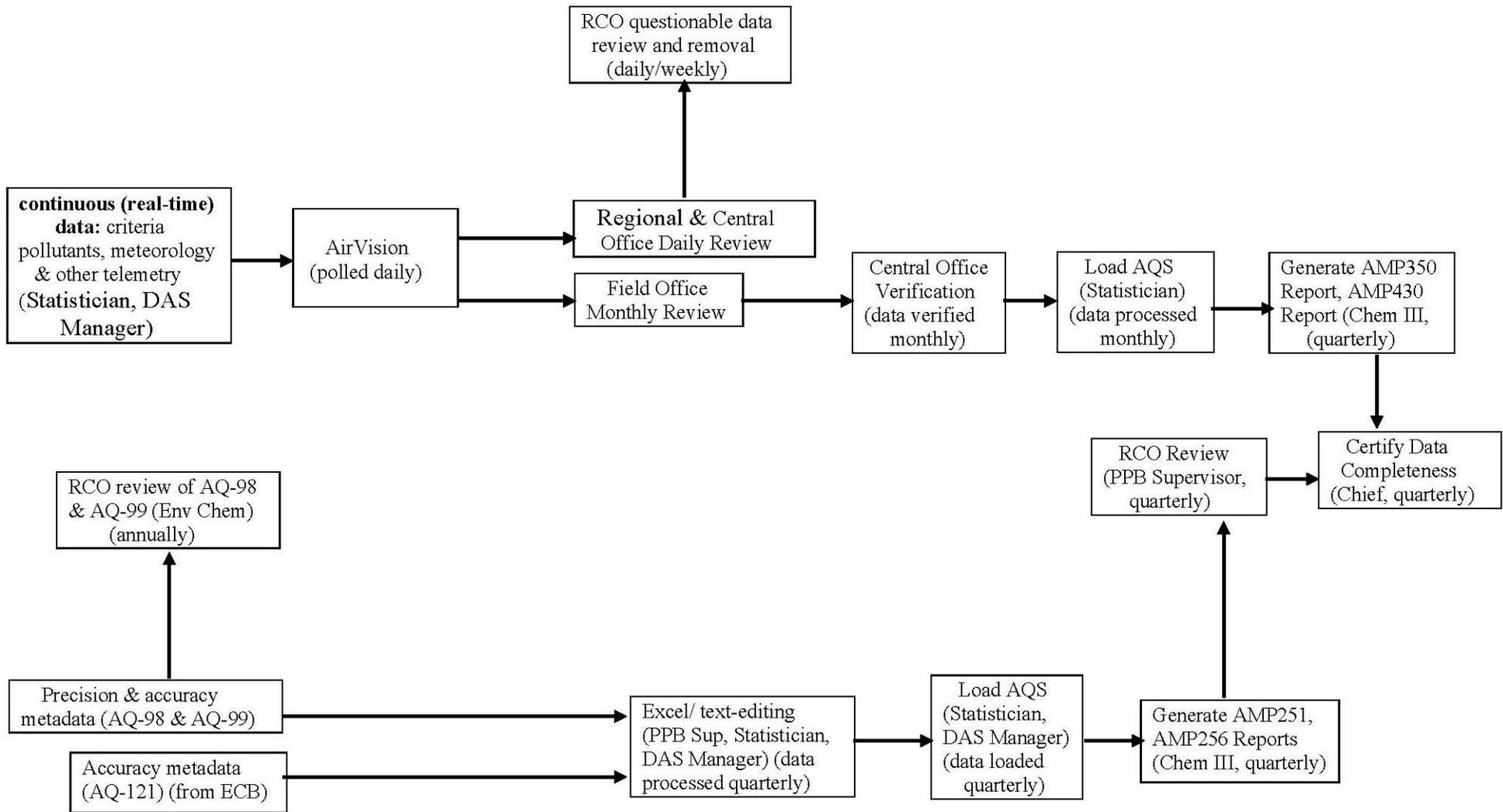
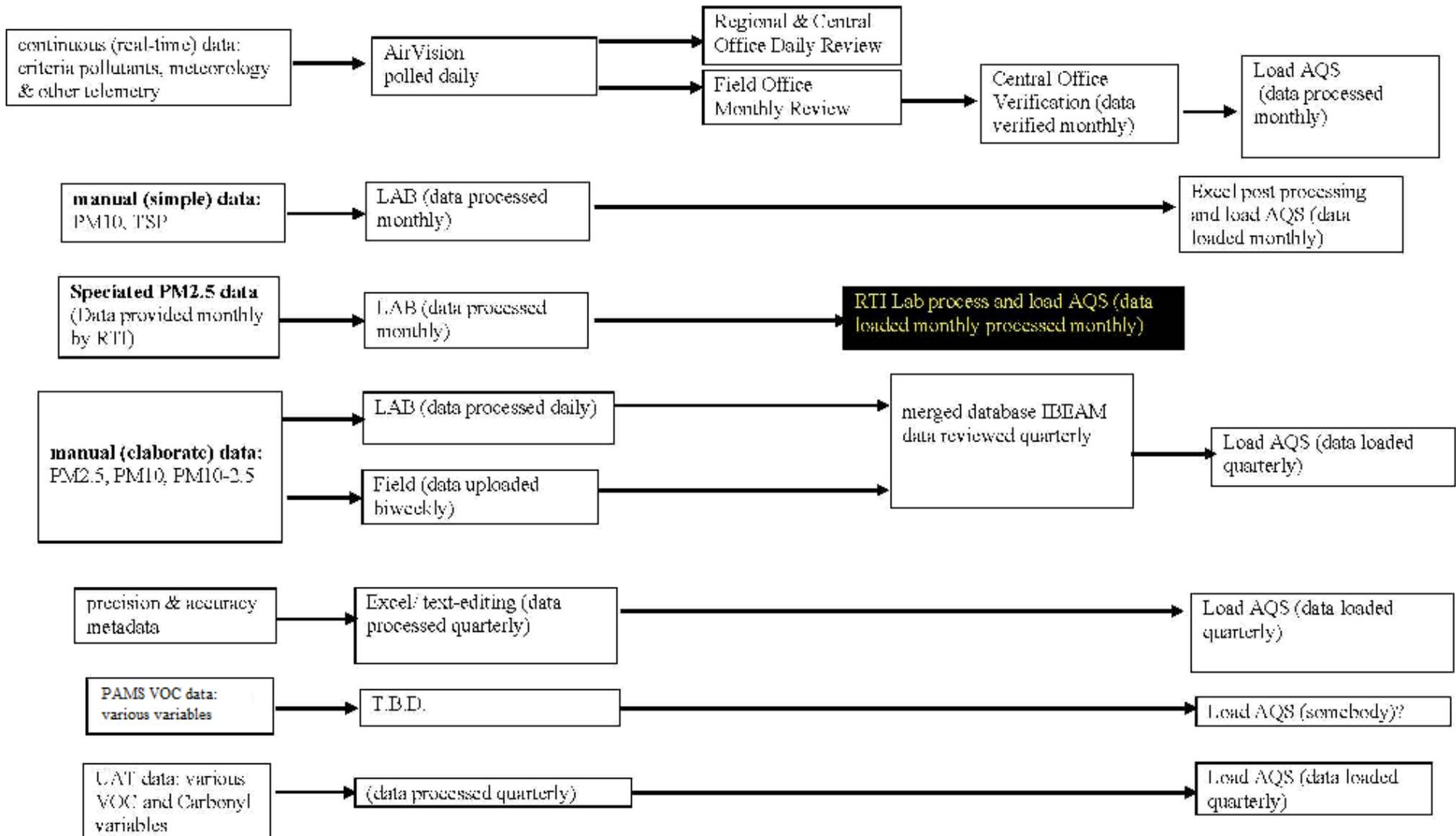


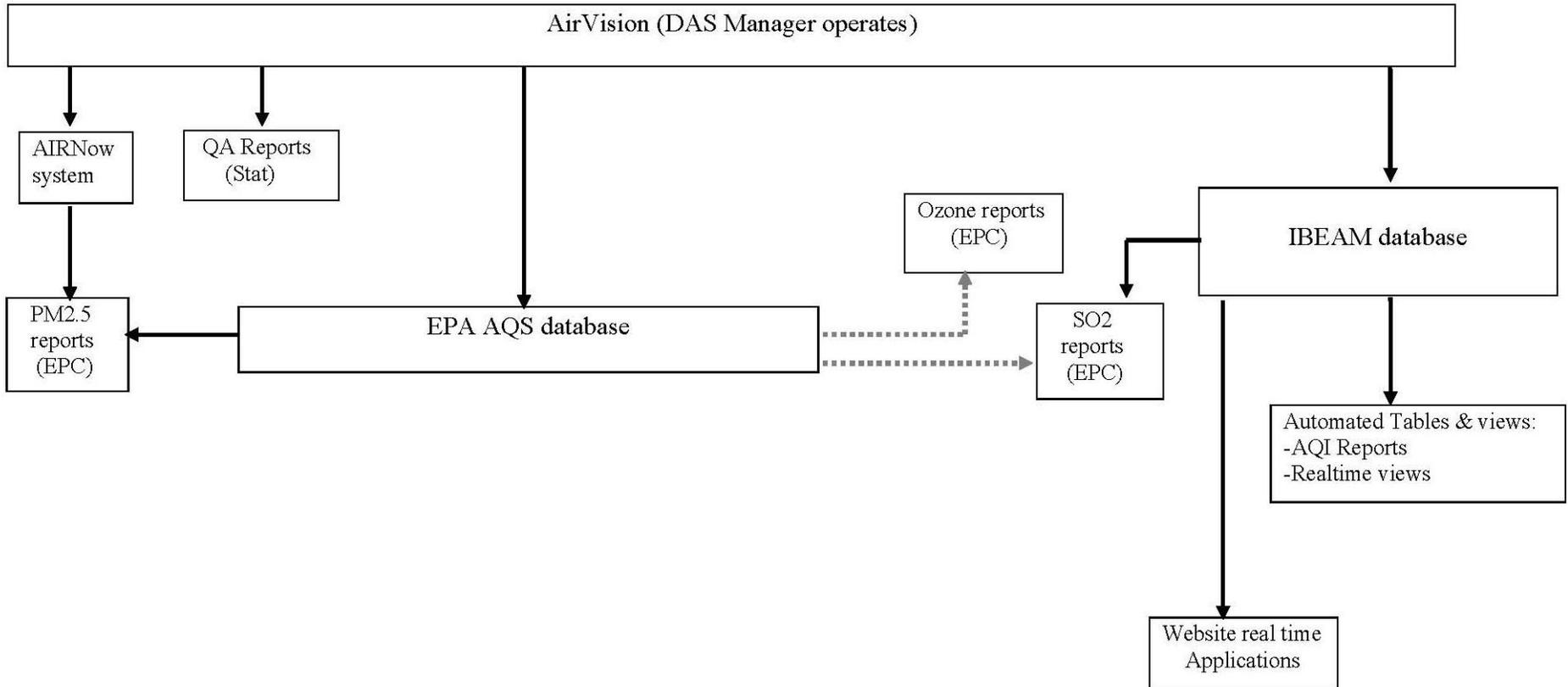
Figure 2 RCO Data Handling Procedures



**Figure 3 Data Management Processes and Products**



**Figure 4 Data Management Processes and Products**



## Sign-Off Sheet

I certify that I have read and approve of the contents of this revision of the "Data Review & Validation QA Plan for Continuous Gaseous & Non-Speciated Particulate Monitors QA Plan, Section IV, Raleigh Central Office (RCO) Responsibilities" with an effective date of October 15, 2014. **Sign, date and return to the Ambient Monitoring Section Chief.**

RCO Staff: Jim Mich 10/22/14

RCO Staff: Ernie Poling 10-22-14

RCO Staff: Cory A. Wheeler 10-22-14

RCO Staff: [Signature] 10/22/14

RCO Staff: John Holland 10/22/14