

# **Particulate Matter 2.5 QA Plan (2.24)**

## **Section IV**

### **HEADQUARTERS**

### **Responsibilities**

ATTACHMENT 12

PM 2.5  
Attachment 12  
October 1, 2001

PM 2.5 - AQ99

Region	Pollutant ID	Method Code	Cal Device #	State & Report. Org.	Year	QTR	(CIRCLE)	UNIT	CODES
FRO	PM2.5	118	1035	37001	2001	2	original X revision deletion	ug/m3	01
	19-20	21-23						ppm	07
								ug/ml	64
								CFM	72
								l/min	73
								m3/min	83
								ug	77

TECHNICIAN U. R. Him

1-5 67 8 9

Date Submitted 6/5/01

Blue color filled in by Region

25-28 31-32

AIRS Site Code	Monitor #	POC #	Temp	Press	DATE		Unit	CFM		
					Month	Day		Code	Sampler	Standard
370510009	601		31.9	759	5	11	73	16.7	16.68	0.1
370510009	602		20.8	758	5	15	73	16.69	16.51	1.1
371230001	603		24.5	753	5	2	73	16.66	16.83	-1.0
371550005	605		27.9	766	5	8	73	16.71	16.58	0.8
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!
							73			#DIV/0!

AIRS Character #

48-54 55-61

24 = A 29 = 2 30 = P 33 = ? 34-47 = N/A

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## **1.0 Background / Overview**

This overview contains a brief Particulate Matter history, the sampler description, and the operator's and lab technician's duties to familiarize the Quality Assurance (QA) Chemist and the Data Technician with the equipment, the operators QA procedures, and the Lab technician's QA procedures. These procedures explain the limits and QA/QC conditions to insure the collection of good data.

Particulate matter originates from a variety of sources. The chemical and physical composition of these various particles vary widely. While individual particles can not be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes. EPA's initial attempt at regulating particles was called Total Suspended Particulate (TSP). That is all particles that are present in ambient air, up to 100 micrometers ( $\mu\text{m}$ ). By 1987, research had shown that the particles of greatest health concern were those equal to or less than 10  $\mu\text{m}$  (PM 10). Today, further research has determined that fine particles are a health concern as particles this small can penetrate the sensitive regions of the respiratory tract. Those particles that are less than 2.5  $\mu\text{m}$  are known as fine particles. Fine particles were regulated by the EPA in July 1997. Particles greater than 2.5  $\mu\text{m}$  and less than 10  $\mu\text{m}$  are known today as coarse particles.

Fine particles can be formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds (VOC). Other sources include power plants, diesel trucks, wood stoves, and industrial processes. The North Carolina PM 2.5 program goal is the measurement of the concentration of particles less than 2.5  $\mu\text{m}$  aerodynamic diameter in units of micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). These particles are collected on 47mm (46.2 mm) polytetrafluoroethylene (PTFE) filters. These concentrations are then compared to the National Ambient Air Quality Standard (NAAQS) thresholds of **65**  $\mu\text{g}/\text{m}^3$  for 24 hours and **15**  $\mu\text{g}/\text{m}^3$  annual arithmetic mean concentration.

The State and the Local Programs received Rupprecht & Patashnick Partisol-Plus Model 2025 PM 2.5 Sequential Samplers, some spare parts, and required equipment through an EPA 103 Grant process during 1998, 1999, and 2000.

If you notice errors or omissions to this SOP, please call / e-mail Pat Bello immediately at (919) 715-6276 or [Pat.Bello@ncmail.net](mailto:Pat.Bello@ncmail.net).

**1.1 Samplers** Use of the most recent EPA Reference or Equivalent method list should be reviewed to determine models of monitors acceptable for network monitoring. If possible, the identical sampler (R & P Partisol-Plus Model 2025 PM 2.5 Sequential Samplers ) should be purchased. Each monitor used in the NAMS/SLAMS system will be a reference method (Appendix C of 40CFR53 and 40CFR58). The Partisol-Plus Model 2025 Sequential Air Sampler is designed to meet the regulatory monitoring requirements for PM 2.5 (40 CFR Part 50 Appendix L). A filter storage and exchange system permits the operation of the device for the four days (96 hrs.) between required site visits. Internal data storage and output features allow data and information to be averaged and stored. Built-in sensors of ambient conditions include temperature, atmospheric pressure, and relative humidity. The Partisol-Plus Sampler provides flexibility in the definition of sampling programs, but only the **EPA basic program, 24-hour midnight-to-midnight** implementation, will be used for the network. The sampler includes the logging of information by exposed filter (filter data), 30 minute period(input data), and by 5-minute period (interval data).

The following is a listing of some of the features contained in the Partisol-Plus Sampler that may be useful for the QA Chemist in performance of QA duties:

- An active volumetric flow control system maintains a constant volumetric flow rate at the level specified by the user (default of **16.7 l/min**) by incorporating a mass flow controller, and ambient temperature and pressure sensors. Sampled volumes will be reported in volumetric terms.
- The sampler uses standard 47 mm filters housed in reusable cassettes.
  - The temperature of the collection filter should be maintained not more than + 5 °C of the outdoor ambient temperature by a filter compartment ventilation system.

- A record of filter data is stored for each filter used in the device, and includes all U.S. EPA-specified values such as error condition flagging, and average temperatures and pressures. Filter data records also include sampled volume in volumetric terms, and analog input data averaged over the collection period. The sampler has a capacity of 50 filter data records.

- Interval data are stored every five minutes, and include the five-minute averages of the filter temperature, ambient temperature, ambient pressure, and average flow rate. Data storage continues both during and after the exposure of the collection filter. The sampler has a capacity of 16 days of five-minute interval data.

- The sampler stores records of input data every 30 minutes by default. The sampler has a capacity of 32 days of input data records stored every 30 minutes.

**NOTE:** INPUT AND INTERVAL DATA MAY BE OF USE WHEN TROUBLESHOOTING DATA. (These records are maintained at the regions.)

- Automatic calibration of analog input and output channels.

- A bi directional RS232 interface for data transfer to or from a PC or Palmtop allows interval, filter, and input data to be retrieved.

## **1.2 Normal Operations**

**1.2.1 Region/Local Field Responsibilities** There are three (3) different sampling schedules; one, three, and six days. There are six every day samplers (three locals, three state). Samplers using the three-day schedule will comprise the majority of the samplers. At least nine (6 state + 3 local) samplers will be designated as collocated precision samplers and run with a primary site sampler. The collocated sampler will run on the EPA six day schedule. Both the primary sampler results and the collocated, 6 day sampler results will be reported to AIRS.

PM2.5 filters are supplied by the EPA to the North Carolina DAQ Particulate Laboratory for the entire state of North Carolina. The filters are inspected and conditioned at 22°C and 38% relative humidity (RH). Stabilized conditioning is required for pre and post weight accuracy. A filter form accompanies each filter after the initial weighing through its complete sequence of events; initial weighing, shipping, **check in at destination local program or region, to the**



Filter removed from sampler (<96hrs. from end of run) YES NO

Sample Ship Date ( to lab) \_\_\_\_/\_\_\_\_/\_\_\_\_

LABORATORY

Sample Receipt Date\_\_\_\_\_

Was the sample received < 4°C \_\_\_\_\_ < 25°C \_\_\_\_\_ >25°C \_\_\_\_\_ (Min/Max Temp received in space)

Comments by either the Field or Lab Technicians:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ use the back of form for further comments.

**The filter initial weigh date is of great importance and must be considered by all, especially QA Chemists. The filter is time limited and must be used in a sample run less than thirty (30) days from the initial filter weight date.** Use of a filter more than 30 days since being initially weighed, will void the filter. Note: voided filters will be identified, documented, weighed, and processed. Voided filters may not count for completeness or the lowering of PM averages, but will count as an exceedance, if the weight so dictates. If a filter is found by an operator to be more than 30 days from the initial weight, send it back to the lab with a comment on the filter form, that it was not used due to time expiration.

Filter timing is again a priority in the post-sampling environment. **All PM 2.5 filters must be removed from the sampler less than 7 days from the end of the sampling run (midnight). At a minimum, any data collected after 7 days will be flagged and possibly voided.**

When sampled filters are collected, the filter form is completed, the filters are transferred to the operator's travel canister, placed in the metal shipping container, and the container placed into

the travel cooler with “blue” ice. The temperature should be at or below 4°C, but never more than 25°C (> 25°C is a void).

**Site Identification** This menu must be completed by the operator as directed on the sampler.

<b>Site Identification</b>				
ID1 : 371830014				
ID2 : 510				
<b>Function Keys in Edit Mode</b>				
		Bksp	A <--	A -->
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>	<b>F5</b>

**Please reference ATTACHMENT 6 to determine the site ID2 code for the specific sampler**

**at that site.** For the Millbrook collocated, 6 day sampler, use 510. Column ID1 is the AIRS number for the specific site. Coordinate with the regional chemist or operator if there is a problem with the information upon reception of data.

### Flow Check (Monthly)

If using the DryCal Lite, the operator determines the measured flow rate in liters/min and compares the measured flow with the current flow displayed in the Audit Screen. If using the FTS to measure flow, press <Edit>, then enter the measured FTS Pressure ("in" H<sub>2</sub>O) in the FTS Pres column. Insure the correct m and b are entered on this screen. The sampler will calculate the flow and display the result in the FTS Flow field (l/min). Compare the measured flow (FTS) with the current flow displayed in the Audit Screen. You may manually verify the sampler calculation using the equation:

$$y = mx + b$$

m = slope

$$y = m \quad x \quad + b$$

b = y intercept

$$Q_{act} = m \frac{\Delta H \times T_{amb}}{P_{amb}}^{1/2} + b$$

$x^{1/2}$  = Square Root

$Q_{act}$  = actual flowrate, lpm

$\Delta H$  = manometer, in H<sub>2</sub>O

T<sub>amb</sub>= ambient Temp, EK

P<sub>amb</sub>= ambient pressure

The sampler calculates with atmospheres      1 Atm = 760mm Hg

or

$$\frac{x \text{ atm}}{1 \text{ atm}} = \frac{\# \text{ mmHg}}{760 \text{ mmHg}} \text{ (from barometer)}$$

Ensure that you use the correct **m & b** for the pressure measurement used, atmospheres or mm Hg. The sampler reports in mmHg for pressure, but the sampler calculation uses atmospheres. You have **m & b** for both measurement values with the FTS.

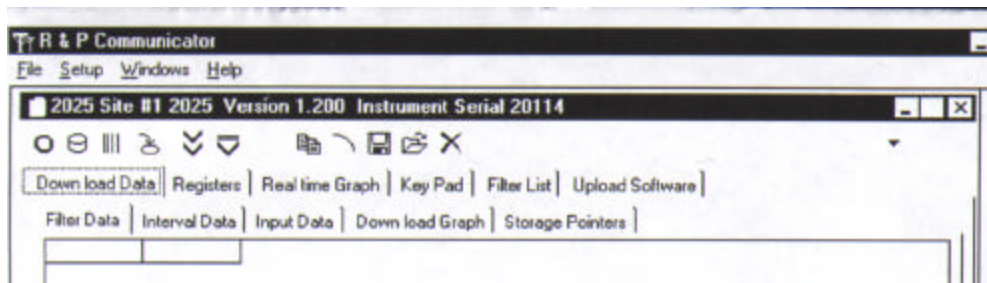
The operator verifies that the current flow is within  $\pm 4\%$  of the measured flow using the calculation below. If this is not the case, **perform** the sampler calibration procedure.

Sampler Flow \_\_\_\_ lpm      **FTS** or **DryCal** Flow \_\_\_\_ lpm

$$\%diff = \frac{(\text{Sampler flow} - \text{FTS/DryCal flow})}{\text{FTS/DryCal flow}} \times 100 = \text{____} (\pm 4\%)$$

The first month and third month flow checks of the quarter are not reported to AIRS. The second month flow check is an audit, performed with a different device than the calibration instrument, different ID.

Post Sampling Verification and Data Retrieval This section describes the procedures for verifying the sampling run status and retrieving the sampling run data. Data can be displayed on the screen or downloaded to a personal computer while in any modes. Use a personal computer/laptop using RP Comm or a palmtop using RP Comm or RP Data for downloading information. RP COMM will transfer data from the sampler to the PC.



Once all data of each type is retrieved, then save. Save ( the floppy disk symbol) each type of data to a file using the File Naming Guide supplied in the appendix.

Sampled Data North Carolina Regional Offices will follow these procedures. The sample filter sheet should be updated before shipping with the sampled volume, the cv (coefficient of variation), and sampler status codes if applicable. The entire data stream of filter, input, and interval data must be downloaded from the sampler every two weeks Only the filter file is e-mailed to the Data & Statistics technician in Raleigh:

TO BE ANNOUNCED &

[Michelle.Tutor@ncmail.net](mailto:Michelle.Tutor@ncmail.net)

**Verifications, Checks, and Audits** The R&P sampler sensors must be verified periodically to ensure the quality of the data collected. There have been misunderstandings in the past as to the meanings of certain words, even though they were explained in earlier sections of the SOP. Please read, understand, and use the following terms in this context for this SOP. **Note:** There is an EPA list of definitions in attachment 7.

**Calibration:** a procedure that sets a sensor to read exactly as the external reference standard. This external standard has traceability that is checked periodically as reading/sensing as per defined by the standard setting authority. For example, traceable to NIST (National Institute of Standards and Technology). *Calibrations are mandated annually, and: after major maintenance, moving the sampler, or having failed a check or audit.*

**Verification:** a test of a sensor to verify, authenticate, or check the truthfulness of the sensor with respect to an external standard, any standard.

**Check:** Same as a verification Checks are to be accomplished monthly and recorded in the site logbook, except the second month of a calendar quarter.

**AUDIT:** A TEST OF A SENSOR USING A STANDARD WITH WHICH THAT SENSOR WAS **NOT** LAST CALIBRATED. Audits are to be accomplished during the second month of a calendar quarter and recorded in the logbook.

**LEAK CHECK:** A VERIFICATION OF THE VACUUM SYSTEM OF THE SAMPLER, THAT INSURES ALL SAMPLED AIR COMES THROUGH THE PM 10 HEAD, THEN THE WINS IMPACTOR WITH MINIMAL LEAKS THAT “COULD” ALLOW PARTICULATE TO ENTER THE SYSTEM AND EITHER BE DEPOSITED ON THE FILTER OR INTO THE AREA BELOW THE FILTER IN THE VACUUM SYSTEM. THERE ARE TWO TYPES OF LEAK CHECKS, EXTERNAL AND INTERNAL. NORTH CAROLINA USES THE EXTERNAL LEAK CHECK AS A NORMAL PROCEDURE AND THE INTERNAL LEAK CHECK FOR TROUBLESHOOTING.

**FLOW CHECK / AUDIT / VERIFICATION:** VERIFY THAT THE CURRENT FLOW IS WITHIN  $\pm 4.49\%$  OF THE MEASURED FLOW (**FTS** OR **DRYCAL**). IF THIS IS NOT THE CASE, PERFORM THE FLOW CALIBRATION PROCEDURE AFTER COMPLETING AN ENTIRE AUDIT OF ALL SENSORS.

Sampler Flow \_\_\_\_ lpm      **FTS** or **DryCal** Flow \_\_\_\_ lpm

$$\%diff = \frac{(\text{Sampler flow} - \text{FTS/DryCal flow}) \times 100}{\text{FTS/DryCal flow}} = \text{_____} (\pm 4.49\%)$$

Ending Flow must be between:  $15.83 < \text{Ending Flow} < 17.5$

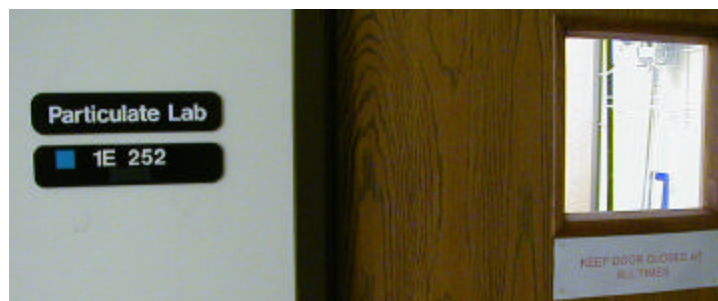
Complete and **Submit the AQ 99** (attachment 12) for flow audits to headquarters.

#### Regional Quality Assurance

The regional Chemist II will ensure that a record of each sampler download and filter form are maintained and reviewed. The downloads are reviewed for the following:

- 1) All scheduled days are documented with missing days explained
- 2) At least one field blank per sampler per month is accomplished
- 3) Look for sampler trends, may mean adjustments to sampler are required:
  - a) sample time not 24 hrs
  - b) cv too high  $>2$
  - c) temps, pressure, RH not reasonable
  - d) average flow is not 16.7
  - e) filter compartment  $< (+ 5) ^\circ\text{C}$  of ambient temp
  - f) AIRS number and site ID info not completed
  - g) status codes, See Attachment 1
- 4) Filter data e-mailed every two weeks and a copy maintained at the region. Maintain Input and Interval data at the region. This can be accomplished in a number of ways. Suggest creating a folder for each sampler. Create a subdirectory for each type file. Recommend maintaining the individual downloads as separate files. Or paste the downloaded data to a master file for that sampler(this is a large task). If the headquarters requires a specific date and time, it will be requested and transmission will be agreed upon at that time. Once a year at the end of the calendar year, send this information to the headquarters for archival. A ZIP file is recommended.

**1.2.2 The Laboratory Facility** The PM 2.5 laboratory is administered and operated by the North Carolina Division of Air Quality (DAQ). The facility is located at the NC DAQ Headquarters, 2728 Capital Blvd., Raleigh North Carolina.



PM 2.5 filters are procured and distributed to the laboratory by the US EPA on a continuing basis through the 103/105 grant process. All filters are inspected by EPA contractors for uniformity and defects. The laboratory also has an acceptance inspection when the individual container is opened for use. The filters to be used immediately will be opened, inspected, and placed in the conditioning environment. The remaining filters will be placed into storage, unopened until needed. New filters will remain in the conditioning environment until the weights have stabilized. Stabilization will be determined for each increment/lot by the use of lot blanks that will represent the entire quantity being conditioned. Once stabilization has been achieved, the filters will be weighed, documented in an Excel spreadsheet, and a 2.5 Filter Form completed for each filter. The filters will be placed in cleaned, uniquely numbered PM 2.5 filter cassettes. These cassettes will be placed into a sampler storage container. The storage container will then be placed into a white shipping container. The shipping container, the individual 2.5 Filter Form, the “Blue Ice”, and the Min/Max thermometer will be placed into a cooler for shipping to the desired location.

The filters can remain at ambient conditions before being placed in the sampler. Once used and removed from the sampler, the filters must be kept at 4 °C. The using agencies will ship the filters at or below 4 °C utilizing frozen “Blue Ice”. The temperature will be logged using a Min/Max thermometer.



- The 2.5 Filter Form documentation will follow the filter throughout its trip from the lab, to and from the sampler, and return to the lab.

- All PM 2.5 filters are time sensitive. They must be used in the PM 2.5 sampler within 30 days of the initial weighing. If the thirty day window has expired, the filter must be returned to the lab for reprocessing and reweighing.
- Upon return to the lab, the filters will be inventoried, inspected, and documented as to the temperature received.

The filters will be archived at  $< 4^{\circ}\text{C}$  for one year after the final weighing. The storage conditions are to be maintained in the event of the State or the US EPA requesting the filter for further analysis. After one year, the filters will be discarded, documented as discarded, and the 2.5 Filter Form documentation will be maintained according to the Headquarters file plan.

The PM 2.5 laboratory is a limited access facility. EPA specified temperature and humidity conditions are maintained by a state of the art computerized HVAC system. Target limits are:  $22^{\circ}\text{C}$  ( $72^{\circ}\text{F}$ )  $\pm 2^{\circ}\text{C}$ , and  $38\% \pm 5\%$  relative humidity (RH). The primary weighing room chamber is accessed through a second (buffer) room that is also maintained at these parameters. Temperature and relative humidity will be monitored and recorded in an electronic format using a Dickson data logger.



The room is constructed to provide a closed system, and a limited dust free environment. The walls are covered with a synthetic non dust producing covering. The ceiling is a sealed suspended ceiling. The floor is an anti-static tile. An adhesive / sticky dust mat is used by all entering the facility to help control outside contaminants. The lab HVAC is a separate system from the

Hq facility. It requires periodic changing of a system return filter(above the hall ceiling) and supply filters in the ceiling distribution ducts.



All filters are maintained on a conditioning rack that covers the filters from free falling contaminants, but is open on all four sides. Multiple trays each containing 55-64 filters in petri dishes can be inserted into the rack. Clean filters are kept in the upper racks separate from the sampled filters in the lower racks. The bottom 12"-18" of the rack will not be used to avoid possible contaminants from the floor. If more conditioning space is required, a second rack will be acquired.

The lab is equipped with two Mettler MT 5 microbalances numbered #1 and #2. These balances have a resolution of 1 $\mu$ g and a repeatability of 1 $\mu$ g as specified by the regulation. They are calibrated and maintained on a semi-annual basis by an outside contractor. The balances are located in the same controlled environment in which the filters are conditioned and mounted on a marble balance table. The balances remain in a powered on state to insure maximum stability. Static considerations are controlled through the use of Polonium Static strips that are replaced according to the manufacturer's recommendation.



Two sets of NIST traceable Class I standard weights are maintained. There is a reference set and an everyday working set of weights. The working standards are verified twice a year against the laboratory reference weights. Both sets of weights are certified by the NC Department of Agriculture Standards lab on an annual basis.

THE HVAC SYSTEM WILL BE CHECKED AS THE FIRST DUTY EACH MORNING. THE CURRENT PARAMETERS AS WELL AS THE AVERAGES FOR THE PREVIOUS 24 HOURS WILL BE CHECKED BY REVIEWING THE DICKSON PROGRAM FOR THE CURRENT WEEK. MONDAYS (OR FIRST DAY OF THE WORKWEEK), THE PREVIOUS 72 HRS WILL BE CHECKED, HOWEVER THE LAST 24 HRS ARE MOST IMPORTANT. VERIFY THAT THE SYSTEM WAS OPERATING CORRECTLY FOR THE REVIEW TIME. THE FOLLOWING IS A COPY OF THE DOCUMENTATION THAT DEMONSTRATES THE LAB IS IN COMPLIANCE WITH PROGRAM DIRECTIVES FOR TEMPERATURE AND HUMIDITY.

The Average temp =  $22\text{C}^{\circ} \pm 2\text{C}^{\circ}$  The Average RH =  $38\% \pm 5\% \text{ RH}$

The Standard Deviation for both must be  $< 5$

Bottom of Excel spreadsheet for week beginning 6-05-2000

00-06-05	6:01:20	21.86	41.02	
00-06-05	6:21:20	21.80	40.63	
00-06-05	6:41:20	21.80	39.63	
00-06-05	7:01:20	21.80	41.16	
00-06-05	7:21:20	21.75	40.41	
00-06-05	7:41:20	21.75	41.26	
		22.40	38.64	Avg Temp / Avg RH Row
		0.40	1.72	Standard Deviation Row

**1.2.3 LAB OPERATIONAL PROCEDURE OVERVIEW** THE FOLLOWING PROCEDURES ARE FOR THE LABORATORY TECHNICIANS USE IN PERFORMANCE OF THEIR ASSIGNED DUTIES.

FILTERS ARE RECEIVED FROM THE EPA IN QUANTITIES THAT ARE GREATER THAN REQUIRED FOR IMMEDIATE USE. ALL FILTERS WILL BE INSPECTED BY THE LAB TECHNICIANS WHEN THE CONTAINER IS OPENED. THIS VISUAL INSPECTION CHECKS PINHOLES, RING SEPARATION, CHAF OR FLESHING, LOOSE MATERIAL, DISCOLORATION, AND FILTER NON-UNIFORMITY.

Presampled filters are conditioned in exposure lots of approximately 350 filters, with six (6) filters designated as laboratory blanks. The exposure lot also includes 5 spare filters for each agency per month and one (1) field blank per site per month. After the visual inspection using a light table, each filter is placed into a petri dish and kept in numerical order on the conditioning tray. After a filter lot has been set out for conditioning, the filter numbers (the tracking field) are entered into the Filter Tracking database and the initial weights worksheet of the Weights Original database. These databases are accessed from the P drive of the Air Quality server. Data are backed up daily by the LAN administrator. The data is archived by the Lab technicians monthly to PCs and a remote location (ECB).

After a minimum 24 hour conditioning period, the initial blank weighing may be performed, but preferably a 48 hour period is utilized. The laboratory blanks are weighed daily until all weight changes are  $< 15\mu\text{g}$ . The time required for the blanks to reach a stable weight determines the conditioning time for the entire lot. Weighing of the entire lot can commence immediately after stability is demonstrated. The conditioning time period for any lot will not be less than 48 hours. Prior to weighing, insure the room conditioning parameters are / have been within limits for the last 24 hours, by checking the Dickson datalogger.

The manufacturers operational balance procedures will be utilized as to specific duties, i.e. turn it on, initiating an auto calibration, opening the door, etc. **NOTE: Discard any filter that is not between 110mg and 160mg.**

Filters to be shipped are placed into individual filter cassettes with backing screens. Insure the top and bottom of the cassette snap together. Record the number of the cassette backing screen with the corresponding filter on the 2.5 Filter Form that accompanies the filter. Record the filter number and the cassette number in the spreadsheets; record the agency to which the filter was shipped, as well as the weigh date into the Filter Tracking spreadsheet. A group of filter cassettes, up to 16, is loaded into a cassette magazine, sealed with an orange cap, and the magazine placed into its protective shipping container. The protective containers are shipped to the using agencies.

Place two or three packages of "Blue Ice" (depending on the size of the "Blue Ice"), a Min/Max thermometer, and one or more cassette magazines (protective containers), as required, and the associated Filter Forms, into a cooler to send the filters to any of the agencies. Presampled filters have no temperature requirement. Affix the appropriate address to the container and ship by state courier. The cooler will be sealed closed with Duct tape. It will be placed in the Parker Lincoln State shipping room for pickup by the state courier personnel prior to 10:30 AM of the day to be shipped.

Coolers with the sampled filters should arrive by courier. **Record the Min/Max interior temperature of the cooler upon arrival** and the date received on each 2.5 Filter Form.

Examine the 2.5 Filter Forms to determine whether all pertinent information is completed. If the white filter protective container is cold, allow it to warm to the filter conditioning temperature before opening to prevent condensation.

Remove the filters from the cassette magazine using the R&P bulb pump.



Match each filter and cassette with the corresponding 2.5 Filter Form. Notify the appropriate agency if the filters and 2.5 Filter Forms do not match.

Remove the filter from the cassette using the special tool provided, being careful not to touch or otherwise disturb the filter and its contents.



Using clean, dry forceps, transfer the filter to a clean petri dish.



Inspect the filter for damage. If damage is found, flag the sample as questionable on the 2.5 Filter Form and the Filter Tracking spreadsheet. Save the damaged filter for inspection. Transfer the filter in its petri dish to the conditioning rack. Pick one laboratory blank from the corresponding batch number to be uncovered along with the samples. There may be more than one batch and therefore more than one blank for the weighing session. Allow filters to condition for at least 24 hours.

After filter removal, the cassettes and magazines are wiped clean with dilute ethanol. The protective shipping containers are inspected and cleaned as necessary.

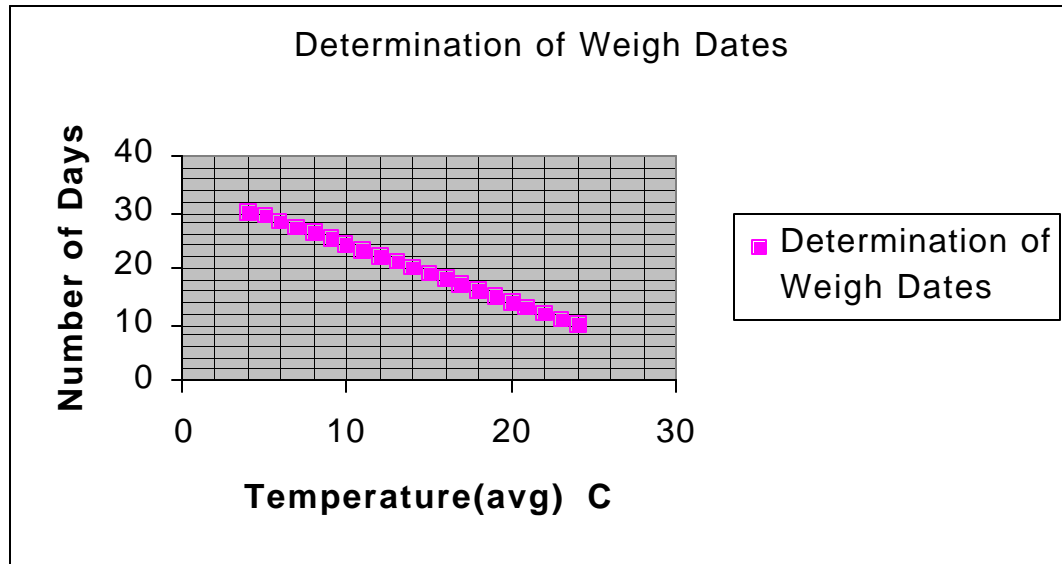
Both pre sampled and post sampled weighings should be performed on the same analytical balance. Post sampled weighings should be completed within ten days of the sampling date (as a goal) or within the specified time period according to EPA's "Determination of Deadline for Post Weighing". If the 4°C was maintained, the filter can be maintained at 4°C (up to 28 days from the end of sampling and weighed within 30 days). If the filter was not maintained at <4°C, it must be conditioned and weighed within the number of days given by the formula:

$$T_{ave} = (T_{max} + T_{min})/2$$

$$\text{Days} = 34 - T_{ave}$$

where  $T_{ave}$  is the average of the minimum and maximum temperature of the samples during transit. (This procedure is in accordance with the attachment to the J. David Mobley letter

(EPA) of January 19, 2000.) If the filter was subjected to temperatures  $>25^{\circ}\text{C}$  after removal from the sampler, it may be a voided sample, but must be documented as such and weighed.



#### 1.2.4 Lab Quality Control Procedures

Analytical Balance - Semi-annually a weight span check will be accomplished on the balance. Use both the working and the reference weights.

1. Weigh the following on each balance: 5g, 2g, 1g, 500mg, 200mg, 100mg, 50mg.
2. Compare the values of each weight on the balance to each other and the locally determined NIST values of the weights. If differences are greater than 2%, visually check for nicks or dirt. Clean, if necessary, and recheck. If this doesn't correct the problem, call the service technician.
3. Have the contract balance service perform preventive maintenance, check the balance accuracy, and compare weights.

Complete a weight span check with the working standards Quarterly as required.

On the day the balance will be used:

Perform an autocalibration

Check the balance with 100mg and 200mg weights at the beginning and end of the weighing session.

Check the balance after every 10 filters with the 100mg weight.

### Types of Blanks

**Lot Blanks:** These are conditioned unsampled filters used to determine filter weight stability over long periods of time for testing. Typically, six filters from each manufacturer's lot are used.

**Laboratory Blanks:** These filters are conditioned unsampled filters used to determine any weight change between pre and post sampling weighings due to contamination in the microbalance environment. Select six filters from the approximately 350 batch of filters. Weight of these blanks should be stable, i.e.  $<15\mu\text{g}$ .

**Trip Blanks:** These filters are conditioned, unsampled filters that determine the possible contamination of filters being shipped to/from the sampler, but not installed. These filters are returned with the sampled filters retrieved from the sampler. The weight change must be  $< 30 \mu\text{g}$ .

**Field Blanks:** These filters are conditioned unsampled filters that are used to determine contamination as in the trip blank and during the sampling and waiting time within a sampler. Sampler contamination could be considered the difference between the field and trip blanks. Field technicians will designate field blanks on the 2.5 Filter Form and the sampler software. One field blank per site, per sampler, per month will be scheduled/sent to the monitoring agencies. A weight change greater than  $30 \mu\text{g}$  may indicate contamination. Any field blank  $>30 \mu\text{g}$  will be brought to the attention of the PM 2.5 coordinator or QA person.

Dickson Temperature and Relative Humidity Sensors: Semi-annually, the Dickson system will be validated with a NIST traceable device. The NIST traceable standard is recertified annually. The sensors should be calibrated if the temperature is more than 1 degree or 1 percent relative humidity different. Start the Dickson program, select Logger, setup, channel 1 (temperature), setup, yes, insert new temperature from NIST instrument, enter. If channel 2 (Relative Humidity) requires calibration, select Channel 2 and continue as for channel 1. This calibration must be documented in the laboratory logbook.

Electronic Data Recording: Two Excel spreadsheet files are used in the laboratory. Both are accessible from the Air Quality network on the P Drive. Both spreadsheets are recreated for each calendar quarter.

Filter Tracking: This spreadsheet contains the filter number, the initial filter weighing date, the region shipped, the site (completed on return of filter sheet), sampled date, the return Min/Max temperatures, and comments received on the filter sheet from the monitoring technicians.

Weights Original: This spreadsheet has four(4) worksheets. This spreadsheet is used in conjunction with the sampler filter file to generate AIRS reports.

Initial Weights: contains the initial weigh date and weight for each filter.

Final Weights: contains the final weigh date, weight, and lab comments as to the filter condition. Additionally the blank assigned/weighed for the weight session is recorded.

Blanks: contains information on the weights of the six lab blanks from each batch of approximately 350 filters.

Standard checks: documents the standard weight checks with the weighing sessions, lab experiments, and miscellaneous information.

Filter Archiving: The filters are stored at or below 4°C in a 50 ft<sup>3</sup> refrigerator at the filter archiving repository (FAR). A min/max thermometer records temperature variations.

These filters are maintained for one year. After one year the filter sheets are documented that the filters have been discarded and the filter sheets will be archived in accordance with the Ambient Monitoring retention schedule.

This has been a description of the PM 2.5 process from filter procurement, initial filter weighing, shipping, sampling, to the final filter weighing and archiving.

**2.0 Data Flow Synopsis** The PM lab weighs the PM 2.5 filters and maintains these values on the P Drive server at DAQ. This is a limited access database. The pre sampling weight value is called the Initial Weights and the post sampling weigh value is called the Final Weights. These values are in milligrams (mg).

The R&P PM 2.5 sampler has an internal system that logs the many required (EPA) data points throughout the sampling period for each filter. These data points must be manually downloaded from each sampler by the field operator. There are three (3) separate files for each filter that are downloaded; filter, input, and interval files. The filter files are sent to the headquarters via email to:

[Azal.Amatya@ncmail.net](mailto:Azal.Amatya@ncmail.net)

[Michelle.Tutor@ncmail.net](mailto:Michelle.Tutor@ncmail.net)

by the field operator at least once every two weeks. It has a specific file naming convention to assist the data technician at the Headquarters in assimilating these data points. The input and interval files are maintained at the regions by the Chemist II.

These two files are kept in the event that they may be needed for additional information that is not normally required in normal QA and AIRS reporting.

The data technician establishes a computer file for each monitor in the network for each calendar quarter. The data comes to the technician for each monitor via email. This data must be appended to the pre established file. There is no capability for Microsoft Excel to append data, therefore the technician must copy the data from the e-mail attachment and paste it into the base file.

The data technician then polls the responsible region's Chemist II for the missing data or an explanation for the missing data. The Chemist II's responses are forwarded to the QA Chemist for inclusion in the AIRS report.

Once the data files are built for the quarter (monthly is the goal), the data technician will import the monitor Excel file into Microsoft Access along with the lab file. The technician then performs a query that will calculate the filter mass per unit volume and add it to the new data stream in a column named  $\text{ug/m}^3$ . A flag column is then added at the end of the data stream. When completed, the data technician alerts the QA Chemist that the data is ready for review. This completed data is in an electronic file folder on the P drive.

First, the chemist checks the required sampling days versus the days in the report. If the required dates are not included in the report, the chemist adds the appropriate dates and annotates the appropriate null code for the missing data. The AQ Chemist then performs a series of checks for each sampling day. When all of the data checks are completed for a particular site, this new file is added to the P drive. Once all of a regions samplers are completed the QA Chemist alerts the data technician that the data is ready to be formatted to an AIRS compatible data stream and uploaded to AIRS.

Once data has been uploaded to AIRS an AMP 350 report is generated to determine if the data was accepted correctly by the AIRS database. If there are errors, corrections

will be submitted to AIRS, and another report generated to verify the correct data is in AIRS.

## 2.1 Data Flow

The regional monitoring technician should download each sampler at least once every two weeks. The input and interval files are maintained at the regions. The filter file is sent to the headquarters via email as an attached comma delimited .csv file. This file has a specific naming convention that allows the data technician to know which base file to add the data.

### DOWNLOAD FILE NAMING

<b>Site Name</b>	<b>AIRS Number</b>	<b>Code</b>		
Gastonia	37-071-0016	GM		
Kannapolis	37-025-0004	KA	Format is:	Site Code
Hickory	37-035-0004	HC		Year (last digit)
Rescue Squad, Hickory	37-035-0005	RS		Month (a thru l)
Candor	37-062-0001	CN		
Wm. Owens Elem. Sch.	37-051-0009	WO		Day (two digits)
Lumberton	37-155-0005	GD		f (filter) or t (interval) or
Dilliard School	37-191-0005	DM		p (input)
ECU Athletic Complex	37-147-0005	GV		A (precision sampler)
Lenoir CC	37-107-0004	LC		
Elizabeth City	37-139-0002	EC		Jan = a      Jul = g
YMCA Market	37-129-0009	MS		Feb = b      Aug = h
Kenansville	37-061-0002	KE		Mar = c      Sep = "i"
Northwoods Elem. Sch.	37-133-0005	NW		Apr = d      Oct = j
Bryson	37-173-0002	BY		May = e      Nov = k
East Marion Jr. HS	37-111-0004	MJ		Jun = f      Dec = l
Spruce Pine	37-121-0001	SP		
Cherry Grove	37-033-0001	UC		
Hopedale	37-001-0002	HD	Example:	filter file downloaded at
Edgeworth/Bellemede	37-081-0009	EB		Millbrook on 9/10/98, ML8i10f
Boone	37-189-0003	BN		
Lexington	37-057-0002	LX		precision interval file from
EPA Health Res. Lab	37-135-0007	HR		Millbrook on 10/03/98, ML8j03t
Durham Health	37-063-0001	DH		

Pittsboro	37-037-0004	UP
St. Augustine's	37-183-0015	ST
Millbrook	37-183-0014	ML
Rocky Mount	37-065-0003	TP

## **2.2 Data Handling**

### **2.2.1 e-mails**

The Data & Statistics technician receives an e-mail from the region with the csv attachments as download files for each sampler in the region. A file in this format allows the technician to open the file immediately rather than having to manipulate the original text file from the sampler. The technician using Excel, creates a base file for each sampler each quarter. To this file the technician adds or appends each e-mail file until the entire quarter is completed for that monitor. This is accomplished by using the "copy" function for the data to be copied and then "paste" the data to the base file. Some monitors have a second, precision sampler, that has a different ID 2. This is the identifier that keeps the two samplers separated. However, there is a separate file for each of these monitors. All e-mails are archived unedited with only a copy of the data pasted to the base file. Both of these files are found on the P drive of the DAQ server.

### **2.2.2 Base File Manipulation**

The base file is edited in Excel after it is completed. This edit deletes columns that are unused options in the R&P file format. The following columns are deleted from the base files in Excel before Access is used to calculate the concentration of the particulate:

Ave Wind Speed; Ave Wind Vel; Ave Wind Dir; Ave A1; Ave A2; Ave A3;  
Cass ID2 or Filt ID2; total(min) or Cass ID2.

The Excel file is then saved and closed.

### 2.2.3 Calculation using Microsoft Access

The quarterly filter file is used with the lab file that contains the before and after weights for each filter. The following is accomplished each quarter for each sampling position in the state system of sampling sites. Some sites as previously stated have more than one position. These sites will have a file for each sampler position.

1. Open Microsoft Access (MA)
2. Create a new database for each calendar quarter
3. Link all of the filter files and the lab Initial Weights (IW) file and Final Weights (FW) to this database
4. Create a query in **design view** to include the site filter file, the IW and FW. The common parameter among the files is the filter ID.
5. In the Filter file the topmost item is an asterisk, Upper case 8, \*. Double click on this asterisk and it transfers the entire filter file to the query out put.
6. In the second column of the query, type the following:

$$\text{ug/m}^3: ([\text{Final Weight}] - [\text{Initial Weight}]) / \text{Volume} * 1000$$

This is the expression used by MA to calculate the micrograms per cubic meter of air sampled. ug/m<sup>3</sup> is actually  $\Phi$ g/m<sup>3</sup> but MA does not have the  $\Phi$  and exponent font. On some downloads, volume may be spelled volumn. The expression must match the spelling used in the download.

7. Name, save, and close the query. Now open the query (normal view) and check that the expression was accomplished correctly, i.e. the ug/m<sup>3</sup> column will have values. If not recheck the query expression and repeat. If the query was good use the "save as" export function and save the query to the **P** drive as an Excel file in a file

folder for the region. This must be an Excel file to allow editing later.

Use the regional file folder for all PM 2.5 samplers in the region.

Repeat the process for each region.

**2.2.4. Precision Checks** – this procedure compares the value of the sampler ( $\mu\text{g}/\text{m}^3$ ) against the value of another collocated sampler of the same make and model sampling for the same time period. The precision calculation is determined by using the value of the primary sampler subtracted from the value of the precision (6 day) sampler divided by the average of the reporting and 6 day sampler and is calculated by the data technician.

$$\frac{\text{6 DAY SAMPLER VALUE}(\text{m G}/\text{M}^3) - \text{PRIMARY SAMPLER VALUE}(\text{mG}/\text{M}^3)}{\text{Average of Reporting and 6 Day Sampler Value}} \times 100 < 10\%$$

100 < 10%

$$\left[ \frac{\text{6 day sampler value}(\mu\text{g}/\text{m}^3) + \text{primary sampler value}(\mu\text{g}/\text{m}^3)}{2} \right]$$

### **3.0 Quality Control Procedures**

**3.1 Filter Identity Crosscheck:** Experience with the R&P samplers has demonstrated that occasionally, the operator completed Filter Sheet and the sampler through the downloaded filter file will report a conflict of information. DAQ considers the Filter Sheet as the data with the highest priority, i.e. takes precedence in a conflict of data. A filter that was not scheduled to run, will in fact run, and the scheduled filter may cycle through the system unsampled. However the filter file reports the scheduled, rather than actual filter sampled. Other problems must be dealt with on an individual basis, with appropriate corrections made. This correction will be a shared responsibility between the QA Coordinator and the PM 2.5 Coordinator.

The first look at the filter files by the QA coordinator is viewing the raw data file using Excel. All collected data is reviewed as to being reasonable, consistent, and complete. The

calculated mass per cubic meter is reviewed at this time. It is at this review that the completed Filter Sheet designated filter for each sampling day is compared to the filter number reported in the data file. If the filter number on the data file is in error, the QA Coordinator will correct the data to reflect the appropriate filter number. See Attachment 8 for an example of a filter file. QC checks are accomplished on both the filter sheet and the downloaded filter file and will be discussed under Quality Control reviews.

### **3.2 Quality Control reviews:**

**3.2.1 Filter Sheet** The first document to be reviewed is the Filter sheet. All applicable information will be completed by the responsible person. The items to check from a quality control perspective are:

**3.2.1.1 Filter Number** The filter used according to the filter sheet for the specific date must be compared to the filter annotated on the downloaded filter file from the sampler. No action is required if all was completed as scheduled. If there is a conflict between the Filter Sheet and the downloaded filter file, the Filter Sheet takes precedence. The filter download file must be corrected with the correct filter and cassette inserted. Complete the quarter's review and then have the Data and Statistics Branch re-accomplish the calculation for the site.

**3.2.1.2 Weigh Date** The difference between the filter weigh date and the filter sampling date must be less than 30 days. If > 30 days a void must be considered.

**3.2.1.3 WINS Cycles** The number of runs or cycles on the WINS impactor must be < 10. If > 10 cycles, a voided sample must be considered.

**3.2.1.4 Leak Checks** The leak check, if accomplished, must pass before sampling can continue. The filters sampled prior to the leak check failure (until the last passed leak check) must be reevaluated in the view of the failed check. These filters can be evaluated as to the possibility of being voided. No more filters may be sampled as valid until a passed leak check is documented.

**3.2.1.5 Flow CV** The flow cv must be < 2.00 or the sample is voided.

**3.2.1.6 Sample Volume** Sample volume must be greater than 22.99 m<sup>3</sup> and less than 25.01 m<sup>3</sup> or voided.

**3.2.1.7 Status Codes** Status codes must be evaluated and verified for possible voids. See Attachment 1.

**3.2.1.8 Filter Timing** The filter must be removed from the sampler within 96 hrs. A void will be considered for any filter remaining in the sampler longer than 96 hrs.

**3.2.1.9 Filter Temperature** The filter temperature upon arrival at the lab must be less than 25°C. Temperatures between 4°C and 24°C require evaluation using the “Determination of Deadline for Post Weighing” p 18 for required time to weigh.

**3.2.1.10 Conditioning Time / Environment** Filters will be placed in the conditioning environment as soon as the temperature and humidity of the travel container has reached room conditions. There may be a scheduled down time that may prevent this immediate conditioning.

**3.2.1.11 Filter Storage** Once filters have been weighed, the filters will be placed into the petri dish for storage and disposition of the filter will be noted on the Filter Form.

**3.2.2 Filter File Review** Review the downloaded filter file. This file should have been appended to include all sampling dates and sorted in chronological order by the Data & Statistics Section for each quarter. It may be reviewed either on the spreadsheet on the computer or printed on an 8.5 x 14 copy paper.

**3.2.2.1 Schedule Check** Check the sampling dates against the EPA 3 & 6 day schedules to determine if the correct days have been sampled or are annotated as not sampled. Mis-sampled days (wrong date) may be utilized as make up samples.

**3.2.2.2 Filter Number Check** Crosscheck the day sampled on the file with the associated filter sheet as to the filter number of the filter. No action is required if all was completed as scheduled. If there is a conflict between the Filter Sheet and the downloaded filter file, the Filter Sheet takes precedence. The filter download

file must be corrected with the correct filter and cassette inserted. Complete the quarter's review and then have the Data and Statistics Branch recalculate the result for the site. This is the only authorize correction to the filter file.

**3.2.2.3 Set Start Time** Set start time should always be 0:00 and set stop time as 0:00.

**3.2.2.4 Actual Start Time** Actual start and stop time should be 0:00.

**3.2.2.5 Total Time** Total time run must be 23.00 hrs to 25.00 hrs or is voided.

**3.2.2.6 Average Flow** Average flow is usually 16.7 lpm. The range is 15.9 to 17.5 lpm.

**3.2.2.7 Flow CV** The average flow CV must be < 2.0 or a void considered

**3.2.2.8 Volume** The volume will correspond to the time with 23 m<sup>3</sup> to 25 m<sup>3</sup>.

**3.2.2.9 Temperatures** The ambient temperatures, Filter temperatures, and the barometric pressures must be reasonable values. i.e. the average value is between the min and max value and the value is representative of the season.

**3.2.2.10 Max Temperature Differential** The max differential temperature should be less than 5°C or a flag or void assigned. The date and time are those annotated to the max temperature differential.

**3.2.2.11 Site ID 1** Site ID 1 should be the appropriate AIRS number for the site. This is manually inserted into the sampler by the field technician and only the technician can correct it. Collocated monitors will have the same AIRS number.

**3.2.2.12 Site ID 2** Site ID 2 is the unique number assigned to the sampler depending on the site in which is located and its primary position as the 1, 3, or 6 day sampler. See attachment 6.

**3.2.2.13 Status Codes** Status codes are R&P codes for EPA mandated flags that are generated by the sampler. See Attachment 1 for explanation of these codes and the process required to decipher complex errors.

**3.2.2.14 Flows** Min Flow and Max flow are just that and give an idea of how the sampler is running.

**3.2.2.15 Relative Humidity** Relative Humidity min, average, and max are also only indicators and must be reasonable numbers. These fields will not void a sample.

**3.2.2.16 Deleted Files** There are several fields that are deleted by the data and statistics technician as options that are not installed or used on our R&P 2025s.

**3.2.2.17 Outlier Verification** An Access/ Excel manipulation had been performed adding the next field to the filter file, the value in  $\mu\text{g}/\text{m}^3$ . For QA purposes, recheck manually, all values less than  $6 \mu\text{g}/\text{m}^3$  and all values greater than  $24 \mu\text{g}/\text{m}^3$ . If there was a void condition, an AIRS null code must be manually inserted in place of the  $\mu\text{g}/\text{m}^3$ . Attachment 4 contains a list of the null codes and reason for the specific code.

**3.2.2.18 Flags** The last field will be the AIRS flag that is manually inserted into the spreadsheet (as required), if an error occurs that mandates a flag. An AIRS flag is an indicator that all conditions of sampling were not perfect, but that a voided sample is not warranted. It further denotes a sample that was investigated and validated as good. See Attachment 4 for flags and associated rationale.

### **3.2.3 Blanks**

**3.2.3.1 Field Blanks** are mandated on each sampler at a rate of one per month per individual sampler. Their net weight must be less than  $30 \mu\text{g}$ . If the value is above  $30 \mu\text{g}$ , investigate the reason to insure the filter samples in that sampler do not have reason to be invalidated.

**3.2.3.2 Trip Blanks** are filters that make the trip the same as the field blanks and samples, but are not inserted into the specific sampler, just placed in with the returning filters. One could consider that the difference between the field blank and the trip blank is the passive loading of the filter inside of the sampler.

**3.2.3.3 Lab Blanks**

**3.2.3.3.1 Lot Blanks:** These are conditioned unsampled filters used to determine filter weight stability over long periods of time for testing.

Typically, six filters from each manufacturer's lot are used

**3.2.3.3.2 Batch Blanks:** These filters are conditioned unsampled filters used to determine any weight change between pre and post sampling weighings due to contamination in the microbalance environment. Select six filters from the approximately 350 batch of filters. Weight of these blanks should be stable, i.e. <15µg.

**3.2.3.4 Blank Database** A database record should be maintained with the lab, field and trip blank data. Using this database, the QC coordinator can check the blank data by site, batch(weigh date), date sampled, region, or operator.

### **3.2.4 Additional Report Reviews**

**3.2.4.1 AIRS Reports** Certain AIRS required reports give a good indication of how the individual samplers and the network are performing. These reports are generated through our AQ 98 Audits and AQ 99 Precision reports. These reports need to be completed and reviewed in a timely manner in order to have a real time review and corrections made prior to the AIRS required completion date of 90 days after the quarter end. In some cases, the data reviewed under normal timing can be almost six months old. It is then too late to do anything except corrections or deletion of data.

**3.2.4.1.1 AQ 98** The AQ 98 Precision checks – this procedure compares the value of the sampler ( $\mu\text{g}/\text{m}^3$ ) against the value of another collocated sampler of the same make and model sampling for the same time period. The precision calculation is determined by using the value of the primary sampler subtracted from the value of the precision (6 day) sampler divided by the average of the reporting and 6 day sampler or :

**6 DAY SAMPLER VALUE(m G/M<sup>3</sup>) – PRIMARY SAMPLER VALUE(mG/M<sup>3</sup>)**

X 100 < 10%

$$\frac{\text{6 day sampler value}(\text{mg}/\text{m}^3) + \text{primary sampler value}(\text{mg}/\text{m}^3)}{2}$$

**3.2.4.1.2 AQ 99** The AQ 99 Audit, checks the accuracy of the flow of the sampler with reference to a NIST traceable flow device. The percent difference is the difference of the sampler determined flow minus the flow as reported by the standard (FTS), divided by the flow of the standard, times 100% or:

$$\frac{\text{sampler flow} - \text{FTS flow}}{\text{FTS flow}} \times 100 = \%d < 4.49\%$$

**3.2.5 PERFORMANCE EVALUATION PROGRAM** THE PERFORMANCE EVALUATION PROGRAM (PEP) IS AN EPA PRECISION PROGRAM INDEPENDENT OF THE STATE SYSTEM. IT IS A SYSTEM CHECK OF THE OPERATIONAL PERFORMANCE OF THE NETWORK BY CHECKING THE VALUE DETERMINED BY THE STATE LAB, OPERATOR, AND SAMPLER AGAINST AN EPA CONTRACT SYSTEM OF DIFFERENT SAMPLERS, DIFFERENT OPERATORS, AND A DIFFERENT WEIGHING LAB. THE SAMPLER SET UP IS LIKE OUR PRECISION SITES, LESS THAN 4 METERS AWAY FROM OUR SAMPLER AND GREATER THAN 1 METER FROM OUR SAMPLER. IF HI VOLS ARE COLLOCATED AT THE SITE ALL PM 2.5 SAMPLERS MUST BE A MINIMUM OF 2 METERS FROM THE HI VOL. THE PEP PROGRAM WILL CHECK EVERY NAMS/SLAMS SITE IN THE STATE IN A FOUR YEAR PERIOD. THIS SITE CHECK WILL OCCUR DURING ONE OF THE FOUR YEARS, ONCE IN EACH QUARTER OF THE YEAR SAMPLED. THE QA CHEMIST WILL COORDINATE WITH REGION IV, HERB BARDEN ON A QUARTERLY BASIS TO DETERMINE THE VALUES FOR THE SCHEDULED DAYS.

[BARDEN.HERBERT@EPAMAIL.EPA.GOV](mailto:BARDEN.HERBERT@EPAMAIL.EPA.GOV)

THESE VALUES WILL BE RETRIEVED AND HAND CALCULATED AS THE TIMING IS WELL BEFORE THE DATA & STATISTICS SECTION IS CAPABLE OF ASSIMILATING THE DATA.

$$F \text{ G/M}^3 = \frac{[(\text{FINAL WEIGHT}) - (\text{INITIAL WEIGHT})] \times 1000}{\text{VOLUME}}$$

THE GOAL OF 10% DIFFERENCE IS CALCULATED AS THE STATE VALUE MINUS THE EPA VALUE DIVIDED BY THE EPA VALUE TIMES 100 OR:

$$\frac{\text{STATE VALUE} - \text{EPA VALUE}}{\text{EPA VALUE}} \times 100 < 10\%$$

VALUES > 10% NEED TO BE INVESTIGATED. IF NO ERRORS CAN BE FOUND, DO NOT CONTINUE TO LOOK FOR A PROBLEM WITH OUR SYSTEM. IN THE PAST, SOME VERY LARGE DIFFERENCES IN DATA WERE DETERMINED TO BE AN EPA SYSTEM PROBLEM.

### **3.2.6 VALIDATION ITEMS**

THE TABLE BELOW IS A SUMMARY OF THE QA ISSUES TO BE ADDRESSED IN THE VALIDATION OF THE SAMPLER FILTER DATA.

**3.2.6.1 FIRST ROW** THE FIRST ROW INFORMATION IS ON THE SAMPLER FILTER SHEET.

**3.2.6.2 SECOND & THIRD ROW** THE SECOND AND THIRD ROW INFORMATION IS IN THE SAMPLER FILTER FILE.

**3.2.6.3 FOURTH ROW** THE FOURTH ROW INFORMATION IS ON FILE AT THE REGIONAL OFFICE IN THE SAMPLER LOGBOOK. IT IS REVIEWED DURING THE ANNUAL SYSTEMS AUDIT.

**3.2.6.4 FIFTH ROW** THE FIFTH ROW INFORMATION IS IN THE SAMPLER FILTER FILE.

**3.2.6.5 LAST ROW** THE LAST ROW OF INFORMATION IS ON FILE AT THE REGIONAL OFFICE IN THE LOGBOOK. IT IS REVIEWED DURING THE ANNUAL SYSTEMS AUDIT.

ANY SAMPLE THAT EXCEEDS THESE GUIDELINES SHOULD BE CONSIDERED A VOID SAMPLE WITH THE APPROPRIATE AIRS NULL CODE ASSIGNED IN THE  $\Phi\text{G}/\text{M}^3$  DATA VALUE. SEE ATTACHMENT 4 FOR THE AIRS NULL CODES. IF THE SAMPLE VALUE IS CONSIDERED GOOD BUT NOT PERFECT, A DATA VALIDITY FLAG MAY BE ASSIGNED. ASSIGNING THIS CODE TELLS THE OBSERVER THAT THERE WAS A PROBLEM IN THE COLLECTION OF THE DATA, THAT THE DATA WAS QUALITY ASSURANCE CHECKED, AND THAT DAQ BELIEVES THE DATA TO BE REPORTABLE.

WHEN THE DATA HAVE BEEN CHECKED AND COMPLETED FOR A SITE, THAT FILE IS PLACED IN A REGIONAL FOLDER ON THE P-DRIVE USING THE SITE NAME AS A FILE NAME. ONCE ALL SITES ARE COMPLETED FOR A REGION, THE QA CHEMIST WILL ALERT THE DATA & STATISTICS TECHNICIAN THAT A REGION IS READY FOR FINAL PROCESSING TO AN AIRS FORMAT.

<b>CRITICAL CRITERIA TABLE</b> (F) = flagged			
Criteria	Acceptable Range	Frequency	40 CFR Reference
<b>Filter Holding Times</b> Pre-sampling Sample Recovery Post Sampling Weighing	< 30 days before sampling # 4 days from sample end date # 10 days at 25EC from sample end date # 30 days at 4EC from sample end date >	all filters all filters all filters	Part 50, App L, Sect 8.3 Part 50, App L, Sect 10.10 Part 50, App L, Sect 8.3
Minimum detection limit	1 $\Phi\text{g}$	all filters	GM

<b>Sampling Period</b> (including multiple power failures)	1380-1500 minutes or value if < 1380 and exceeds NAAQS ( <i>F</i> )	all filters	Part 50, App L, Sect 3.3 Part 50, App L, Sect 7.4.15
<b>Sampling Instrument</b> Average Flow Rate Variability in Flow Rate	Average within 5% of 16.67 l/min cv # 2%	every 24 hrs of op every 24 hrs of op	Part 50, App L, Sect 7.4 Part 50, App L, Sect 7.4.3.2
<b>Calibration</b> 3 Point FR Calibration Temperature Calibration Pressure Calibration One-point FR Check	∇ 4.49% of transfer standard ∇ 2EC of transfer standard ∇ 10 mm of transfer standard ∇ 4.49% of transfer standard	1/ yr - check failure 1/ yr - check failure 1/ yr - check failure 1/ 30 days	Part 50, App L, Sect 9.2.5 Part 50, App L, Sect 9.3 Part 50, App L, Sect 9.3

Criteria	Acceptable Range	Frequency	40 CFR Reference
Sampling Instrument Individual Flow Rates Filter Temp Sensor	no flow rate excursions > ∇5% for >5min ( <i>F</i> ) no excursions of > +5CE than ambient lasting longer than 30 min ( <i>F</i> )	every 24 hr of op every 24 hr of op	Part 50, App L, Sect 7.4.3.1 Part 50, App L, Sect 7.4
Verification External Leak Check One Point Temp Check One Point Pressure Check One Point Flow Rate Check  One Point Flow Rate Audit	< 80 ml/min ∇ 2EC of standard ∇ 10 mm Hg of standard ∇ 4.49% of transfer standard ∇ 5.49% of 16.67 (15.8-17.5 l/min)  ∇ 4.49% of audit transfer standard ∇ 5.49% of 16.67 (15.8-17.5 l/min)	1 / quarter 1/ 30 days 1/ 30 days 1/ 30 days  Mid Quarter	Part 50, App L, Sect 7.4 Part 50, App L, Sect 9.3 Part 50, App L, Sect 9.3 Part 50, App L, Sect 9.2.5 GM  Part 58, App A, Sect 3.5.1.2 GM

#### **4.0 PM 2.5 DATA REPORTING AND VERIFICATION**

**4.1 DATA TRANSFER** THE QUALITY ASSURANCE CHEMIST WILL NOTIFY THE DATA & STATISTICS TECHNICIAN WHEN THE DATA FOR ALL SITES IN A REGION ARE COMPLETED AND READY FOR SUBMITTAL TO THE US EPA AIRS DATABASE.

**4.1.1 AIRS INPUT FILE** THE D&S TECHNICIAN WILL MAKE BAR CHARTS OF THE DATA. THE TECHNICIAN WILL "PASTE" REVIEWED DATA IN A "MODEL" SPREADSHEET TEMPLATE WHICH CREATES AN AIRS INPUT OF 10 KINDS OF DATA RECORDS.

THESE RECORDS ARE CODED:

CODE	VARIABLE
68101	FLOW CV
68102	VOLUME
68103	AMBIENT TEMPERATURE MIN
68104	AMBIENT TEMPERATURE MAX
68105	AMBIENT TEMPERATURE AVG

68106	PRES MIN
68107	PRES MAX
68108	PRES AVG
68109	VALID (MIN)
88101	UG/M3

SEE ATTACHMENT 9 FOR AIRS DATA STREAM EXAMPLE (80 CHARACTER SET)

**4.2 PRECISION MONITORS** THE SITES THAT HAVE PRECISION PM 2.5 MONITORS (6 DAY SCHEDULE) ARE REPORTED EXACTLY AS THE SITES WITH ONLY ONE MONITOR (4.1.1 POC 1) EXCEPT THE PRECISION POC IS 2 (MILLBROOK IS THE EXCEPTION, REPORT 3).

**4.2.1 PRECISION CALCULATION** THE SITES THAT ARE COLLOCATED HAVE A CALCULATION OF THE DIFFERENCE OF THE TWO MONITORS DIVIDED BY THE AVERAGE OF THE TWO MONITORS OR:

$$\frac{6 \text{ DAY SAMPLER} - \text{SITE SAMPLER}}{[ \frac{6 \text{ DAY SAMPLER} + \text{SITE SAMPLER} ]}{2}} \times 100$$

THIS CALCULATION IS ACCOMPLISHED FOR EACH DAY THAT BOTH SAMPLERS RUN.

SEE ATTACHMENT 10, AQ 98

**4.3 ACCURACY REPORTS** EACH SAMPLER IS CHECKED AT LEAST ONE TIME PER QUARTER BY AN INDEPENDENT TRACEABLE FLOW TRANSFER STANDARD (FTS). THE COMPARISON OF THE SAMPLER TO THE AUDIT DEVICE IS REPORTED ON AN AQ 99. THIS REPORT IS INPUT INTO AIRS. THE CALCULATION:

$$\frac{[\text{SAMPLER FLOW} - \text{FTS FLOW}]}{\text{FTS FLOW}} \times 100$$

SEE ATTACHMENT 11, AQ 99

**4.4 BACK UPS** ALL DATA FOR THE PM 2.5 PROGRAM IS BACKED UP ELECTRONICALLY ON THE SERVER AT THE ECB.

**4.5 AIRS DATA INPUT VERIFICATION** ONCE THE DATA HAS BEEN UPLOADED TO AIRS AND THEN UPDATED BY THE US EPA AIRS SYSTEM, THEN AN AIRS REPORT, AMP 320 RAW DATA REPORT, WILL BE REQUESTED BY DATA & STATISTICS. THIS AMP 320 REPORT WILL BE COMPARED BY DATA & STATISTICS TO THE DATA RELEASED BY THE QA CHEMIST. ALL DATA MUST BE IDENTICAL.

# ATTACHMENT I

## PRC 5: Status Codes

Hexidecimal On Filter file	Sampler	Problem
0	OK	No Status Conditions
(H)1	M	Flash Memory
(H)2	C	Automatic System Calibration Failed
(H)4	Y	System Reset Occurred
(H)8	Z	Power Failure
(H)10	F1	Flow 1 Out of Range
(H)20	F2	x- Flow 2 Out of Range
(H)40	F3	x- Flow 3 Out of Range
(H)80	S1	Flow 1 Stopped Due to 10% Dev for 5 minutes*
(H)100	S2	x- Flow 2 Stopped Due to 10% Dev for 5 minutes*
(H)200	S3	x- Flow 3 Stopped Due to 10% Dev for 5 minutes*
(H)400	A	Ambient Sensor Out of Range
(H)800	T	Filter or Compartment Temp Sensor Out of Range
(H)1000	E	Electronics Temperature Out of Range
(H)2000	R1	Diff of Filter Temp 1 and Ambient Temp > ± 5 °C
(H)4000	R2	x- Diff of Filter Temp 2 and Ambient Temp > ± 5 °C
(H)8000	X	Filter Exchange Mechanism Failure*
(H)10000	N	Out of Filters
(H)20000	O1	Coeff of Variation for Flow 1 Too High
(H)40000	O2	x- Coeff of Variation for Flow 2 Too High
(H)80000	O3	x- Coeff of Variation for Flow 3 Too High
(H)100000	P	Elapsed Sample Period Out of Range
(H)200000	L	Leak Check Failed
(H)400000	D	Audit Performed in Middle of Sample
(H)800000	B	Blank Filter
(H)1000000	S	Stop Key Pressed
(H)2000000	V	Flow #1 >1 lpm non sample times

NOTE: The current status code is the sum of all conditions that currently apply.

x- does not apply to EPA 2025 samplers

### DECIPHERING HEXADECIMAL STATUS CODES

When the Partisol-Plus Sampler's PRC 5: Status Codes are downloaded, they are displayed as hexadecimal numbers. This attachment explains how they relate to the sampler's status codes. Generally, in our everyday lives, we use the decimal number system, which is a

base-10 number system. It uses 10 symbols (0, 1, 2, 3, 4, 5, 6, 7, 8 and 9) to represent number values. The hexadecimal number system is a base-16 number system that uses 16 symbols (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F) to represent number values.

Dec	Hex
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

When downloaded, the Partisol-Plus Sampler's Status Codes are displayed in hexadecimal form. The sampler may display more than one code at a time. When the unit does show more than one status code, it adds the codes together and displays them as a hexadecimal sum.

For example, if the unit displays the Flash Memory status code (hexadecimal number "1") and the System Reset Occurred status code (hexadecimal number "4") at the same time, the two status codes (when downloaded) will be displayed as the hexadecimal number "5." The status Code table has only two status codes that would add up to a value of 5. By looking at this table and breaking down the downloaded status codes, you will be able to decipher which status codes the unit has displayed. To properly use the Status Code table, you must separate the status codes on the table into place holders: the "one's," "ten's," "100's," "1,000's," "10,000's," and "100,000's" and the "1,000,000's" place. To break down the downloaded status codes, you must match each section of the status code with these place holders. See examples for assistance with deciphering hexadecimal status codes.

Example 1:

Decipher the following downloaded status code: 20C30

First, look at the Status Code table and break down the status code into its different place holders:

1) There are no status codes displayed in the “one’s” place of the original status code.  
2) In the “ten’s” place of the original status code, a status code of “30” is displayed. Because there are no status codes in the table that match this number, you will need to break down this number further. In the “ten’s” place of the table, there are only two status codes that, when added together, will amount to 30: 10 “Flow 1 Out of Range” and 20 “Flow 2 Out of Range.” These are two of the status codes that the unit is displaying in its original status code. At this point, you must subtract “30” from the original status code:  $20C30 - 30 = 20C00$ . Now, continue to break down the resulting status code to decipher the rest of the status codes displayed in this number.

3) In the “100’s” place of the new status code (20C00), a status code of “C00 ” is displayed. Because there are no status codes in the table that match this number, you will need to break down this number further. First, convert C00 to a decimal number. From the table, you see that “C” is 12, which converts “C00” to “1200.”

Next, look at the Status Code table to decipher the “1200” status code. In the “100’s” place of the table, there are only two status codes that, when added together, will amount to 1200: 400 “Ambient Sensor Out of Range” and 800 “Filter or Compartment Temp Sensor Out of Range.” These are two more of the status codes that the unit is displaying in its original status code. Now, subtract “C00” from “20C00”:  $20C00 - C00 = 20,000$ . Continue to break down this status code to decipher the rest of the status codes displayed in this number.

4) In the “10,000’s” place of the Status Code table, the status code 20000 “Coeff of Variation for Flow 1 Too High” matches the “20,000” status code. This is the last status code that the unit is displaying in its original status code. Therefore, the downloaded status code, “20C30,” breaks down into the following status codes, according to the Status Code table:

**10 “Flow 1 Out of Range”**

**20 “Flow 2 Out of Range”**

**400 “Ambient Sensor Out of Range”**

**800 “Filter or Compartment Temp Sensor Out of Range”**

**20000 “Coeff of Variation for Flow 1 Too High.”**

Example 2:

Decipher the following downloaded status code: 70B002

First, look at the Status Code table and break down the status code into its different place holders:

1) In the “one’s” place of the original status code, a status code of “2” is displayed. In the “one’s” place of the Status Code table, the “2” status code matches the 2 “Automatic System Calibration Failed” status code. This is one of the status codes that the unit is displaying in its original status code. Now, subtract “2” from “70B002”:  $70B002 - 2 = 70B000$ . Continue to break down this status code to decipher the rest of the status codes displayed in this number.

2) In the “ten’s” place of the new status code, there are no status codes displayed.

3) In the “100’s” place of the new status code, there are no status codes displayed.

4) In the “1,000’s” place of the new status code (70B000), a status code of “B000” is displayed.

Because there are no status codes in the Status Code table that match this number, you will need to break down this number further.

First, convert “B000” to a decimal number. From the table you see that “B” is 11, which converts “B000” to “11,000.” Next, look at the Status Code table to decipher the “11,000” status code. In the “1,000’s” place of the table, there are three status codes that, when added together, will amount to 11,000: 1000 “Electronics Temperature Out of Range,” 2000 “Diff of Filter Temp 1 and Ambient Temp  $> \pm 5^\circ \text{C}$ ” and 8000 “Filter Exchange Mechanism Failure.” These are three more of the status codes that the unit is displaying in its original status code. Now, subtract “B000” from “70B000”:  $70B000 - B000 = 700000$ . Continue to break down this status code to decipher the rest of the status codes displayed in this number.

5) In the “10,000’s” place of the new status code, there are no status codes displayed.

6) In the “100,000’s” place of the new status code (700000), a status code of “700000” is displayed. Because there are no status codes in the Status Codes table that match this number, you will need to break down this number further. In the “100,000’s” place of the PRC 5: Status Code, there are three status codes that, when added together, will amount to “700,000”: 100000 “Elapsed Sample Period Out of Range,” (H)200000 “Leak Check Failed” and 400000 “Audit

Performed in Middle of Sample.” These are three more status codes that the unit is displaying in its original status code. Therefore, the downloaded status code, “70B002,” breaks down into the following status codes, according to the Status Code table:

**2 “Automatic System Calibration Failed”**

**1000 “Electronics Temperature Out of Range”**

**2000 “Diff of Filter Temp 1 and Ambient Temp >  $\pm 5^{\circ}$  C”**

**8000 “Filter Exchange Mechanism Failure”**

**100000 “Elapsed Sample Period Out of Range”**

**200000 “Leak Check Failed”**

**400000 “Audit Performed in Middle of Sample.”**

## **ATTACHMENT 4**

**NULL CODES**

**VALIDITY FLAGS**

AQS	AIRS Code	Item Description	AIRS/AQS Code	Item Description
AA	9967	SAMPLE PRESSURE OUT OF LIMITS	A	HIGH WINDS
AB	9968	TECHNICIAN UNAVAILABLE	B	STRATOSPHERIC OZONE
AC	9969	CONSTRUCTION/REPAIRS IN AREA	INTRUSION	
AD	9970	SHELTER STORM DAMAGE	C	VOLCANIC ERUPTIONS
AE	9971	SHELTER TEMPERATURE OUTSIDE LIMITS	D	SANDBLASTING
AF	9972	SCHEDULED BUT NOT COLLECTED	E	FOREST FIRE
AG	9973	SAMPLE TIME OUT OF LIMITS	F	STRUCTURAL FIRE
AH	9974	SAMPLE FLOW RATE OUT OF LIMITS	G	HIGH POLLEN COUNT
AI	9975	INSUFFICIENT DATA (CAN'T CALCULATE)	H	CHEMICAL SPILLS & INDUST. ACCIDENTS
AJ	9976	FILTER DAMAGE	I	UNUSUAL TRAFFIC CONGESTION
AK	9977	FILTER LEAK	J	CONSTRUCTION/DEMOLITION
AL	9978	VOIDED BY OPERATOR	K	AGRICULTURAL TILLING
AM	9979	MISCELLANEOUS VOID	L	HIGHWAY CONSTRUCTION
AN	9980	MACHINE MALFUNCTION	M	REROUTING OF TRAFFIC
AO	9981	BAD WEATHER	N	SANDING/SALTING OF STREETS
AP	9982	VANDALISM	O	INFREQUENT LARGE GATHERINGS
AQ	9983	COLLECTION ERROR	P	ROOFING OPERATIONS
AR	9984	LAB ERROR	Q	PRESCRIBED BURNING
AS	9985	POOR QUALITY ASSURANCE	R	CLEAN UP AFTER A MAJOR DISASTER
AT	9986	CALIBRATION	S	SEISMIC ACTIVITY
AU	9987	MONITORING WAIVED	T	MULTIPLE PM2.5 VALIDITY
AV	9988	POWER FAILURE (POWR)	FLAGS	
AW	9989	WILDLIFE DAMAGE	U	SAHARA DUST
AX	9990	PRECISION CHECK (PREC)	V	VALIDATED VALUE
AY	9991	Q C CONTROL POINTS (ZERO/SPAN)	W	FLOW RATE AVERAGE OUT OF SPEC.
AZ	9992	Q C AUDIT (AUDT)	X	FILTER TEMPERATURE DIFFERENCE
BA	9993	MAINTENANCE/ROUTINE REPAIRS	Y	ELAPSED SAMPLE TIME OUT OF SPEC.
BB	9994	UNABLE TO REACH SITE	1	DEVIATION FROM A CFR/CRITICAL
BC	9995	MULTI-POINT CALIBRATION		CRITERIA REQUIREMENT
BD	9996	AUTO CALIBRATION	2	OPERATIONAL DEVIATIONS
BE	9997	BUILDING/SITE REPAIR	3	FIELD ISSUE
			4	LAB ISSUE
			5	OUTLIER

<p>BF 9998 PRECISION/ZERO/SPAN BG 9966 MISING OZONE DATA NOT LIKELY TO EXCEED LEVEL OF STANDARD</p>	<p>6 QAPP ISSUE 7 BELOW LOWEST CALIBRATION LEVEL  updated Jan 15, 2001</p>
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**ATTACHMENT 6**

ID2	Agency_Monitor_Id	Site	Parameter_Code	cboMethodcode	Comment	AIRS
10 1	20719	175 BINGHAM RD, ASHEVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370210034
10 2	20750	175 BINGHAM RD, ASHEVILLE	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	370210034
10 3	20732	9 MAIN ST, WAYNESVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370870010
10 5	20734	E MARION JR HS, BALDWIN AVE, MARION	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371110004
10 7	20739	CITY HALL, SUMMIT ST, SPRUCE PINE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371210001
10 8	20753	CITY HALL, SUMMIT ST, SPRUCE PINE	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	371210001
10 9	20745	PARKS 7 REC FACIL, CENTER ST, BRYSON CITY	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371730002
19 1		EASTERN BAND OF THE CHEROKEE INDIANS			R and P Sequential Sampler	370990006
19 2		EASTERN BAND OF THE CHEROKEE INDIANS			Collocated R & P Seq. Samp.	370990006
30 1	370250004	FLOYD ST, KANNAPOLIS	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370250004
30 5	20717	1622 E GARRISON BLVD GASTONIA	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370710016
30 6	20751	1622 E GARRISON BLVD GASTONIA	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	370710016
30 7	370350004	1650 1ST ST, HICKORY	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370350004
309		USED			R and P Sequential Sampler	
39 1	20735	FIRE STA #10, 2136 REMOUNT RD, CHARLOTTE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371190010
39 3	20737	MONTCLAIRE, CHARLOTTE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371190042
39 4	20737	MONTCLAIRE, CHARLOTTE	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	371190042
39 5	20738	GARRINGER, 1130 EASTWAY DR, CHARLOTTE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371190041
40 1	20718	827 S GRAHAM & HOPEDALE RD, BURLINGTON	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370010002
40 3	20721	CHERRY GROVE RECR, CHERRY GROVE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370330001
40 5	20730	EDGEWORTH & BELLEMEAD ST, GREENSBORO	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370810009

40 6	20752	EDGEWORTH & BELLEMEAD ST, GREENSBORO	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	370810009
40 7	20731	BOONE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371890003
40 9		S SALISBURY ST LEXINGTON	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370570002
49 1	20728	1300 HA TTIE AVE, WINSTON-SALEM	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370670022
49 3	20729	N FORSYTH HIGH SCHOOL, WINSTON- SALEM	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370670024
49 5	20729	N FORSYTH HIGH SCHOOL, WINSTON- SALEM	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	370670024
50 1	370370004	RT 4 BOX 62, PITTSBORO	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370370004
50 3	370630001	HEALTH DEPT, 300L E MAIN ST, DURHAM	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370630001
50 5	370650003	TALBERT PARK, ROCKY MT	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370650003
50 7	371350007	MASON FARM RD & COLUMBIA, CHAPEL HILL	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371350007
50 9	371830014	E MILLBROOK JHS, 3801 SPRING FOREST RD, RAL	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371830014
51 0	20756	E MILLBROOK JHS, 3801 SPRING FOREST RD, RAL	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	371830014
51 1	20747	ST. AUG COLL, 808 N STATE ST, RALEIGH	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371830015
60 1	370510009	W B OWEN SCHOOL RAEFORD RD FAYETTEVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370510009
60 2	20749	W B OWEN SCHOOL RAEFORD RD FAYETTEVILLE	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	370510009
60 3	20716	112 PERRY DR, CANDOR	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371230001
60 5	20715	IHS LUMBERTON	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371550005
70 1	20725	HWY 70E & HWY 58S, KINSTON	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371070004
70 3	371390002	600 WESTOVER ST, ELIZABETH CITY	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371390002
70 5	371470005	851 HOWELL ST, GREENVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371470005
70 6	20755	851 HOWELL ST, GREENVILLE	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	371470005
70 7	20748	DILLARD MS, DEVEREAU ST,	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential	371910005

7		GOLDSBORO			Sampler	
80 1	20733	HWY 50 KENANSVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	370610002
80 3	20740	2710 MARKET ST, WILMINGTON	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371290009
80 4	20754	2710 MARKET ST, WILMINGTON	PM2.5 - LOCAL CONDITIONS	118	Collocated R & P Seq. Samp.	371290009
80 5	20741	617 HENDERSON DR, JACKSONVILLE	PM2.5 - LOCAL CONDITIONS	118	R and P Sequential Sampler	371330005
80 7		CASTLE HAYNE			R and P Sequential Sampler	371290002

**Use the 9 digit ID column #4 for Site ID#1 on the specific sampler that is described**  
**Use the 3 digit ID column #1 for Site ID#2 on the specific sampler that is described**

7/15/02

### Attachment 7

#### GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

**Acceptance criteria** — Specified limits placed on characteristics of an item, process, or service defined in requirements documents. (ASQC Definitions)

**Accuracy** — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; the EPA recommends using the terms “*precision*” and “*bias*”, rather than “accuracy,” to convey the information usually associated with accuracy. Refer to *Appendix D, Data Quality Indicators* for a more detailed definition.

**Activity** — An all-inclusive term describing a specific set of operations of related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that, in total, result in a product or service.

**Assessment** — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

**Audit (quality)** — A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

**Audit of Data Quality (ADQ)** — A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

**Authenticate** — The act of establishing an item as genuine, valid, or authoritative.

**Bias** — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value). Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

**Blank** — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

**Calibration** — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

**Calibration drift** — The deviation in instrument response from a reference value over a period of time before recalibration.

**Certification** — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

**Chain of custody** — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

**Characteristic** — Any property or attribute of a datum, item, process, or service that is distinct, describable, and/or measurable.

**Check standard** — A standard prepared independently of the calibration standards and analyzed exactly like the samples. Check standard results are used to estimate

analytical precision and to indicate the presence of bias due to the calibration of the analytical system.

**Collocated samples** — Two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

**Comparability** — A measure of the confidence with which one data set or method can be compared to another.

**Completeness** — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

**Computer program** — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as “software,” or it may be stored permanently on computer chips, referred to as “firmware.” Computer programs covered in a QAPP are those used for design analysis, data acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

**Confidence Interval** — The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability.

**Confidentiality procedure** — A procedure used to protect confidential business information (including proprietary data and personnel records) from unauthorized access.

**Configuration** — The functional, physical, and procedural characteristics of an item, experiment, or document.

**Conformance** — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

**Consensus standard** — A standard established by a group representing a cross section of a particular industry or trade, or a part thereof.

**Contractor** — Any organization or individual contracting to furnish services or items or to perform work.

**Corrective action** — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

**Correlation coefficient** — A number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables. The most common correlation coefficient is the product-moment, a measure of the degree of linear relationship between two variables.

**Data of known quality** — Data that have the qualitative and quantitative components associated with their derivation documented appropriately for their intended use, and when such documentation is verifiable and defensible.

**Data Quality Assessment (DQA)** — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA Process include: 1) reviewing the DQOs and sampling design, 2) conducting a preliminary data review, 3) selecting the statistical test, 4) verifying the assumptions of the statistical test, and 5) drawing conclusions from the data.

**Data Quality Indicators (DQIs)** — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness.

**Data Quality Objectives (DQOs)** — The qualitative and quantitative statements derived from the DQO Process that clarify study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

**Data Quality Objectives (DQO) Process** — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

- ! state the problem,
- ! identify the decision,
- ! identify the inputs to the decision,
- ! define the boundaries of the study,
- ! develop a decision rule,
- ! specify tolerable limits on decision errors, and
- ! optimize the design for obtaining data.

DQOs are the qualitative and quantitative outputs from the DQO Process.

**Data reduction** — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

**Data usability** — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

**Deficiency** — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

**Demonstrated capability** — The capability to meet a procurement's technical and quality specifications through evidence presented by the supplier to substantiate its claims and in a manner defined by the customer.

**Design** — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

**Design change** — Any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto.

**Design review** — A documented evaluation by a team, including personnel such as the responsible designers, the client for whom the work or product is being designed, and a quality assurance (QA) representative but excluding the original designers, to determine if a proposed design will meet the established design criteria and perform as expected when implemented.

**Detection Limit (DL)** — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

**Distribution** — 1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; 2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

**Document** — Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

**Document control** — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

**Duplicate samples** — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

**Environmental conditions** — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

**Environmental data** — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

**Environmental data operations** — Any work performed to obtain, use, or report information pertaining to environmental processes and conditions.

**Environmental monitoring** — The process of measuring or collecting environmental data.

**Environmental processes** — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

**Environmental programs** — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and

development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

**Environmental technology** — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

**Estimate** — A characteristic from the sample from which inferences on parameters can be made.

**Evidentiary records** — Any records identified as part of litigation and subject to restricted access, custody, use, and disposal.

**Expedited change** — An abbreviated method of revising a document at the work location where the document is used when the normal change process would cause unnecessary or intolerable delay in the work.

**Field blank** — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

**Field (matrix) spike** — A sample prepared at the sampling point (i.e., in the field) by adding a known mass of the target analyte to a specified amount of the sample. Field matrix spikes are used, for example, to determine the effect of the sample preservation, shipment, storage, and preparation on analyte recovery efficiency (the analytical bias).

**Field split samples** — Two or more representative portions taken from the same sample and submitted for analysis to different laboratories to estimate interlaboratory precision.

**Financial assistance** — The process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

**Finding** — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally accompanied by specific examples of the observed condition.

**Goodness-of-fit test** — The application of the chi square distribution in comparing the frequency distribution of a statistic observed in a sample with the expected frequency distribution based on some theoretical model.

**Grade** — The category or rank given to entities having the same functional use but different requirements for quality.

**Graded approach** — The process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results. (See also *Data Quality Objectives (DQO) Process*.)

**Guidance** — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

**Guideline** — A suggested practice that is not mandatory in programs intended to comply with a standard.

**Hazardous waste** — Any waste material that satisfies the definition of hazardous waste given in 40 CFR 261, "Identification and Listing of Hazardous Waste."

**Holding time** — The period of time a sample may be stored prior to its required analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or "flagging" of any data not meeting all of the specified acceptance criteria.

**Identification error** — The misidentification of an analyte. In this error type, the contaminant of concern is unidentified and the measured concentration is incorrectly assigned to another contaminant.

**Independent assessment** — An assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

**Inspection** — The examination or measurement of an item or activity to verify conformance to specific requirements.

**Internal standard** — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

**Item** — An all-inclusive term used in place of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, product, structure, subassembly, subsystem, system, unit, documented concepts, or data.

**Laboratory split samples** — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability.

**Limit of quantitation** — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

**Management** — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

**Management system** — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

**Management Systems Review (MSR)** — The qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

**Matrix spike** — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

**May** — When used in a sentence, a term denoting permission but not a necessity.

**Mean (arithmetic)** — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

**Mean squared error** — A statistical term for variance added to the square of the bias.

**Measurement and Testing Equipment (M&TE)** — Tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

**Memory effects error** — The effect that a relatively high concentration sample has on the measurement of a lower concentration sample of the same analyte when the higher concentration sample precedes the lower concentration sample in the same analytical instrument.

**Method** — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

**Method blank** — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

**Mid-range check** — A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

**Mixed waste** — A hazardous waste material as defined by 40 CFR 261 Resource Conservation and Recovery Act (RCRA) and mixed with radioactive waste subject to the requirements of the Atomic Energy Act.

**Must** — When used in a sentence, a term denoting a requirement that has to be met.

**Nonconformance** — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

**Objective evidence** — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

**Observation** — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

**Organization** — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

**Organization structure** — The responsibilities, authorities, and relationships, arranged in a pattern, through which an organization performs its functions.

**Outlier** — An extreme observation that is shown to have a low probability of belonging to a specified data population.

**Parameter** — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

**Peer review** — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

**Performance Evaluation (PE)** — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

**Pollution prevention** — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

**Population** — The totality of items or units of material under consideration or study.

**Precision** — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

**Procedure** — A specified way to perform an activity.

**Process** — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

**Project** — An organized set of activities within a program.

**Qualified data** — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

**Qualified services** — An indication that suppliers providing services have been evaluated and determined to meet the technical and quality requirements of the client as provided by approved procurement documents and demonstrated by the supplier to the client's satisfaction.

**Quality** — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

**Quality Assurance (QA)** — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

**Quality Assurance Program Description/Plan** — See *quality management plan*.

**Quality Assurance Project Plan (QAPP)** — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Project Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

**Quality Control (QC)** — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring the results are of acceptable quality.

**Quality control (QC) sample** — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

**Quality improvement** — A management program for improving the quality of operations. Such

management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

**Quality management** — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

**Quality Management Plan (QMP)** — A formal document that describes the quality system in terms of the organization’s structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

**Quality system** — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

**Radioactive waste** — Waste material containing, or contaminated by, radionuclides, subject to the requirements of the Atomic Energy Act.

**Readiness review** — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

**Record (quality)** — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

**Recovery** — The act of determining whether or not the methodology measures all of the analyte contained in a sample. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

**Remediation** — The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health.

**Repeatability** — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

**Reporting limit** — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

**Representativeness** — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition. See also *Appendix D, Data Quality Indicators*.

**Reproducibility** — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

**Requirement** — A formal statement of a need and the expected manner in which it is to be met.

**Research (applied)** — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

**Research (basic)** — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

**Research development/demonstration** — The systematic use of the knowledge and understanding gained from research and directed toward the production of useful materials, devices, systems, or methods, including prototypes and processes.

**Round-robin study** — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are compared and used to develop summary statistics such as interlaboratory precision and method bias or

recovery efficiency.

**Ruggedness study** — The carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

**Scientific method** — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

**Self-assessment** — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

**Sensitivity** — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

**Service** — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, and installation.

**Shall** — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

**Should** — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

**Significant condition** — Any state, status, incident, or situation of an environmental process or condition, or environmental technology in which the work being performed will be adversely affected sufficiently to require corrective action to satisfy quality objectives or specifications and safety requirements.

**Software life cycle** — The period of time that starts when a software product is conceived and ends when the software product is no longer available for routine use.

The software life cycle typically includes a requirement phase, a design phase, an implementation phase, a test phase, an installation and check-out

phase, an operation and maintenance phase, and sometimes a retirement phase.

**Source reduction** — Any practice that reduces the quantity of hazardous substances, contaminants, or pollutants.

**Span check** — A standard used to establish that a measurement method is not deviating from its calibrated range.

**Specification** — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

**Spike** — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

**Split samples** — Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

**Standard deviation** — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

**Standard Operating Procedure (SOP)** — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

**Supplier** — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

**Surrogate spike or analyte** — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

**Surveillance (quality)** — Continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

**Technical review** — A documented critical review of work that has been performed within the state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work but are collectively equivalent in technical expertise to those who performed the original work. The review is an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements have been satisfied.

**Technical Systems Audit (TSA)** — A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, recordkeeping, data validation, data management, and reporting aspects of a system.

**Traceability** — The ability to trace the history, application, or location of an entity by means of recorded

identifications. In a calibration sense, traceability relates measuring equipment to national or international

standards, primary standards, basic physical constants or properties, or reference materials. In a data

collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

**Trip blank** — A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

**Validation** — Confirmation by examination and provision of objective evidence that the particular

requirements for a specific intended use have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs. See also *Appendix G, Data Management*.

**Variance (statistical)** — A measure or dispersion of a sample or population distribution. Population variance is the sum of squares of deviation from the mean divided by the population size (number of elements). Sample variance is the sum of squares of deviations from the mean divided by the degrees of freedom (number of observations minus one).

**Verification** — Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity.

## ATTACHMENT 8

2025 1.300 F D

Filter ID	Cass ID	Set Start Date	Set Start Time	Act Start Date	Act Start Time	Set Stop Date	Se
T0082818	RP019509	12/23/00	0:00	12/23/00	0:00	12/24/00	

T0082819	RP007232	12/26/00	0:00	12/26/00	0:00	12/27/00
T0082820	RP016247	12/29/00	0:00	12/29/00	0:00	12/30/00
T0083013	RP008180	1/1/01	0:00	1/1/01	0:00	1/2/01
T0083014	RP007729	1/2/01	0:00	1/2/01	0:00	1/2/01

Flow cv	Volume	Amb Temp Min	Amb Temp Ave	Amb Temp Max	Filt Temp Min	Filt Temp Ave	Filt
0	24.1	-3.7	0.2	5.9	-3.9	0.9	
0.1	24.1	-5.1	0.9	7.5	-4.8	2	
0.3	24.1	-1.7	3.5	9.2	-2.1	4.4	
0	24.1	-2.4	3.2	9.5	-1.5	4.5	
0	0	0	0	0	0	0	

Pres Max	Max Diff Temp	Date	Time	Site ID1	Site ID2	Status Codes
774	2.4	12/23/00	14:55	370610002	801	0
775	3.3	12/26/00	12:35	370610002	801	0
759	3	12/29/00	15:15	370610002	801	0
768	3.7	1/1/01	14:00	370610002	801	0
0	0	1/1/80	0:00	370610002	801	800000

Ave Wind Speed	Ave Wind Vel	Ave Wind Dir	RH Min	RH Ave	RH Max	Ave AI
0.2	0.2	0	27.3	34.6	49.6	0
0.2	0.2	0	26	33	45.5	0
0.2	0.2	0	33.2	47.7	68	0
0.2	0.2	0	27.3	41	53.2	0
0	0	0	0	0	0	0

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## ATTACHMENT 10

June 15, 2000

MEMORANDUM

SUBJECT: Flagging and Valid PM2.5 Data

FROM: Richard D. Scheffe, Leader (*Original signed by Rich Scheffe*), Monitoring and Quality Assurance Group (MD-14)

TO: Regional Monitoring Contacts

I would like to reiterate some information in the memo from David Mobley of March 27, 2000 (Attachment 1) which described the use of flags. Attachment C of the memo states "Flags would be placed only on data which the State/local was uncertain of its quality, not on data it considers to be invalid, which should not be entered." There has been some misconception among some agencies that EPA wants to see all the data. This is not true. State and local agencies have developed QAPP's and quality systems to determine data validity, and we do not want data that agencies truly feel is invalid to enter into AIRS.

Our current thinking is that flagged data have the potential to be validated, or be of benefit to a secondary use, such as network design. However, due to existing regulations/ guidance, there are cases where potentially valid data are labeled invalid. An example might be the violation of the 96-hour filter retrieval requirement which we hope to demonstrate has negligible impact on data quality. Another example is the lack of an approved QAPP prior to data collection. On the other hand, obviously poor quality data corroborated by a number of QC check failures should not be entered, despite the lack of explicit requirements. In short, we are asking QA managers who have developed their quality system to utilize their technical expertise and available quality control information during the data validation process.

The PM2.5 flags were generated for data that either did not meet a CFR criteria for which the State felt the quality of the data were acceptable, or for data that they were unsure of its quality. Based on conversations and my knowledge of the past, there were two ways an agency would address this issue:

- 1) not enter the data, or
- 2) enter the data as valid.

Neither of these decisions is optimal because, in the first case, data of adequate quality for either NAAQS comparisons or other uses is not available or, in the second case, inappropriate data are used for the NAAQS or other evaluations.

Flags provide a way for the data generators to appropriately qualify data for the data users and will allow us to determine what acceptance criteria do not significantly effect quality and, therefore, remove it from the reference method. Flags also allow us the option to revise our requirements (regulations and guidance) over the next 2 years and salvage potentially useful data that have been collected prior to such change.

We recognize the potential burden placed on data analysts as well as confusion generated by adding flags, and expect that issues raised by flags to be resolved prior to utilizing the data for designation purposes. Based on comments raised by participants at the recent PM2.5 Workshop, clearly, more work is required among all of us on developing an effective flag policy. We do not intend to extend these flagging procedures to other criteria pollutants.

Attachment

**Use of Data Flags for PM 2.5 Data**

OAQPS is emphasizing the need to accumulate as much PM<sub>2.5</sub> data into AIRS as possible in order to perform various data analysis and data quality assessments. Since EPA and the States have gone to the effort to collect this information, it is important that we use it to gain as much knowledge as possible about preliminary concentrations, trends, and ways to improve data quality. OAQPS has developed a set of generic data qualifiers (flags) in order to allow data to be entered in AIRS that the State/locals believe have value, but are unsure of its quality. The approach tries to provide a balance of ease of use and specificity. Due to limitations in the current AIRS network, the only place for flags is in the exceptional event area where most letters are already in use.

There are 4 flags already associated with PM<sub>2.5</sub>. The flags T, W, X and Y are the flags associated with the sampler acceptance criteria identified in Table L-1 of 40 CFR Part 50. The 6 flags listed below can also be used. Applicability of other flags in AIRS pertaining to PM<sub>10</sub> or other pollutants has not been determined.

If you have any questions on this information, please contact Michael Papp (919-541-2408) or Rich Scheffe (919-541-4650).

### Flag Comments

- 1. Deviation from a CFR requirement**- Data collected did not or may not meet all of the critical criteria for sampling and analysis as specified in CFR and the Validation Template critical criteria table (Table 1). As stated in the Validation Template: *“Criteria that were deemed critical to maintaining the integrity of a sample or group of samples were placed in the **Critical Criteria Table** (see Table 1). Observations that do not meet each and every criterion on the Critical Criteria Table should be invalidated unless there are compelling reason and justification for not doing so. Basically, the sample or group of samples for which one or more of these criteria are not met is invalid until proven otherwise.”* The State/local may use this flag when it is unclear of the effect of the deviation on data quality. This flag should be rarely used, but there may be instances where other QA/QC information tend to validate the sample or changes/updates to the critical criteria table may allow utilization of the data for some purposes.
  - 2. Operational Deviations**- Data quality may be impacted by sampling and analysis procedures which did not or may not comply with acceptable range or threshold values from either the Validation Template operational evaluations table (see Table 2) or a State/local defined acceptance criteria.
  - 3. Field Issue** - Data that may have been effected by events occurring in the field that could potentially have compromised the integrity of the sample (oil crystallization, excessive dust etc.)
  - 4. Lab Issue**- Data that may have been effected by events occurring in the lab that could potentially have compromised the integrity of the sample (cassette off gassing, etc.)
  - 5. Outlier** - Data value that appears to be invalid either because it is outside the normal/expected range of concentrations or fails various statistical or comparison tests. However, there is no additional information available that would provide a reason to invalidate the value(s).
  - 6. QAPP Issue** - Data collection prior to QAPP approval per 01/21/99 memo from Bill Hunt
- Flags would be placed only on data for which the State/local was uncertain of its quality, not on data it considers to be invalid, which should not be entered.** Since these flags are generic and AIRS does not have a free form comment field at the individual sampler level, State and locals would have to document, at the local level, the actual problem that occurred with each sample that is flagged.

Tables 1 and 2 provide examples of more specific flags that could be associated with the generic flag. For example, each “1” flag could be associated with another flag (1\_ \_) that would distinguish the actual CFR criteria violated. This way, the State and locals would not have to generate much in the way of free form notes on the flagged data. In addition, there are some acceptance criteria in the Validation Template that

would not require a flag. These are designated by "N/A". State and local agencies would have to develop any additional flags not identified in Tables 1 and 2. Use of flags would allow more data into the system, affording better data analysis and data quality assessments (prior to any official NAAQS assessment) to determine whether or not the flagged data could be used for attainment decisions. These assessments would also help effect changes in acceptance criteria in our regulation and guidance documents. OAQPS plans on using the Data Validation Workgroup, made up of EPA Regions and State and local monitoring representatives who helped develop the PM2.5 Data Validation Template, to assist in evaluation of the usefulness of flagged data.

## ATTACHMENT 11

### AQ - 98

Region	Site	AIRS Code		Unit	µg/m3	0 = void	
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ARO	Spruce Pine	371210001	DATE	Code	3 day	6 day	% Diff.
			4/1/01	01	8.92	8.79	-1.47
Pollutant ID	Method Code		4/7/01	01	19.75	19.33	-2.15
25	118		4/13/01	01	7.75	0	
			4/19/01	01	13.08	13.08	0.0
State & Report. Org.			4/25/01	01	0	9.96	
37001	Year	Qtr	5/1/01	01	22	22	0.0
	2001	2nd	5/7/01	01	10	10	0.0