UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4

Science and Ecosystem Support Division
Field Services Branch
980 College Station Road
Athens, Georgia 30605-2720

September 14, 2018

Mr. Robert Colby, Director
Chattanooga Hamilton County
Air Pollution Control Bureau
6125 Preservation Drive
Chattanooga, Tennessee 37416

SESD Project # QT16-0038

Dear Mr. Colby:

We have reviewed the following document that you submitted for approval:

Quality Assurance Project Plan 2018 for Chattanooga-Hamilton County Air Pollution Control Ambient Air Monitoring Program

The quality assurance and technical elements within this QAPP were compared to EPA regulations and current guidance. The stated procedures appear to be clear, sound, and appropriate as written, to the extent they can be evaluated. EPA approval of this document is granted. Please be aware that approval of this QAPP does not constitute a waiver from any regulatory requirements. Your agency remains accountable for ensuring that this ambient air monitoring project adheres to all the applicable requirements detailed in 40 CFR Parts 50, 53, and 58, and that the data generated is of sufficient quality to be used for regulatory decision-making purposes. This QAPP should be reviewed internally by Chattanooga Hamilton County on an annual basis and revised when procedures change; at a minimum, the QAPP must be revised within five years.

If you have any questions, please contact Richard Guillot at 706-355-9737 or via email at guillot.richard@epa.gov.

Sincerely,

Tim Simpson, Acting Chief,
Superfund and Air Section

QUALITY ASSURANCE PROJECT PLAN

2018

Rev 3 9/7/18
Rev 2 3/8/18
Rev 1 11/18/15
Approved 4/23/07
Original 3/30/07

Chattanooga Hamilton County
Air Pollution Control Bureau

Kathy Jones
Air Monitoring Manager

1. QUALITY ASSURANCE PROJECT PLAN IDENTIFICATION AND APPROVAL

Quality Assurance Project Plan 2018 for Chattanooga-Hamilton County Air Pollution Control Ambient Air Monitoring Program

The attached QAPP is hereby recommended for approval and commits the Chattanooga Hamilton County Air Pollution Control Bureau to follow the elements described within.

1) Signature: Kathy Jones Date 9/7/18
Air Monitoring Manager

2) Signature: Robert H Kelly Date 9-7-18
Director

3) Signature: Timothy Simpson Date 9-14-18
EPA Region 4 Quality Assurance Officer

Courtesy Copy of EPA approved final version will be provided to the State of Tennessee

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3. GLOSSARY OF TERMS

Airvision- Agilaire Data Acquisition Software on a central telemetry computer
Accuracy- the degree of agreement between an observed value and an accepted reference value.
AQI- Air Quality Index: index developed by EPA to indicate the magnitude of the highest pollutant of the previous day, color coded to reflect pollution health warnings
AQS- Air Quality System- EPA's National Air Monitoring Database
APTI- Air Pollution Training Institute
AV Trends- Agilaire Data Acquisition software for a PC operated at a site
Audit- comparison against a NIST traceable magnitude of ozone or, for particulate, comparison against a NIST traceable flow, temperature, and/or pressure standard
Certificate of Exemption- Document that exempts the local agency from State of Tennessee regulatory authority
CHCAPCB- Chattanooga-Hamilton County Air Pollution Control Bureau
DQO- Data Quality Objectives
DQA- Data Quality Assessment
DQI- Data Quality Indicators
EDAS- Data Acquisition Software by ESC, Bureau legacy software
Exceptional Events (EE)- Pollution events affecting Bureau data documented and flagged in AQS and for which a formal request for EE status may be submitted to EPA
FEM- Federal Equivalent Monitor- EPA approved monitoring method
FRM- Federal Reference Monitor-EPA approved monitoring method
IML- Inter-Mountain Laboratories of Sheridan, Wyoming
MOA- Memorandum of Agreement with the State of Georgia
NAAQS- National Ambient Air Quality Standards
NPAP- National Performance Audit Program for gases
Null Value Codes- Explanatory codes placed in AQS for missing data
NIST- National Institute of Science and Technology
PEP- Performance Evaluation Program (national) for particulate
PQAO- Primary Quality Assurance Organization
Precision Check- a measure of agreement among repeated measurements of the same property under identical, or substantially similar, conditions
Region 4- Group of southeastern states termed Region 4 by EPA: Tennessee, Kentucky, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida. EPA Region 4 is headquartered in Atlanta.
QMP- Quality Management Plan
SESD- Science and Ecosystem Division of EPA, Athens, Georgia
SLAMS- State and Local Air Monitoring Sites
SOP- Standard Operating Procedure
Span Check- one point ozone measurement at the full span or near full span of the instrument scale
State- Tennessee Dept. of Environment & Conservation, Air Pollution Control Division
T640- Teledyne $PM_{2.5}$/PM_{10} continuous light scattering instrument. Not FEM for PM_{10}
TEOM- Tapered Element Oscillating Microbalance, Thermo Environmental Instruments, LLC, $PM_{2.5}$ Continuous
The Bureau- Chattanooga-Hamilton County Air Pollution Control Bureau
TSA- Technical Systems Audit conducted by EPA SESD
VSCC- Very Sharp Cut Cyclone

4. DISTRIBUTION LIST

The Bureau

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EPA

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Region4/ Atlanta	Sara Waterson	waterson.sara@epa.gov	404-562-9061

5. ORGANIZATION

5.1. Introduction

The Chattanooga-Hamilton County Air Pollution Control Bureau is a local air pollution control agency for Hamilton County, Tennessee. Each of the four major metropolitan areas in Tennessee has a local air pollution control agency for that county. Those agencies each have a Certificate of Exemption which exempts them from regulatory oversight by the State of Tennessee Air Pollution Control Board. There are local agencies in Knox County (Knoxville), Shelby County (Memphis), and Davidson County (Nashville) in addition to the local agency in Hamilton County (Chattanooga). The State of Tennessee agency covers the other 91 counties in Tennessee. There are, therefore, five air monitoring networks in the state, four of which are managed by local agencies that each have regulatory authority over one county. In some cases, the State of Tennessee or nearby states' sites and local agency sites are in close proximity.

Hamilton County includes ten municipalities -- the City of Chattanooga, the City of Soddy Daisy, the Town of Signal Mountain, the Town of Lookout Mountain, the City of East Ridge, the City Red Bank, the City of Collegedale, the City of Lakesite, the Town of Walden, and the City of Ridgeside. Both Hamilton County and the City of Chattanooga contribute to the funding of the agency.

Hamilton County is situated just above and to the east of the Tennessee, Alabama, Georgia state intersection and directly above the State of Georgia. The State of Georgia operates a particulate site in Hamilton County's designation area in Walker County, Georgia. This geographical position makes cooperative efforts with the State of Georgia imperative. Hamilton County attainment areas for both ozone and particulate contain Georgia counties. The Bureau has a Memorandum of Agreement (MOA) with the State of Georgia to share information in a working relationship.

Hamilton County has geographic features critical to the understanding of local air quality as the county is bordered on the east by White Oak Mountain, on the west by a row of mountains-

Lookout, Raccoon, Elder, and Signal Mountains, and bisected down the middle by a long ridge. North of the Tennessee River, which runs horizontally through the heart of the city, the ridge is called Big Ridge, south of the river it is named Missionary Ridge.

During the Civil War many battles were fought in the area because Chattanooga was a railroad hub between the North and the South.

Figure 1. Map of Tennessee

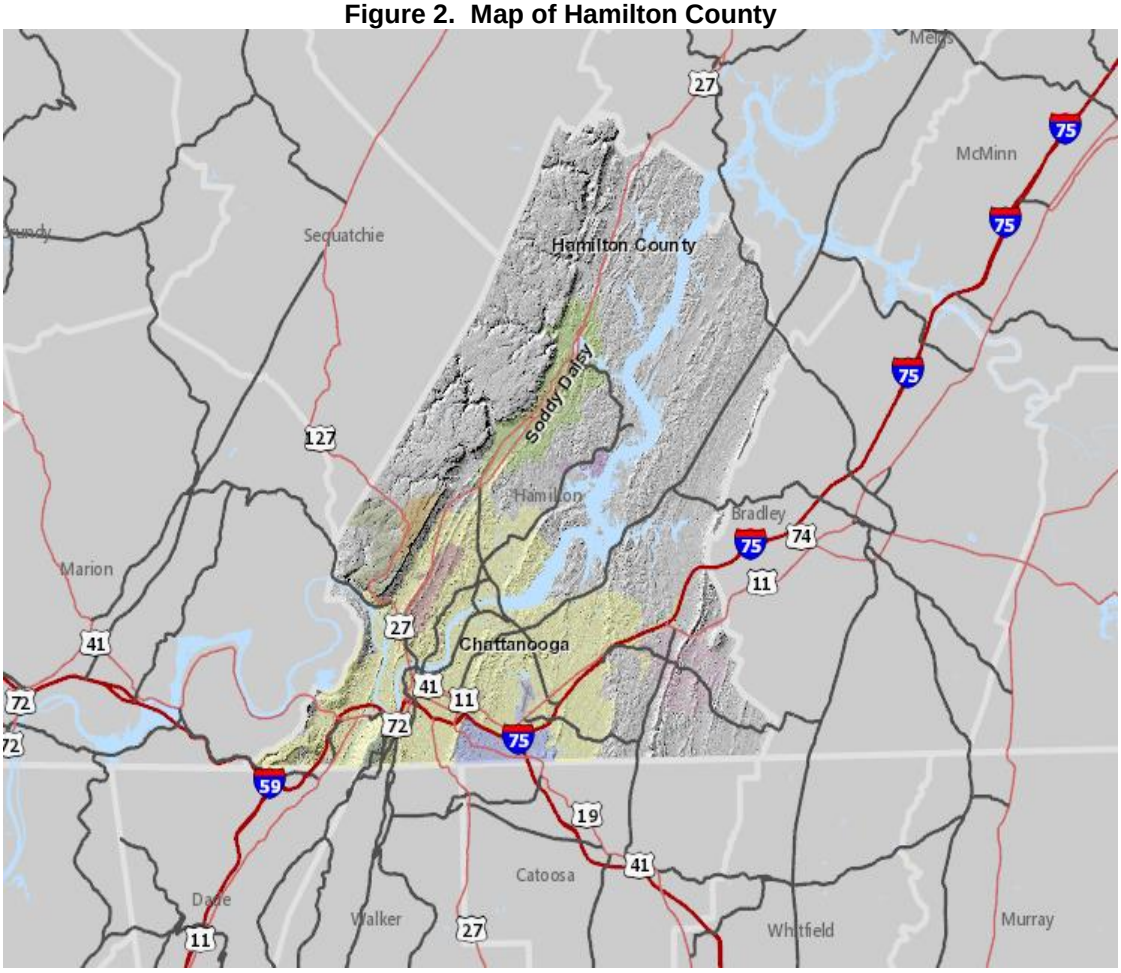
Interstate 75 is a major North-South transportation corridor that runs east of downtown. The Georgia border is roughly four miles from downtown Chattanooga and also borders the City of East Ridge.

In 1969 Chattanooga was named the most polluted city in the nation by the Department of Health Education and Welfare. The effort to reduce pollution has been considerable and successful. Now Chattanooga is known internationally for its revitalization- of which good air quality plays a part. National and international sporting events are becoming commonplace as Ironman Competitions and the Head of the Hooch Regatta are both held in Chattanooga. These events bring in millions of dollars to the Chattanooga economy. Competitive athletes cannot function in a polluted environment, therefore, clean air is essential to the “outdoor” economy.

Effective January 1, 2015, each agency in the State of Tennessee became its own Primary Quality Assurance Organization (PQAO). Hamilton County, therefore, is responsible for its own quality assurance. There is a cooperative relationship with the State of Tennessee and copies of important documents are sent to the State as a courtesy. Major documents are shared with the State of Georgia, as well.

Hamilton County borders Dade, Catoosa, and Walker Counties in Georgia, south of the Tennessee border as illustrated in Figure 2. In Figure 2 the City of Chattanooga is indicated in a beige/ light tan color.

Figure 2. Map of Hamilton County



5.2. Air Pollution Control Board

The Chattanooga-Hamilton County Air Pollution Control Bureau (the Bureau) is a local air pollution control agency operated jointly by the City of Chattanooga and Hamilton County. The Air Pollution Control Board, composed of nine private citizens appointed by the City and County Mayors and a representative of the local health department, supervises a Director.

As a joint agency managed by a Board, the Bureau is independent of the City and County. The City of Chattanooga finance officer, however, acts as the fiscal agent of the Bureau. The Bureau purchases through the City Purchasing Department, utilizes the services of the City Information Technology Department, uses the City garage for vehicle maintenance, and hires through the City Personnel Department. Payroll is administered through the City Payroll Department. The Bureau retirement program is independent of the City.

5.3. Director

The Director of the Chattanooga Hamilton County Air Pollution Control Bureau is designated by the Chattanooga-Hamilton County Air Pollution Control Board as the authority for the Board. The Director is ultimately responsible for the management and administrative parts of the Quality Assurance program according to Bureau policy. The Director is responsible for:

- Managing three department heads: Operations, Engineering, and Air Monitoring
- Managing and reviewing budgets, contracts, grants, and proposals
- Overseeing air monitoring activities
- Acquiring resources and maintaining budgets pertinent to the collection of environmental data

The Director delegates the responsibility and authority to develop, organize, implement, and maintain ambient air monitoring programs to the Air Monitoring Manager. The Director has "stop work" authority, but he has to trust the Air Monitoring Manager to keep him informed because most quality assurance decisions are made within the Air Monitoring Department. The Air Monitoring Manager would instruct technicians to "stop work" and notify the Director what has been done and why. The Monitoring Manager would inform the Director of the corrective activity. The Director considers the Air Monitoring Manager a specialist and must rely upon the expertise of the person in the position.

5.4. Air Monitoring Manager

The Air Monitoring Manager reports directly to the Director of Air Pollution Control. The Air Monitoring Manager has the responsibility of implementing the air monitoring program, acquiring air monitoring data, and the quality assurance program for Hamilton County, Tennessee. The Air Monitoring Manager supervises two Instrument Technicians who operate the air monitoring equipment.

The Air Monitoring Manager:

- Functions as the point of quality assurance contact with EPA SESD and EPA Region 4 in Atlanta
- Functions as the point of contact with the contract $PM_{2.5}$ weighing laboratory, Inter-Mountain Laboratory of Sheridan, Wyoming
- Functions as the point of contact with Air Monitoring Managers at the States of Tennessee and Georgia
- Functions as the Quality Assurance officer –as such verifies and validates data.
- Functions as supervisor for AQS data loading and loads some data.
- Ensures complete submittal to AQS
- Is responsible for proper siting of monitors.
  Scouting potential locations; obtaining permissions from land owners, lessors, and EPA; securing parties to install power and phone lines, foundations, a shelter, and fencing if needed; procuring a shelter and a crane to put it in place,
- Is responsible for supervising collection of environmental data
  Making sure the monitors operate properly, making sure make-up data is obtained when data is missing,
- Pre-proofs any technician AQS submittal, runs confirming AMP reports, notifies the State as a courtesy when data is loaded.
- Ensures proper data completeness
- Maintains budgets pertinent to the collection of environmental data
- Writes QMP, QAPP, SOPs, Five Year Assessment, Network Review (yearly), Site Evaluations, Equipment Evaluations, Exceptional Event request documentation
- Documents pollution events that affect monitoring data
- Trains staff in the requirements of the QAPP, QMP, and SOPs

- Ensures that monitoring personnel follow the QAPP, QMP, and SOPs
- Participates in training and certification activities
- Verifies that all required QC activities are performed and that measurement quality objectives are met as prescribed in the QAPP
- Documents deviations from established procedures and methods
- Reports nonconforming conditions and corrective actions to the Director, and EPA Region 4. The report may also be given to the State as a courtesy.
- Assesses the effectiveness of the network system
- Investigates vendors, obtains quotes, and orders air monitoring equipment
- Flags or verifies flags of suspect data
- Investigates, documents, and flags data affected by Exceptional Events in AQS and provides explanation
- Prepares data evaluations and reports
- Prepares the $PM_{2.5}$ Grant
- Responds to public data requests
- Directs the work of two Instrument Technicians
- Serves as Administrator of Data Acquisition software, Airvision

5.5. Instrument Technician

- Performs routine maintenance, calibration, and operation of air monitoring instruments
- Ensures that the air monitoring program incorporates quality assurance (QA) elements of SOPs and the QAPP and QMP
- Collects and reviews data
- Downloads monitor metadata from Federal Reference $PM_{2.5}$ Monitors to send to IML
- Reviews ozone and continuous $PM_{2.5}$ data in Airvision
- Reviews all continuous data and adds Null Value Codes for voided hours. Investigates any irregularities.
- Loads data into AQS and notifies Manager when data is loaded
- Documents deviations from established procedures and methods
- Assists in planning, establishing, or relocating sites
- Designs sites' setup
- One technician is currently also assigned Stage I Vapor Recovery gasoline station inspections.

5.6. Inter-Mountain Laboratories of Sheridan, Wyoming

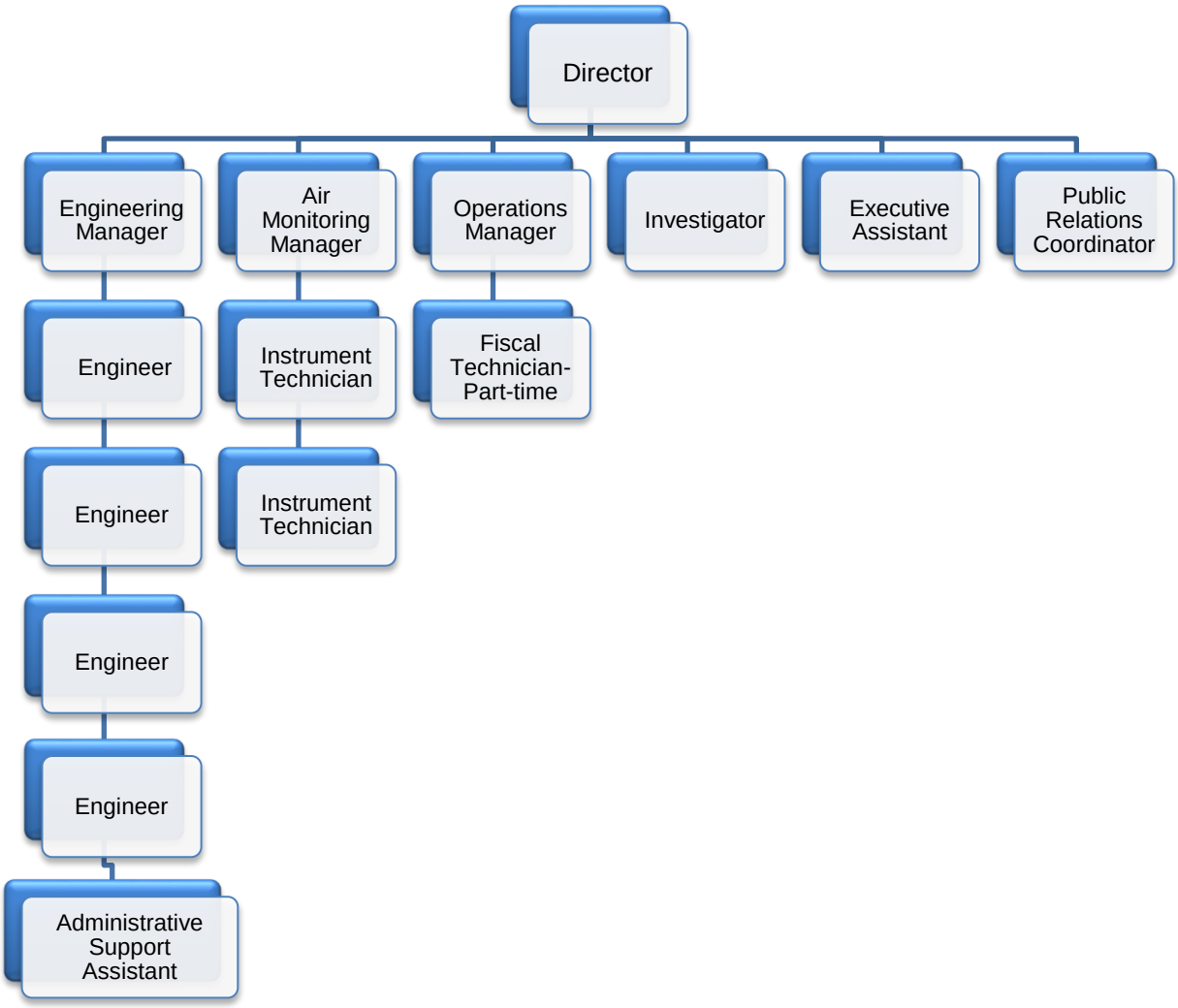
- Subcontractor for filter weighing since January 1, 1999
- Contracted to condition and preweigh filters under strict static-free temperature and humidity conditions
- Loads weighed filters into clean cassettes
- Mails loaded filters to the Bureau in a cooler
- The Bureau mails exposed filters back to IML in cooler at below 4° C or below the average exposure temperature
- IML conditions and postweighs filters within 30 days of exposure under strict static-free temperature and humidity conditions
- IML stores filters in a freezer for one (1) year, then mails filters to the Bureau. The Bureau stores the filters in a freezer for four (4) more years.

- Contracted to prepare AQS loadable data lines with the data calculated from the weights
- IML provides an Excel™ tabbed readable report each quarter in addition to the AQS data files.
- The IML Laboratory Supervisor is the contact at IML for the Air Monitoring Manager at the Bureau.

5.7. Agency Organization

The Chattanooga-Hamilton County Air Pollution Control is organized into three departments: Operations, Engineering, and Air Monitoring. A Director has the responsibility for managing these departments according to Bureau policy. Inter-Mountain Laboratories of Sheridan, Wyoming, is the filter weighing subcontractor for gravimetric laboratory services.

Figure 3. Organizational Chart



6. DEFINITION AND BACKGROUND

The purpose of the Chattanooga-Hamilton County Air Pollution Control Ambient Air Monitoring Program Quality Assurance Project Plan (QAPP) is to describe the Bureau's Quality Assurance program for air monitoring. The *Code of Federal Regulations* requires all environmental data operations to have an EPA-approved QAPP (40 CFR, Part 58. Appendix A, 2.1.2). The QAPP documents how Quality Assurance (QA) activities will be implemented to produce data that is comparable to the NAAQS. Detailed procedures help achieve a high percentage of valid data while maintaining integrity and accuracy. Quality Assurance procedures must meet or exceed the minimally acceptable quality criteria established to assist management in making confident decisions. Because variability and error exist in all data collection, a QAPP is used to limit those variables. The production of quality data protects human health by determining if further pollution reductions are required.

The QAPP, additionally, is to serve as an instruction manual for the agency to perform its air monitoring operations in the absence of experienced air monitoring employees. As retirements occur, agencies must be able to continue functioning with the same level of quality assurance with new employees.

The individuals producing air quality data for Chattanooga-Hamilton County must follow specific written procedures for operating instruments and handling data.

A special project may require different procedures depending on the purpose and scope of the project. A QAPP may be developed specifically for that project, independent of this QAPP, which addresses the QA areas or elements required.

Since no separate Quality Assurance Department exists in a small agency, the Air Monitoring Manager is responsible for Quality Assurance activities related to air monitoring data collection at the Bureau. The Air Monitoring Manager ensures that the quality assurance programs for the instrument, laboratory, and data processing phases of the monitoring program are implemented.

The Bureau is only required to monitor for ozone and $PM_{2.5}$. This document, therefore, addresses quality assurance procedures for those pollutants.

The Bureau's QAPP will be reviewed annually and revised if procedures have changed or updates are needed. EPA requires update and resubmittal of the QAPP to EPA's Region 4 QA staff at SESD every 5 years. Changes are subject to EPA approval. Chattanooga-Hamilton County is its own Primary Quality Assurance Organization (PQAO) and as such has its own QAPP. Before 2015 the Bureau was in the State of Tennessee's PQAO and adopted the State of Tennessee QAPP with a letter or document outlining the differences in the two programs.

The 1970 Clean Air Act and its amendments provide the framework for protecting air quality. Active environmental data collection operations must be established and operated in a manner that assures the highest quality data are collected. Ambient air quality monitoring programs monitor criteria pollutants: particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide ($SO_{2)}$, carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb). The National Ambient Air Quality Standards (NAAQS) establish limits for each of these pollutants. Because the Bureau is required to monitor for $PM_{2.5}$ and ozone, only those NAAQS are provided in Table 1.

Table 1. National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Ozone	primary and secondary	8 hours	.070 ppm	Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$ primary	1 Year	12 $\mu g/m^3$	Annual mean, averaged over 3 years
	$PM_{2.5}$ secondary	1 Year	15 $\mu g/m^3$	Annual mean, averaged over 3 years
	$PM_{2.5}$ primary and secondary	24 hours	35 $\mu g/m^3$	98^{th} percentile, averaged over 3 years
	PM_{10} Primary secondary	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years

7. DESCRIPTION

7.1. Description of Work to be Performed

The ultimate benefit of a Quality Management System is to protect and preserve human health. For this goal, air monitoring data should be as accurate and complete as possible to compare against the National Ambient Air Quality Standards (NAAQS). Data quality assurance is essential to accurately assessing air quality and determining pollution reductions to meet the standards. Excellent air quality positively impacts the economics of the region by attracting new industries. Optimizing data quality can have a positive heath impact for the residents of Hamilton County. The public relies upon the accuracy of the data since those with compromised health, especially heart and lung health, must make daily decisions that might affect their health.

A Quality Assurance program for the Bureau includes establishing a monitoring network that meets the network requirements of *40 CFR Part 58*. The network must have the appropriate density, location, and sampling frequency. Each site must have reliable EPA approved air monitoring and data recording equipment. Ozone sites, and the continuous PM monitor or monitors, must have shelter (self-contained or a module) from the elements and reliable heating and air conditioning, if necessary, to maintain the instrumentation at the required temperatures. The continuous sites must have the capability, through telemetry or some other means, to report to the national mapping program, AirNow.

The site must meet siting requirements in *40 CFR Part 58* Appendices D (Network Design Criteria) and E (Probe and Monitoring Path Siting Criteria) with site documentation submitted to Region 4 in the planning phase of a new site and formal approval, normally including an EPA site visit, obtained from Region 4 before the site is installed. EPA Region 4 should be notified of the establishment of any temporary site, especially one unable to meet regulatory requirements.

The sites are evaluated yearly in the Network Review submitted to the State of Tennessee for inclusion in the yearly State Air Monitoring Plan. The evaluation is to determine if each site is meeting siting requirements. If the site is not meeting site requirements or is borderline, a determination will be made if the site can be altered to meet requirements or if the site must

move. If EPA has concerns about the site provided, EPA will contact the Bureau during the approval process for the State Air Monitoring Plan, additional information will be provided, and remedial activities, if necessary, will be scheduled. EPA will provide comments, if necessary, about the site evaluations in the yearly reply to the State Air Monitoring Plan.

The grass and weed maintenance for the Siskin Drive (4002) and East Ridge Tombras Avenue (0031) sites are performed by the Air Monitoring Technicians. These two sites have fenced enclosures and the attempt is made to keep the site grass as neat as the grass around the outside of the enclosure. The grass may be cut weekly when there is a lot of rain, and not as often if it is dry. There is not an established weekly schedule for maintenance. Special attention is paid to the East Ridge site since it is located at City Hall.

There are no trees at any site for which annual pruning must be scheduled. Two trees at the East Ridge Tombras Avenue site are classified as obstructions.

The Eastside Utility (4003) and Soddy-Daisy High School (1011) sites are physically maintained by the owners or lessors of the property. The Eastside Utility and Soddy Daisy sites do not have fenced enclosures as both are in secure areas. Bureau Technicians might trim around those sites if necessary. Usually, no maintenance is required from Bureau Technicians for those sites.

The data produced must meet Data Quality Objectives (DQOs) and data completion requirements in order to be comparable to the National Ambient Air Quality Standards. Quality assured data must then be completely loaded into AQS, the EPA national database, within 90 days of the end of the quarter on the regulatory schedule (note: this is less than three months). If the data do not or will not meet data completion requirements, EPA Region 4 is to be contacted as soon as the determination is made that completion will be inadequate. As a courtesy, the States of Tennessee and Georgia should be contacted with the same information. Data is officially certified the following year by May 1.

For each vendor's model of monitor and data logger there is a separate Region 4 approved Standard Operating Procedure (SOP). The Bureau has its own EPA-approved Data Handling SOP. Individuals employed in the Air Monitoring Department are required to read all the EPA approved SOPs and place a signature on each signature page to state that the employee has read it. SOPs include all the precision and accuracy measurement procedures.

7.2. Instrument Activities

Instrument Technicians perform activities that include installing equipment, conducting periodic preventative maintenance, and servicing equipment located at SLAMS and Special Purpose Monitoring Stations (SPMS) located within Hamilton County. Operational servicing activities may include collecting samples, recording pertinent Instrument data, and restocking consumables at the monitoring sites. Instrument responsibilities include quality assurance activities such as flow and leak checks and verifications or calibrations on the $PM_{2.5}$ monitors and calibrations and shelter temperature checks on the ozone monitors. Instrument activities can include surveillance for relocating sites or locating suitable new monitoring sites.

7.3. Laboratory Activities

Chattanooga-Hamilton County contracts with Inter-Mountain Laboratories (IML) of Sheridan, Wyoming, for $PM_{2.5}$ laboratory services. The Bureau has contracted with IML since 1999, the beginning of the $PM_{2.5}$ monitoring program. Chattanooga-Hamilton County is responsible for reviewing the IML QAPP and determining if it meets EPA requirements in *40 CFR Part 50 Appendix L.*

The IML contract is for pre-conditioning, pre-weighing, and post-conditioning and post-weighing 47 mm Teflon $PM_{2.5}$ filters to 3 decimal places (.001) in a temperature and humidity controlled/ static-free laboratory environment according to Part 40 of the *Code of Federal Regulations*; EPA's QA *Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program* EPA-454/B-17-001; and EPA's Quality Assurance Guidance Document 2.12, *Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods EPA 454/B-16-001*. In AQ *Guidance Document 2.12* applicable portions are specifically Chapter 9, Gravimetric Laboratory Design and Setup; Chapter 10, Filter Preparation and Analysis: Chapter 11, Performance Evaluation- 11.2.7 Balance Accuracy Assessment and 11.2.8 Temperature and Relative Humidity Logger Audit Procedure; and Chapter 12, Calculations, Validations, and Reporting of $PM_{2.5}$- 12.2.2 Net $PM_{2.5}$ Mass Calculation and 12.2.3. $PM_{2.5}$ Concentration Calculation. IML is responsible for any discussion in the Handbook or Guidance that is applicable to laboratory procedures.

The lab, therefore, is contracted to prepare filters for instrument use. In addition to conditioning and weighing filters prior to and after exposure, IML is responsible for cleaning $PM_{2.5}$ cassettes before loading them with filters; preparing and analyzing lab blanks and any other required control samples; maintaining consumable inventories; and shipping and receiving activities.

The Bureau requires that IML ship cassettes in plastic petri dishes, normally used for microbiology work, secured with blue vinyl tape. This is unique to Chattanooga-Hamilton County as other agencies generally use small zip bags, canisters, or capped filter cassettes for shipping. The Bureau supplies the petri dishes and tape to IML and maintains contact to assure that the lab has an adequate supply. The Bureau keeps one case of petri dishes and several rolls of blue tape in the Bureau lab. The Bureau chose this method to avoid plastic bag particulate contamination issues that seemed to crop up intermittently during the origins of the $PM_{2.5}$ program. The petri dish is more protective as filters are less likely to be damaged in packing and handling for shipping.

The Bureau keeps the current version of IML's QAPP on file on the Air Monitoring Manager's computer and on the flash drive on the Bureau bookcase in the laboratory. A copy is also kept on the Air Monitoring Manager's Google Drive.

Data are not considered final data that are returned from the contract laboratory. Data returned from the laboratory are verified and validated before data is entered into AQS. It is verified and validated again after entry into AQS when AMP reports are run to confirm completeness. The AMP reports are inspected to confirm that Null Value Codes have been entered for voided data.

Chattanooga-Hamilton County no longer operates PM_{10} monitors as EPA approved the deletion of the monitors and site in 2015. No filter conditioning or weighing occurs in the Bureau laboratory. Copies of the site deletion request and approval are attached to this QAPP.

7.4. Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. In this document "assessment" is an all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance. Assessments are flow checks, precision and span checks, local audits, State audits, national audit programs (NPAP and PEP), and EPA Technical System Audits. All flow, precision, and audit assessments are loaded into AQS unless there is some reason that the assessment is not considered valid.

Particulate flow audits are required monthly and loaded into AQS. Span checks are performed on a 6-day schedule and precision checks on a 3-day schedule. This means that on the 6-day schedule both span and precision checks are performed.

7.5. Records

Chattanooga-Hamilton County will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision, and maintenance of documents and records. The Bureau has developed an EPA approved Data Handling SOP which details the data collection and documentation procedure at the agency. The categories and types of records and documents which are applicable to document control for ambient air quality information are presented in the Critical Documents and Records Table:

Table 2. Critical Documents and Records

Categories	Record/Document Type
Site Information	Network Descriptions Site Files Site Maps Site Pictures
Environmental Data Operations	Quality Assurance Project Plan Quality Management Plan Five Year Assessment Standard Operating Procedures Instrument and Laboratory Notebooks Sample Handling/Custody Records Inspection/Maintenance Records
Raw Data	Any Original Data (routine and quality control) Including Data Entry Forms
Data Reporting	Air Quality Index Reports Annual SLAMS Report Data/Summary Reports
Data Management	Data Algorithms Data Management Plans/Flowcharts: SOPs
Quality Assurance	Good Laboratory Practices Site Audits Network Reviews Data Quality Assessments Quality Assurance Reports Technical System Audits Exceptional Events Documentation Response/Corrective Action Reports

7.6. Site Locations

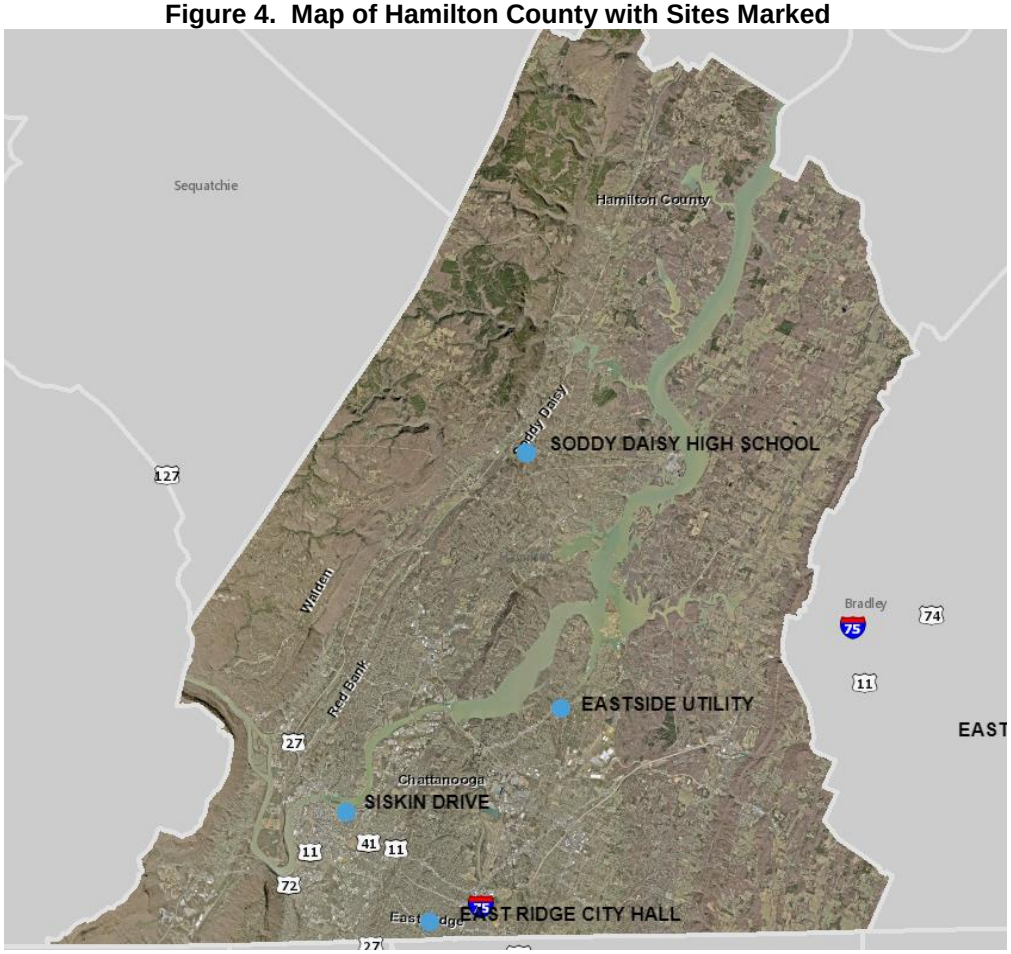
Table 3 provides information about each air monitoring site operated by Chattanooga-Hamilton County. TEI is Thermo Environmental Instruments, LLC.

Table 3. Air Monitoring Sites

Name of Site	Description	AQS #	Pollutant	Instruments
911 Siskin Drive	Downtown	470654002	$PM_{2.5}$	Collocated TEI 2025s (to be replaced with I models in 2018), T640, TEOM to be deleted in 18
East Ridge City Hall	Near GA border	470650031	$PM_{2.5}$	TEI 2025
Eastside Utility	North of Downtown	470654003	Ozone	TEI 49i, 49ips; 8872, 8816 loggers; Computer for AV trends
Soddy-Daisy High School	North of City	470651011	Ozone	TEI 49i, 49ips; 8832,8816 loggers; Computer for AV trends software

Figure 4 indicates the locations of the sites listed in Table 3.

Figure 4. Map of Hamilton County with Sites Marked



8. QUALITY OBJECTIVES AND CRITERIA FOR MEASURING DATA QUALITY

8.1. Data Quality Objectives

Data quality objectives (DQOs) are developed to set “rules” for the quality of the data. If there are specific parameters and specific error limits that the data meet, then data is certain to be of a minimum specified quality or exceed that quality. This specified quality makes the data more comparable regionally.

In a region, such as the southeastern states of EPA Region 4, are multiple agencies with multiple operators. Multiple vendor equipment is approved by EPA for use, and there are different models of the same vendor’s equipment approved. Sites are differently located as some are on buildings, some are near the ground, some are on hills or near forests, and some are in open fields. Some are near roads and some are not, depending upon the network. Different weigh labs are utilized for filter based monitoring. This provides a huge variation in variables in comparing similarly acquired data. Some common factors or variables have to be determined to make the data comparable. The common factor must be data quality assurance that is standardized but personalized per agency.

EPA has established data quality indicators (DQI) that provide qualitative and quantitative descriptions used in interpreting the degree of acceptability of data. The idea is to establish qualitative and quantitative goals for the data generated in the measurement process. Of the five principal DQIs, precision and bias are the quantitative measures, representativeness and comparability are qualitative measures, and completeness is a combination of both qualitative and quantitative measures. The specific requirements of these five DQIs are established before data collection commences. The goal is to locate and eliminate (or minimize) bias, so the data collected show the true conditions of the area being sampled. This includes consideration of siting criteria, spatial scales, monitoring objectives, climatic change, source configurations, and the duration of the study.

Bureau employees in the Air Monitoring Department must follow the written procedures and methodologies in this QAPP.

Data quality objectives are statements that clarify the intended use of the data, define the type of data needed, and specify the tolerable limits on the probability of making a decision error due to uncertainty in the data.

In terms of data collection, the goals of the Ambient Air Quality Monitoring Program are to:

- determine the highest concentrations expected to occur in the area covered by the network;
- determine representative concentrations in areas of high population density;
- determine the impact on ambient pollution levels of significant sources or source categories
- determine the general background concentration levels;
- determine the extent of regional pollutant transport among populated areas, and in support of secondary standards; and determine the welfare-related impacts in rural and remote areas (such as visibility impairment and effects on vegetation).

8.1.1. Intended Use of Data

This data will be used to:

- establish a historical baseline concentration of natural and anthropogenic air pollutants,
- monitor the current dynamic concentrations of these air pollutants,
- evaluate compliance with the NAAQS,
- monitor progress made toward meeting ambient air quality standards
- activate emergency control procedures that prevent or alleviate air pollution episodes
- provide data upon which long term control strategies can be reliably developed
- observe pollution trends throughout the region, and
- provide a database for researching and evaluating effects.

8.1.2. Type of Data Needed

Of the six criteria pollutants, only ozone and $PM_{2.5}$ are monitored at the designated SLAMS sites. No noncriteria pollutants are currently monitored in Hamilton County. Hamilton County has no Near Road, PAMS sites, toxics or lead monitoring sites. EPA defunded $PM_{2.5}$ speciation in 2014, but speciation is still active at the Walker County, Georgia, site (132950002) in North Georgia in the same designation area. The Walker County site is operated by the State of Georgia.

The type of data needed is data that is of the quality and quantity to be compared against the NAAQS according to *40 CFR Parts 50, 53, and 58* requirements, and the data must be of such quality that decision makers can make comparisons to the NAAQS with confidence and certainty. *40 CFR 58.16* specifies the data reporting requirements that Chattanooga-Hamilton County will follow, and the appendices to *40 CFR Part 50* explain the data handling conventions and computations necessary for determining whether the NAAQS are met for each pollutant.

8.1.2. Critical Criteria Parameters

EPA has developed a list of critical parameters for each criteria pollutant (noted in pink on the criteria tables). If data are outside the critical parameters, the specific data are under serious consideration to be voided. Each excursion of a critical parameter is studied on a case-by-case basis and the determination may be to keep and flag the data in AQS rather than void it, depending upon the circumstances of the excursion. If data is in excursion of the critical parameters shown in pink, retention of the data must be defensible and may be questioned in an EPA Total Systems Audit (TSA). The agency may produce technical papers using statistical analyses or some other means to establish proof that the data is useable.

The *Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume II, Ambient Air Quality Monitoring Program , January 2017, states that observations that do not meet each and every criterion on the critical table should be invalidated unless there are compelling reasons and justification for not doing so. The items on the critical tables listed in pink are mostly directly taken from *40 CFR*. The document says the group of samples for which one or more of these criteria are not met is invalid until proven otherwise.

EPA has also developed lists of parameters in the criteria tables (noted in yellow and blue) that are not considered critical but EPA considers them important. Data outside of any of the parameters listed in yellow and blue may be flagged in AQS.

8.1.3. Tolerable Error Limits

In the development of the EPA model QAPP for $PM_{2.5,}$ EPA utilized the formal DQO process (see: *Guidance for the Data Quality Objectives Process,* EPA QA/G-4, EPA/600/R-96/055, September 1994) to specify tolerable limits on the probability of making a decision error due to uncertainty in the data. The DQO process establishes limits on the probability of coming up with false positive or false negative error. A false positive error is encountered when the data indicate that an emissions limit has been exceeded when in fact, due to errors in the data, it has not been exceeded. Alternately, a false negative error is encountered when the data indicate that no emissions limit has been exceeded when in fact, due to errors in the data, an emissions limit has been exceeded. Utilizing the DQO process will determine the objectives regarding the quality of the ambient air measurement system to control precision and bias in order to reduce the probability of decision errors. It is, therefore, important that data be accurate so there is not a false positive or negative error.

In *40CFR Part 58, Appendix A*, *2.3* there are statements for acceptable measurement uncertainty. These are provided in Table 4.

Table 4. Acceptable Measurement Uncertainty

	Acceptable Measurement Uncertainty Goal
Automated and Manual $PM_{2.5}$ Methods	Upper 90% Confidence limit for the CV of 10% and $\pm$ 10% for total bias
Automated O_3 Methods	Upper 90% confidence limit for the CV of 7% and for bias as an upper 95% confidence limit for the absolute bias of 7%

8.2. Quality Objectives

There are five Quality Objectives that EPA believes increase the completeness and precision and decrease the bias of the data produced by the measurement systems. The quality of the data must be maintained within the established acceptance criteria. These data indicators are designed to evaluate and control various phases (sampling, preparation, analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the Data Quality Objectives (DQOs).

- ***Precision -*** "Precision is a measure of agreement between two replicate of the same property, under prescribed similar conditions. This agreement is calculated as either the range or as the standard deviation." (US EPA QA/G-5, Appendix D) This is the random component of error.

- ***Bias -*** "Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction." (US EPA QA/G-5, Appendix D) Bias is determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

- ***Comparability -*** "Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables." (US EPA QA/G-5, Appendix D)

- ***Representativeness -*** "Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point or for a process condition or environmental condition. Representativeness is a

qualitative term that should be evaluated to determine whether in situ or other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomenon measured or studied." (US EPA QA/G-5, Appendix D)

- ***Completeness - "***Completeness is a metric quantifying the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Completeness can be expressed as a ratio or a percentage. Data completeness requirements are included in the reference methods in 40 CFR Part50.

8.2.1. Critical Criteria Validation Templates

EPA has developed critical criteria validation templates for each pollutant monitoring method. Each critical parameter (in pink) has a listed citation from *40 CFR*. In the yellow and blue sections the citations may be from the quality assurance handbook, an SOP, an operation's manual, or a recommendation from EPA. On the validation tables under Information/Action is listed the citation that caused the committee to place the criteria in a specific category.

If there is an excursion of a parameter listed in the pink section of the template, the data may be voided with a specific Null Value Code for the issue. In some cases critical data may be preserved by technical studies if there are compelling reasons or justification for retaining the data. If justified, data would be flagged and retained in AQS rather than voided and issued a Null Value Code. Excursions of parameters in the yellow and blue sections of the validation templates may cause the data to be flagged in AQS but not voided.

In the past few years some items have been moved to the critical section (pink). Therefore, when using the validation tables for reference it is important that the most recently updated version is used.

$PM_{2.5}$ Filter Based Local Conditions Validation Template

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- $PM_{2.5}$ Filter Based Local Conditions			
Field Activities			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM/ARM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Filter Holding Times			
Pre-sampling	***all filters***	***≤ 30 days before sampling***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.5
Sample Recovery	***all filters***	***≤ 7 days 9 hours from sample end date***	1, 2 and 3) 40 CFR Part 50, App. L 10.10
Sampling Period (including multiple power failures)	***all filters***	***1380-1500 minutes, or if value < 1380 and exceedance of NAAQS 1/ midnight to midnight local standard time***	1, 2 and 3) 40 CFR Part 50 App L Sec. 3.3 and 40 CFR Part 50 App N Sec. 1 for the midnight to midnight local standard time requirement See details if less than 1380 min sampled
Sampling Instrument			
Average Flow Rate	***every 24 hours of op***	***average within 5% of 16.67 liters/minute***	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	***every 24 hours of op***	***CV ≤ 2%***	1, 2 and 3) 40 CFR Part 50, App L Sec. 7.4.3.2
One-point Flow Rate Verification	***every 30 days each seperated by 14 days***	***< ± 4.1% of transfer standard*** < ± 5.1% of flow rate design value	1, 2 and 3) 40 CFR Part 50, App L, Sec. 9.2.5 and 7.4.3.1 and 40 CFR Part 58, Appendix A Sec. 3.2.1
Design Flow Rate Adjustment	***After multi-point calibration or verification***	***< ± 2.1% of design flow rate***	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
Individual Flow Rates	***every 24 hours of op***	***no flow rate excursions > ±5% for > 5 min. 1/***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.1
Filter Temp Sensor	***every 24 hours of op***	***no excursions of > 5° C lasting longer than 30 min 1/***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.11.4
External Leak Check	***Before each flow rate verification/calibration*** and before and after $PM_{2.5}$ separator maintenance	***< 80.1 mL/min*** (see comment #1)	1) 40 CFR Part 50 App L, Sec. 7.4.6.1 2) 40 CFR Part 50 App L Sec. 9.2.3 and Method 2-12 Sec. 7.4.3 3) 40 CFR Part 50, App. L, Sec. 7.4.6.1
Internal Leak Check	If failure of external leak check	***< 80.1 mL/min***	1) 40 CFR Part 50, App. L, Sec. 7.4.6.2 2) Method 2-12, Sec. 7.4.4 3) 40 CFR Part 50, App. L, Sec. 7.4.6.2
Laboratory Activities			

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Post-sampling Weighing	***all filters***	***Protected from exposure to temperatures above 25C from sample retrieval to conditioning*** ***≤10 days from sample end date if shipped at ambient temp, or*** ***≤ 30 days if shipped below avg ambient (or 4º C or below for avg sampling temps < 4º C) from sample end date***	1, 2 and 3) 40 CFR Part 50 App L Sec. 8.3.6 and L Sec. 10.13. See technical note on holding time requirements at : https://www3.epa.gov/ttn/amtic/pmpolgud.html
Filter Visual Defect Check (unexposed)	***all filters***	***Correct type & size and for pinholes, particles or imperfections***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 10.2
Filter Conditioning Environment			
Equilibration	***all filters***	***24 hours minimum***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.5
Temp. Range	***all filters***	***24-hr mean 20.0-23.0º C***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.1
Temp. Control	***all filters***	***< 2.1º C SD* over 24 hr.***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.2 SD use is a recommendation
Humidity Range	***all filters***	***24-hr mean 30.0% - 40.0% RH or Within ±5.0 % sampling RH but ≥ 20.0%RH***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.3
Humidity Control	***all filters***	***< 5.1 % SD* over 24 hr.***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.4 SD use is recommendation
Pre/post Sampling RH	***all filters***	***difference in 24-hr means < ± 5.1% RH***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.3
Balance	***all filters***	***located in filter conditioning environment***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.2
Microbalance Auto-Calibration	***Prior to each weighing session***	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.6 3) NA
OPERATIONAL EVALUATIONS TABLE $PM_{2.5}$ Filter Based Local Conditions			
Field Activities			
One-point Temp Verification	every 30 days	< ± 2.1ºC	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec. 7.4.5 and Table 6-1 3) Recommendation
Pressure Verification	every 30 days	< ± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec. 7.4.6 and Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
Temperature multi-point Verification/Calibration	on installation, then every 365 days and once a calendar year	< ± 2.1ºC	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.4.4 Table 6-1

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Pressure Verification/Calibration	on installation, and on one-point verification failure	< ± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
Flow Rate Multi-point Verification/ Calibration	***Electromechanical maintenance or transport*** or every 365 days and once a calendar year	< ± 2.1% of transfer standard	1) 40 CFR Part 50, App. L, Sec. 9.2. 2) 40 CFR Part 50, App. L, Sec. 9.1.3, Method 2.12 Sec. 6.3 & Table 6-1 3) Recommendation
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1, 2 and 3) Recommendation
Precision			
Collocated Samples	***every 12 days for 15% of sites by method designation***	CV < 10.1% of samples ≥ 3.0 µg/m^3	1) and 2) Part 58 App A Sec. 3.2.3 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.1
Accuracy			
Temperature Audit	every 180 days and at time of flow rate audit	< ± 2.1ºC	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	< ±10.1 mm Hg	1, 2 and 3) Method 2.12 Sec. 11.2.3
Semi Annual Flow Rate Audit	***Twice a calendar year and between 5-7 months apart***	< ± 4.1% of audit standard < ± 5.1% of design flow rate	1 and 2) Part 58, App A, Sec. 3.2.2 3) Method 2.12 Sec. 11.2.1
Monitor Maintenance			
$PM_{2.5}$ Separator (WINs)	every 5 sampling events	cleaned/changed	1, 2, and 3) Method 2.12 Sec. 8.2.2
$PM_{2.5}$ Separator (VSCC)	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3.3
Inlet Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Downtube Cleaning	every 90 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.4
Filter Housing Assembly Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Circulating Fan Filter Cleaning	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	< ±15.1 µg change between weighings	1, 2, 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor. Method 2.12 Sec. 10.5
Exposure Lot Blanks	3 filters per lot	< ±15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.5 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1, 2 and 3) Method 2.12 Sec. 10.7 and 10.3
Lab QC Checks			

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Field Filter Blank	10% or 1 per weighing session	<± 30.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.1 2 and 3) Method 2.12 Table 7-1 & Sec.10.5
Lab Filter Blank	10% or 1 per weighing session	<± 15.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.2 2 and 3) Method 2.12 Sec. 10.5
Balance Check (working standards)	beginning, 10th sample, end	< ±3.1 µg from certified value	1, 2 and 3) Method 2.12 Sec. 10.6 Standards used should meet specifications in Method 2.12, Sec. 4.3.7
Routine Filter re-weighing	1 per weighing session	<± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8
Microbalance Audit	every 365 days and once a calendar year	<± 0.003 mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	< ± 2.1ºC	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	***At installation*** every 365 days and once a calendar year	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.11 3) NA
Lab Temperature Certification	every 365 days and once a year	< ± 2.1ºC	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Calibration & Check Standards -			
Working Mass Stds. Verification Compared to primary standards	Every 90 days	< ± 2.1 ug	1, 2 and 3) Method 2.12 Sec. 9.7
Primary standards certification	every 365 days and once a calendar year	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
SYSTEMATIC CRITERIA -$PM_{2.5}$ Filter Based Local Conditions			
Siting	every 365 days and once a calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	***Annual Standard***	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
	24- Hour Standard	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	***all filters***	***µg/m^3 at ambient temp/pressure ($PM_{2.5}$)***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Rounding convention for design value calculation	***all filters***	***to one decimal place, with additional digits to the right being truncated***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Annual 3-yr average	***all concentrations***	***nearest 0.1 µg/m^3*** (≥ 0.05 round up)	1, 2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
24-hour, 3-year average	***all concentrations***	***nearest 1 µg/m^3*** (≥ 0.5 round up)	1, 2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
Detection Limit			
Lower DL	***all filters***	***≤ 2 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.1
Upper Conc. Limit	***all filters***	***≥ 200 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.2
Precision			
Single analyzer (collocated monitors)	every 90 days	Coefficient of variation (CV) < 10.1% for values ≥ 3.0 µg/m^3	1, 2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
Primary Quality Assurance Org.	***Annual and 3 year estimates***	***90% CL of CV < 10.1 % for values ≥ 3.0 µg/m^3***	1, 2 and 3) 40 CFR Part 58, App A, Sec. 4.2.1 and 2.3.1.1
Bias			
Performance Evaluation Program (PEP)	***5 audits for PQAOs with ≤ 5 sites 8 audits for PQAOs with > 5 sites***	***< ± 10.1% for values ≥ 3.0 µg/m^3***	1, 2 and 3) 40 CFR Part 58, App A, Sec. 3.2.4, 4.2.5 and 2.3.1.1
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	every 365 days and once a calendar year	***< ± 2.1% of NIST Traceable Std.***	1) 40 CFR Part 50, App. L Sec. 9.1 & 9.2 2) Method 2-12 Sec. 4.2.2 & 6.4.3 3) 40 CFR Part 50, App. L Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Clock/timer Verification	Every 30 days	***1 min/mo***	1 and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App. L Sec. 7.4.12
Laboratory Activities			
Microbalance Readability	***At purchase***	***1 µg***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.1
Microbalance Repeatability	At purchase	1 µg	1) Method 2.12 Sec. 4.3.6 2) Recommendation 3) Method 2.12 Sec. 4.3.6
Primary Mass/Working mass Verification/Calibration Standards	At purchase	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Comment #1 The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

1/ value must be flagged SD * = standard deviation CV= coefficient of variation

Continuous PM2.5 Local Conditions Validation Template

NOTE: This validation template attempts to provide the critical criteria, annual multipoint verifications/calibrations, and verification/calibration standards recertification frequencies and acceptable ranges for PM2.5 continuous FEMs and ARMs. At the time this validation template was most recently updated (January 2016) there were eleven continuous monitors designated as a Federal Equivalent Method (FEM) and none designated as an Approved Regional Method (ARM). For the most widely used continuous FEMs we have added select method specific operational criteria. However, due to limited available information, we do not have operational criteria for all approved FEMs, especially those methods with just a handful or less of monitors that have been implemented. Where we do list operational criteria for a specific method, we only list the criteria believed to be the most important. More detailed information on operational criteria is available for the most widely used PM2.5 continuous FEMs in Technical System Audit Supplementary Checklists for PM Continuous Monitors. These files are available on the web at: https://www3.epa.gov/ttn/amtic/contmont.html.

Technical Systems Audit Checklists

- PM continuous TSA checklist – Met One BAM – Draft (PDF)
- PM continuous TSA checklist – Thermo TEOM-FDMS – Draft (PDF)

Where appropriate, 40 CFR Part 58 App A and 40 CFR Part 50 App L requirements apply to Continuous PM2.5 FEMs; however, not all criteria may apply to each continuous FEM and ARM due to the nature of the measurement principle and design of the instrument. Also, while this validation template is designed to apply to PM2.5 continuous FEMs and ARMs, it may also apply to PM2.5 continuous methods that are not specifically approved as FEMs or ARMs and used to meet SLAMS monitoring requirements in support of the AQI, but not the NAAQS.

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- $PM_{2.5}$ Continuous, Local Conditions			
Sampler/Monitor Designation	NA	***Meets requirements listed in FRM/FEM/ARM designation*** Confirm method designation on front panel or just inside instrument.	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Firmware of monitor	At setup	1. Must be the firmware (or later version) as identified in the published method designation summary. ***2. Firmware settings must be set for flowrate to operate and report at "local conditions" (i.e., not STP).***	40 CFR Part 50 App N. sec. 1 (c)
Data Reporting Period	Report every hour	1. The calculation of an hour of data is dependent on the design of the method. ***2. A 24-hour period is calculated in AQS if 18 or more valid hours are reported for a day [1].***	See operator's manual. Hourly data are always reported as the start of the hour on local standard time 40 CFR Part 50 App N. Sec 3 (c)

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Sampling Instrument			
PM10 Inlet (if applicable to method designated)	At Setup	Must be a Louvered PM10 size selective inlet as specified in 40 CFR 50 appendix L, Figures L-2 through L-19	
PM2.5 second stage separator (if applicable to method designated)	At Setup	Must be a BGI Inc. Very Sharp Cut Cyclone (VSCC™) or equivalent second stage separator approved for the method.	The other approved second stage separator option for select FEMs is the Dichot. Only the GRIMM 180 and Teledyne T640 and T640X are known to not have a second stage seperator as part of the method.
Average Flow Rate	***every 24 hours of operation; alternatively, each hour can be checked***	***average within 5% of 16.67 liters/minute at local conditions***	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	***every 24 hours of op***	***CV ≤ 2%***	1, 2 and 3) 40 CFR Part 50, App L Sec. 7.4.3.2
One-point Flow Rate Verification	***every 30 days each seperated by 14 days***	***< ± 4.1% of transfer standard*** < ± 5.1% of flow rate design value	1, 2 and 3) 40 CFR Part 50, App.L, Sec. 9.2.5, 40 CFR Part 58, Appendix A Sec. 3.2.3 & 3.3.2
Design Flow Rate Adjustment	***After multi-point calibration or verification***	***< ± 2.1% of design flow rate***	1,2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
External Leak Check	***Before each flow rate verification/calibration*** and before and after $PM_{2.5}$ separator maintenance	Method specific. See operator's manual.	1) 40 CFR Part 50 App L, Sec. 7.4.6.1 2) 40 CFR Part 50 App L Sec.t 9.2.3 and Method 2-12 Sec. 7.4.3 3) 40 CFR Part 50, App. L, Sec. 7.4.6.1
Internal Leak Check	If failure of external leak check	Method specific. See operators manual.	1) 40 CFR Part 50, App. L, Sec. 7.4.6.2 2) Method 2-12 7.4.4 3) 40 CFR Part 50, App. L, Sec. 7.4.6.2
Annual Multi-point Verifications/Calibrations			
Leak Check	every 30 days	< 1.0 lpm BAM (Not Thermo BAMS) ± 0.15 lpm TEOM	1) 40 CFR Part 50 App L, Sec. 7.4.6.1 2) Recommendation 3) BAM SOP Sec. 10.1.2 TEOM SOP Sec. 10.1.6 Thermo BAM leak check should not be attempted. Foils could be ruptured.
Temperature multi-point Verification/Calibration	on installation, then Every 365 days and 1/ calendar year	< ± 2.1°C	1) 40 CFR Part 50, App.L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.4.4
One-point Temp Verification	every 30 days	< ± 2.1°C	1) 40 CFR Part 50, App.L, Sec. 9.3 2) Method 2.12 Sec. 7.4.5 and Table 6-1 3) Recommendation
Pressure Verification/Calibration	on installation, then Every 365 days and 1/ calendar year	< ± 10.1 mm Hg	1) 40 CFR Part 50, App.L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.5 BP verified against independent standard verified against a lab primary standard that is certified NIST traceable 1/year

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Flow Rate Multi-point Verification/ Calibration	***Electromechanical maintenance or transport or*** Every 365 days and 1/ calendar year	< ± 2.1% of transfer standard	1) 40 CFR Part 50, App.L, Sec. 9.2. 2) 40 CFR Part 50, App.L, Sec. 9.1.3, Method 2.12 Sec. 6.3 & Table 6-1 3) Recommendation
Other Monitor Calibrations/checks	per manufacturers' op manual	Annual zero test on Met One BAM 1020 and BAM 1022	per manufacturers' operating manual. Note: more frequent zero tests may be appropriate in areas with seasonal changes in dew-points.
Precision			
Collocated Samples	***every 12 days for 15% of sites by method designation***	CV < 10.1% of samples ≥ 3 µg/m^3	1) and 2) Part 58 App A Sec. 3.2.3 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.1
Accuracy			
Temperature Audit	every 180 days and at time of flow rate audit	< ± 2.1ºC	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	< ±10.1 mm Hg	1, 2 and 3) Method 2.12 Sec. 11.2.3
Semi Annual Flow Rate Audit	***Twice a calendar year and 5-7 months apart***	< ± 4.1% of audit standard < ± 5.1% of design flow rate	1 and 2) Part 58, App A, Sec. 3.3.3 3) Method 2.12 Sec. 11.2.1
Shelter Temperature			
Temperature range	At setup	per operator manual	
Temperature Control	Daily (hourly values)	< 2.1° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Temperature Device Check	every 180 days and twice a calendar year	< ± 2.1° C	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Monitor Maintenance			
$PM_{2.5}$ Separator (WINS)	every 5 sampling events	cleaned/changed	1, 2,and 3) Method 2.12 Sec. 8.2.2
$PM_{2.5}$ Separator (VSCC)	every 30 days	cleaned/changed	1,2 and 3) Method 2.12 Sec. 8.3.3
Inlet Cleaning	every 30 days	cleaned	1,2 and 3) Method 2.12 Sec. 8.3
Downtube Cleaning	every 90 days	cleaned	1,2 and 3) Method 2.12 Sec. 8.4
Filter Housing Assembly Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Circulating Fan Filter Cleaning	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
TEOM-FDMS Specific Operational Criteria			
Total Flow Verification	every 30 days	Sum of flow rates from 3 paths equal design flow rate < ± 5.1%	1,2 and 3) TEOM SOP Sec. 10.1.2
Bypass leak check (TEOM)	every 30 days	± 0.60 lpm	1,2 and 3) TEOM SOP Sec. 10.1.6 or TEOM Operating Manual Sec. 5-4
Replace TEOM filters	as needed	Change TEOM filter as filter loading approaches 90%, but must be changed before reaching 100%.	1,2 and 3) TEOM SOP Sec. 10.1.8
Replace the 47-mm FDMS (Purge) filters	every 30 days or any time TEOM filters are replaced	replaced	1,2 and 3) TEOM SOP Sec. 10.1.10

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Internal/External Data Logger Data	Every 30 days 10 randomly selected values	agree exactly (digital) and ± 1 µg/m^3 (analog). Note: digital is expected and should be used unless there is no capacity to utilize digital in the monitoring agencies' data system.	1, 2 and 3) TEOM SOP Sec. 10.1.24
Replace In-line filters	every 180 days and twice a calendar year	replaced	1, 2 and 3) TEOM SOP Sec. 10.2
Clean cooler assembly	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.1
Clean/Maintain switching valve	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.2
Clean air inlet system of mass transducer enclosure	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.3
Replace the dryers	1/yr or due to poor performance	Review dryer dew point data to determine acceptable performance of dryer	1, 2 and 3) TEOM SOP Sec. 10.3.4
Calibration (KO) constant verification	every 365 days and once a calendar year	Pass or Fail (≤ 2.5%)	1, 2 TEOM SOP Sec. 10.3.6 3) 1405-DF operating guide. Verification software either passes or fails the verification. Acceptance criteria is ≤ 2.5 %
Rebuild sampling pump	18 months	< 66% of local pressure	1, 2 and 3) TEOM SOP Sec. 10.4
GRIMM Specific Operational Criteria			
Internal rinsing air filter	After a few years	Changed	1, 2 and 3) GRIMM SOP Sec. 12.4 May require a trained service staff to change. May only require changing if a message reads "check nozzle and air inlet"
Change Dust Filter	Every 365 days and 1/ calendar year	Changed	1, 2 and 3) GRIMM SOP Sec. 12.3
Relative Humidity Setting	At Setup	Per Operators manual (55%) unless otherwise directed and approved to use at a different value	
Calibration of spectrometer	Yearly	+/- 5% for mass	Operators' Manual section 5.2
Cleaning or changing of the Nafion in inlet	As needed	We are seeking clarification from GRIMM on this	Operators' Manual section 11.4.2
Thermo BAM Specific Operational Criteria			
Cleaning Nozzle and Vane (BAM)	Minimally every 30 days	cleaned	1, 2 and 3) BAM SOP Sec. 10.1.3
Leak Check	every 30 days	≤ 0.42 L/min	1) BAM 5014i Instruction Manual 2) 3) BAM 5014i Instruction Manual
Replace or clean pump muffler	every 180 days and twice a calendar year	Cleaned or changed	

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Internal/External Data Logger Data (BAM)	Every 30 days 10 randomly selected values	agree exactly (digital) and ± 1 µg/m^3 (analog). Note: digital is expected and should be used unless there is no capacity to utilize digital in the monitoring agencies' data system.	1, 2 and 3) BAM SOP Sec. 10.1.9
Clean/replace internal debris filter	Every 365 days and 1/ calendar year		
MetOne BAM Specific Operational Criteria			
BAM check of membrane span foil	Daily	Avg. < ± 5.1% of ABS	1, 2 and 3) BAM SOP Sec. 10.4.3. Applies on the BAM 1020
BAM electrical grounding	At setup	1. Is the chassis of the BAM grounded? Is the downtube grounded to the chassis at the collar (i.e., with setscrews)	Per operator manual
Nozzle cleaning	Every 30 days, or more often as needed	cleaned	Per operator manual
Zero test	Yearly	Standard deviation of the data from a 72-hour zero test < 2.4 µg/m^3	Per operator manual
SYSTEMATIC CRITERIA- $PM_{2.5}$ Continuous, Local Conditions			
Siting	every 365 days and once a calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	***Annual Standard***	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
	24- Hour Standard	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	***all filters***	***µg/m^3 at ambient temp/pressure ($PM_{2.5}$)***	1. 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Rounding convention for data reported to AQS	***all filters***	***to one decimal place or as reported by instrument***	1. 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Annual 3-yr average	***all concentrations***	***nearest 0.1 µg/m^3*** (≥ 0.05 round up)	1,2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
24-hour, 3-year average	***all concentrations***	***nearest 1 µg/m^3*** (≥ 0.5 round up)	1,2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
Verification/Calibration Standards Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	every 365 days and once a calendar year	***< ± 2.1% of NIST Traceable Std.***	1) 40 CFR Part 50, App.L Sec. 9.1 & 9.2 2) Method 2-12 Sec. 4.2.2 & 6.4.3 3) 40 CFR Part 50, App.L Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Clock/timer Verification	Every 30 days	***1 min/mo****	1 and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App.L Sec. 7.4.12
Precision			
Single analyzer (collocated monitors)	every 90 days	Coefficient of variation (CV) < 10.1% for values ≥ 3.0 µg/m^3	1,2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
Primary Quality Assurance Org.	***Annual and 3 year estimates***	***90% CL of CV < 10.1 % for values ≥ 3.0 µg/m^3***	1,2 and 3) 40 CFR Part 58, App A, Sec. 4.2.1 and 2.3.1.1
Bias			
Performance Evaluation Program (PEP)	***5 audits for PQAOs with ≤ 5 sites*** ***8 audits for PQAOs with > 5 sites***	***< ±10.1% for value > 3 µg/m^3***	1,2 and 3) 40 CFR Part 58, App A, Sec. 3.2.7, 4.3.2 and 2.3.1.1

1/ 24 hour average value must be flagged if not meeting criteria
SD= standard deviation , CV= coefficient of variation
**** = need to ensure data system stamps appropriate time period with reported sample value**

Ozone Validation Template

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
Monitor	NA	***Meets requirements listed in FRM/FEM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One Point QC Check Single analyzer	***Every 14 days***	< ±7.1% (percent difference) or < ±1.5 ppb difference whichever is greater	1 and 2) 40 CFR Part 58 App A Sec. 3.1 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.2. QC Check Conc range 0.005 - 0.08 ppm and 05/05/2016 Technical Note on AMTIC
Zero/span check	Every 14 days	Zero drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14 day) Span drift < ± 7.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA -OZONE			
Shelter Temperature Range	Daily (hourly values)	20.0 to 30.0º C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2 Generally, the 20-30.0º C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30º C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	< 2.1º C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Shelter Temperature Device Check	Every 182 days and 2/ calendar year	<± 2.1º C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Annual Performance Evaluation Single analyzer	***Every site every 365 days and 1/ calendar year within period of monitor operation,***	Percent difference of audit levels 3-10 < ±15.1% Audit levels 1&2 < ± 1.5 ppb difference or <± 15.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) Recommendation- 3-audit concentrations not including zero. AMTIC guidance 2/17/2011 AMTIC Technical Memo
Federal Audits (NPAP)	***20% of sites audited in calendar year***	Audit levels 1&2 < ± 1.5 ppb difference all other levels percent difference < ± 10.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration of standard of higher level Every 182 day and 2/ calendar year if manual zero/span performed biweekly Every 365 day and 1/ calendar year if continuous zero/span performed daily	All points < ± 2.1 % or ≤ ±1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 ± .05	1) 40 CFR Part 50 App D 2) Recommendation 3) 40 CFR Part 50 App D Sec 4.5.5.6 Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	Concentrations below LDL	1) 40 CFR Part 50 App D Sec. 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
Certification/recertification to Standard Reference Photometer (Level 1)	Every 365 days and 1/calendar year	single point difference < ± 3.1%	1) 40 CFR Part 50 App D Sec. 5.4 2 and 3) Transfer Standard Guidance EPA-454/B-10-001 Level 2 standard (formerly called primary standard) usually transported to EPA Regions SRP for comparison
Level 2 and Greater Transfer Standard Precision	Every 365 days and 1/calendar year	***Standard Deviation less than 0.005 ppm or 3.0% whichever is greater***	1) 40 CFR Part 50 Appendix D Sec. 3.1 2) Recommendation, part of reverification 3) 40 CFR Part 50 Appendix D Sec. 3.1
(if recertified via a transfer standard)	Every 365 days and 1/calendar year	Regression slopes = 1.00 ± 0.03 and two intercepts are 0 ± 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Ozone Transfer standard (Level 3 and greater)			
Qualification	Upon receipt of transfer standard	< ±4.1% or < ±4 ppb (whichever greater)	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Certification	After qualification and upon receipt/adjustment/repair	RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts ≤ 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 1
Recertification to higher level standard	Beginning and end of O3 season or every 182 days and 2/calendar year whichever less	New slope = ± 0.05 of previous and RSD of six slopes ≤3.7% Std. Dev. of 6 intercepts ≤ 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails
Detection (FEM/FRMs) Noise and Lower Detectable Limits (LDL) are part of the FEM/FRM requirements. It is recommended that monitoring organizations perform the LDL test to minimally confirm and establish the LDL of their monitor. Performing the LDL test will provide the noise information.			
Noise	Every 365 days and 1/ calendar year	***≤ 0.0025 ppm (standard range)*** ***≤ 0.001 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Lower detectable limit	Every 365 days and 1/calendar year	***≤ 0.005 ppm (standard range)*** ***≤ 0.002 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA-OZONE			
Standard Reporting Units	***All data***	***ppm (final units in AQS)***	1, 2 and 3) 40 CFR Part 50 App U Sec. 3(a)
Rounding convention for design value calculation	***All routine concentration data***	***3 places after decimal with digits to right truncated***	1, 2 and 3) 40 CFR Part 50 App U Sec. 3(a) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
Completeness (seasonal)	***3-Year Comparison***	***≥ 90% (avg) daily max available in ozone season with min of 75% in any one year.***	1,2,3) 40 CFR Part 50 App U Sec 4(b)
	8- hour average	***≥ if at least 6 of the hourly concentrations for the 8-hour period are available***	1) 40 CFR Part 50 App U 2 and 3) 40 CFR Part 50 App U Sec. 3(b)
	Valid Daily Max	***≥ if valid 8-hour averages are available for at least 13 of the 17 consecutive 8-hour periods starting from 7:00 a.m. to 11:00 p.m***	1) 40 CFR Part 50 App U 2,3) 40 CFR Part 50 App U Sec. 3(d)
Sample Residence Time Verification	Every 365 days and 1/calendar year	***≤ 20 Seconds***	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
			3) 40 CFR Part 58 App E, Sec. 9 (c)
Sample Probe, Inlet, Sampling train	***All sites***	***Borosilicate glass (e.g., Pyrex®) or Teflon®***	1) 40 CFR Part 58 App E, Sec. Sec. 9 (a) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. Sec. 9 (a) FEP and PFA have been accepted as an equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	Every 365 days and 1/calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
EPA Standard Ozone Reference Photometer (SRP) Recertification (Level 1)	Every 365 days and 1/calendar year	Regression slope = 1.00 ± 0.01 and intercept < 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-454/B-10-001 This is usually at a Regional Office and is compared against the traveling SRP
Precision (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	**90% CL CV < 7.1%**	1) 40 CFR Part 58 App A 2.3.1.2 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
Bias (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	**95% CL < ± 7.1%**	1) 40 CFR Part 58 App A 2.3.1.2 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3

8.2.2. General Data Quality Objectives

- All data should be traceable to a National Institute of Science and Technology (NIST) primary standard.

- All standards used must maintain current certifications. Equipment used by the State or contract auditors for audits must also have current certifications. No audit equipment shall be used by any party without proof of current certification.
- All data shall be of a known and documented quality. The level of quality for comparison against the NAAQS is established by *40 CFR Part 50* and applicable guidance documents. Two major measurements used to define quality are precision and bias.
- All data shall be comparable. This means all data shall be produced in a similar and scientific manner. The use of the standard methodologies for sampling, calibration, and auditing found in the QAPP should achieve this goal.
- All data shall be representative of the parameters being measured with respect to time, location, and the conditions under which the data are obtained. The use of the standard methodologies contained in the QAPP should ensure that the data generated are representative.
- The QAPP must be dynamic to continue to achieve its stated goals as techniques, systems, concepts, and project goals change. A list will be maintained of minor QAPP changes that can be incorporated before a revision is submitted. EPA does not want resubmission for every small update.

8.2.3. Specific Data Quality Objectives (NAAQS)

All criteria pollutants have been monitored in the past in Hamilton County, and sites have been deleted as industrial sources have changed, as power plants nearby have been more regulated or shut down, and ambient levels have fallen. Chattanooga-Hamilton County, therefore, is only required to monitor for $PM_{2.5}$ and ozone. EPA granted the Bureau a waiver for required PM_{10} monitoring since a long history of PM_{10} monitoring has indicated levels significantly below the standard.

The specific data objective is to:

- determine whether or not the primary and secondary NAAQS for particulate matter (measured as $PM_{2.5)}$ of 12 $\mu g/m^3$ (annual arithmetic mean averaged over three years) and a daily standard of 35 $\mu g/m^3$ are exceeded.
- determine whether or not the 8-hour average NAAQS for O_3 of 70 ppb, effective December 28, 2015, is exceeded.

Chattanooga-Hamilton County was designated attainment for the one-hour ozone standard in 1988. Chattanooga-Hamilton County participated in an Early Action Compact for the 8-hour ozone standard that was accepted by EPA. Hamilton County, therefore, was given nonattainment with deferred status for ozone in 2004. Hamilton County was designated attainment for the 75 ppb 8-hour standard in 2012 and for the 70 ppb 8-hour ozone standard in January, 2018.

In 2005, Hamilton County was designated nonattainment for the 1997 $PM_{2.5}$ standard. In 2014 a SIP package was submitted to EPA to request attainment for the 15 µg/m^3 standard. That process was completed by publication of a final rule in the Federal Register on November 4, 2015. On April 15, 2015, Hamilton County was designated attainment for the 2012 12 µg/m^3 standard.

In January of 2015, EPA permitted Chattanooga-Hamilton County to delete the one remaining PM_{10} collocated monitoring site due to years of very low data. EPA approved this deletion as part of its monitoring network review for the State. EPA Region 4 considers this site deletion approval as having granted a waiver of the PM_{10} monitoring requirements and as such EPA says the waiver must be mentioned in the State Monitoring Plan yearly and formally requested in the 5-year plan every five years. Chattanooga-Hamilton County deleted the $PM_{2.5}$ monitor at the Soddy Daisy High School site (470651011) at the end of the December 2015. The monitor was not a regulatory requirement, and the site was not the highest data site. EPA defunded $PM_{2.5}$ speciation in Hamilton County in 2014. The Georgia Maple Street, Walker County, site (132950002) still performs $PM_{2.5}$ speciation in the attainment area.

8.3. Network Scale

Representativeness is defined as a measure of the degree to which data accurately and precisely represent a selected characteristic of a monitored system. Support in achieving representativeness is provided through adhering to the requirements provided in:

- *40 CFR Part 58, Appendix D* (Network Design for State and Local Air Monitoring Stations [SLAMS]),
- *40 CFR Part 58, Appendix E* (Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring).

Each monitor operated is assigned a scale of representativeness based on the definitions of *40 CFR* Part 58, Appendix D.

- ***Micro Scale -*** describes air volumes associated with area dimensions ranging from several meters up to about 100 meters (m).
- ***Middle Scale -*** describes air volumes associated with area dimensions up to several city blocks in size with dimensions ranging from about 100 m to 500 m (0.5 kilometer [km]).
- ***Neighborhood Scale -*** describes air volumes associated with an area of city that has relatively uniform land use with dimensions in the 500 m to 4,000 m (0.5 to 4.0 km) range.
- ***Urban Scale -*** describes air volumes within cities with dimensions on the order of 4,000 m to 50,000 m (4.0 km to 50 km). This scale would usually require more than one site for definitions.
- ***Regional Scale*** - describes air volumes associated with rural areas of reasonably homogeneous geography that extends for tens to hundreds of kilometers.

9. TRAINING REQUIREMENTS

Adequate education and training are integral to any monitoring program that strives for reliable data. Training is aimed at increasing the effectiveness of employees and their organization. As part of a QA program, *40 CFR Part 58, Appendix A* requires the development of operational procedures for training.

These procedures should include information on:

- Personnel qualifications – general and position-specific
- Training requirements – by position
- Training frequency

An effective level of training becomes absolutely critical when long-term employees retire. New employees must have the training and means to continue to operate the Air Monitoring department with the same level of quality assurance as before the retirement. In some agencies a number of employees have retired at the same time leaving a serious deficit in knowledge. Training is a prevention against a knowledge deficit.

The Air Monitoring Manager and the Instrument Technicians must meet the minimum requirements of the job descriptions of their positions. Instrument Technicians currently both have military electronics training, and both Technicians have Associates degrees. The Manager has a Bachelor's degree. The Air Monitoring Manager and the Technicians are responsible for maintaining their own training certificates and must be able to produce them upon request.

Observations during TSA audits may result in EPA's request for additional training. When EPA requests additional training, it is not considered optional.

Air monitoring staff are encouraged to communicate with management to discuss options for career development.

AQS data loading training is necessary for all Air Monitoring employees because data loading must continue when an employee leaves. EPA considers timely data loading as a critical function of an Air Monitoring Department. In a small agency employees tend to be highly specialized, but AQS loading knowledge should not be limited to one employee. It is wise that every employee in the department loads files each quarter so that loading skills remain current. This enables the employees to remain abreast of programming changes in AQS. If an employee does not regularly load data, he or she will lose their registration and must reregister, and they must relearn the process.

The Air Monitoring in-house training program involves cross-training on equipment for which the employee is not assigned. Every air monitoring employee may be called upon to serve as a backup person for a different facet of the program from what the employee is ordinarily assigned. Some agencies rotate employees to different positions for training periods. That is not done as an official action at the Bureau, but since there are but two Technicians, one has to cover the duties of the other during periods of illness, vacations or military leaves. So rotation, in effect, does happen. The Technician primarily responsible for ozone monitoring (Ozone Technician) substitutes more for the Technician primarily responsible for particulate monitoring (Particulate Technician). This is due to the Particulate Technician's military service in the U.S. Navy Reserve. This involves military leave at least once yearly, sometimes multiple leaves per year and may include extended periods of time.

Air monitoring personnel training consists of (1) required reading prior to implementing the requirements of this QAPP, (2) attending air quality training sessions taught by SESD (3) attending technical conferences when funding allows, (4) attending vendor classes when funding allows, and (5) attending AQS training classes. Documents required to be read shall include this QAPP, SOPs, and the operational procedures specific to the equipment with which the

Technician will be working or servicing. Required reading shall be documented on a "Required Reading" Form.

All employees are actively encouraged to pursue training opportunities whenever possible and as needed, as funding allows. Courses and seminars may be provided as videotapes, closed circuit transmission, web based real-time interactive formats, and/or live instruction. Organizations that provide training opportunities include local and regional universities, the Air and Waste Management Association, Metro 4, the Air Pollution Training Institute (APTI), the Western States Air Resources Council, EPA, and monitoring equipment vendors.

Technicians benefit from attending Region 4 Workshop if funding allows. One of the advantages of attending the Workshop is interacting with others that perform the same job. When a Bureau employee contacts another agency for help or advice, the agency contacted is more likely to assist someone they know personally. Relationships should be fostered at other agencies because help in an emergency can mean the difference between acceptable data and data that must be voided. Employees should develop positive relationships with State and EPA employees as the local agencies must have a good working relationships with all the State and Federal employees with whom they interact.

Currently employed Bureau air monitoring personnel have sufficient training to perform necessary functions at an acceptable level with equipment the Bureau owns. Currently employed Bureau air monitoring personnel are all trained in AQS data loading. The Bureau maintains a list of conferences and training classes that Air Monitoring employees attend. It is stored on the bookcase in the laboratory.

New air monitoring personnel are provided training for their individual monitoring tasks. New employees are sometimes sent for additional training at another agency. When the Bureau acquires new equipment, air monitoring employees may be sent to vendor or EPA training classes. It takes years to develop a knowledgeable air monitoring equipment Instrument Technician. Also, as technology is changing more rapidly than in the past, employees must be kept abreast of new monitoring technologies.

9.1. Quality Assurance

All Air Monitoring staff are required to read and understand this QAPP. Once the QAPP is approved by EPA, employees are expected to perform their work according to the principles set forth in this document. Employees must also read and understand the parts of the EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II (QA Handbook) that apply directly to their work and be familiar with the entire Handbook. The Bureau does not have regularly scheduled staff meetings in Air Monitoring but the Manager makes contact with employees daily.

There are no regularly scheduled Director-held management meetings at Air Pollution Control. Internal communication is done through e-mail so that there is a record of the exchange.

9.1.1. Equipment/Monitor-Specific Procedural Training

Bureau Instrument Technicians must be able to operate, maintain, and troubleshoot equipment for which each Technician is responsible. Each Technician must be able to troubleshoot

equipment for which he is not responsible in the event of the other Technician's absence. One Bureau Technician is in the military and can be on leave for extended absences.

Proper implementation of this QAPP requires the following specific training:

- Reading and understanding the specific SOPs of the equipment the Technician operates (the Technicians have helped write the SOPs so they are familiar with them).
- Installation, operation, and maintenance knowledge of specific equipment- gained by studying operations and service manuals and supplemented by vendor offered formal training sessions.
- On the job training.
- Interaction with others that perform the same functions.
- Applicable health and safety training.

10. DOCUMENTATION AND RECORDS

The quality of the data acquired in the air monitoring program is dependent upon the quality of the documentation. EPA's position is that if it is not written down, it did not happen. Documents and records must be carefully and completely filled out, stored and bound (if required) appropriately, easily available for reference in one area of the Bureau, and stored for the regulatory length of time. There is no formal report distribution system within the Bureau since it is a small agency. The three Air Monitoring employees have access to all air monitoring records.

The Bureau Director is sent a daily afternoon report of the peak data for the day, and reports are prepared on Monday for the weekend. The Bureau produces a daily media report (for each of the five work days) for the previous day that contains the AQI and ozone and particulate data. It also contains a mold spore and pollen count. It is sent to all Bureau employees. The Director will send an e-mail to the Manager and Technician if he has questions about the reports. Actual reports are in the Reports to Management section of this document.

The Bureau Director is presented AQS AMP reports to review for the entire year at certification. The Director, the Public Information Specialist and all air monitoring employees are sent the daily Enviroflash forecast prepared by State meteorologists.

IML sends electronic reports for each quarter that are stored on the Air Monitoring Manager's computer in files by each year. The AQS text files from IML are also stored on the Air Monitoring Manager's computer and on the Air Monitoring Manager's Google Drive account.

10.1. Information Reported

10.1.1. Routine Data Activities

Chattanooga-Hamilton County maintains records in appropriate files that allow for the efficient archiving and retrieval of records. The Bureau uses multiple backup procedures to prevent data loss.

Any maintenance, calibrations, or audits performed are recorded in:

- the bound log book at the site for each monitor. Each particulate monitor has its own log book as well as each continuous monitor.
- the logger Message to Central file or, in the case of the 8872, the Log file. The state has been putting their messages also in the Message to Operator file as well as the Message to Central or Log file. The file is downloaded hourly by telemetry. If the poll fails for some reason, the information not collected is collected on the next poll.

Back-up documentation:

- the Messages to Central or Log files are printed quarterly and hard copies are kept on the bookcase in the lab. Log books are copied every quarter and the paper copies are kept in the lab.
- Data is backed up by CD every two weeks.
- The Bureau server is backed up every two weeks.
- Paper copies of the ozone precision checks and span checks are archived in notebooks in the lab for a period of five (5) years.
- Continuous monitors have internal loggers from which data can be retrieved.

10.1.2. Quarterly Data Submittal to AQS

Chattanooga-Hamilton County shall submit quarterly data, as specified in *40 CFR Part 58*, to EPA's national database, AQS, directly by entering data into the database. Continuous data is converted to AQS format by the Airvision software and Null Value Codes are added. Inter-Mountain Laboratories of Sheridan Wyoming, is contracted to put $PM_{2.5}$ data into AQS format and supply that data to the Bureau. IML adds the Null Value Codes which are reviewed by Bureau personnel before loading. Once the data is proofed and formatted, it is loaded to the EPA Network Exchange, then to AQS. Precision and accuracy data lines are formatted using the generator or the functions in Maintenance in AQS or hand-built. This data shall be submitted no later than 90 days (note: less than three months) following the close of each calendar quarter, as specified in *40 CFR Section 58.35*, and shall be certified accurate, to the best of his/her knowledge, by the Air Monitoring Manager, the Director, or the Director's designee. The quarterly data submittal is reviewed by running multiple AMP reports to confirm data was entered and to confirm all Null Value Codes have been accurately added.

EPA has stated that some AMP reports may not provide correct information if Null Value Codes are missing for voided data.

If, when AMP reports are run, data are found to be missing, the Manager contacts the Technician responsible for that data loading, and the Technician loads the missing data. AMP reports are run a second time. If data are still found to be incompletely loaded, the missing data will be submitted, and AMP reports will be run a third time. In other words, AMP reports are run to confirm complete data submittal every time the submission is thought to be completed.

An attempt is made to submit the data 60 days into the next calendar quarter to allow for any issues that arrive in loading and as a courtesy to the State. This gives the State time to review

the data before the 90-day deadline, if the State so chooses. When the data is submitted by the Bureau, an e-mail is sent to State representatives, normally the person responsible for AQS submission and a Manager in Air Monitoring, to indicate the data is loaded -with the certified accurate statement included. Confirming AMP reports are run from AQS (normally 350, 450, and 251) and attached to the e-mail to the State. The reports demonstrate to the State that the data is loaded and indicate the level of data completeness. This email to the State is a courtesy, not a requirement, but the State should be notified if the Bureau intends to cease this communication.
Employees should not wait until the end of the quarter to load the previous quarter's data into AQS. AQS can crash from extreme traffic, and there is a much slower response time from the Help Line during times of high usage or AQS can be shut down for planned maintenance on a critical day. It is better to allow plenty of time to handle any issues.

10.1.3. Annual Reports Submitted to EPA

- Chattanooga-Hamilton County must certify its data each year by May 1 to EPA by Chattanooga-Hamilton County's Director or the Director's designee, to be accurate to the best of his/her knowledge taking into consideration the quality assurance findings. This certification will be based on the various assessments and reports performed by the organization, in particular, the AMP600 report that documents the Precision and Accuracy checks and whether raw data is fully entered. The AMP600 is required to be submitted to EPA with the certification letter. The certification letter also must explain any data that is not being certified and why. EPA has been sending yearly a memo detailing what documents are expected in the certification package. The requirements can change with changes in EPA personnel or as AQS programmers develop new AMP reports.
- Once the certification letter is submitted, Chattanooga-Hamilton County must log into AQS and, under certification in the menu, click that data is recommended for certification for each individual monitor. Then EPA, after reviewing the data, will add an EPA concurrence flag to each monitor.
- If any previous year's data is altered in AQS, that year must be recertified with a new certification letter. First, check under the certification tab in AQS to determine if the change altered the EPA flag that indicates EPA agreement with the certification of that specific data. AQS is supposed to automatically drop the EPA certification flag if the data is altered. It may not drop the flag if the method code is changed or some alteration is made to the data line that does not affect the data itself. If the flag has been dropped, a new letter for certification of that year must be sent to EPA explaining whatever action was taken. It is imperative that after any change in AQS is made, the certification section is checked to make sure the EPA concurrence check for that year on a monitor was not removed by the action. It is critical that data not be allowed to remain uncertified once a change has been made that removed the certification.
- Chattanooga-Hamilton County must submit a Network Review to the State to be included in the State of Tennessee monitoring plan due July 1. The State usually requests the Review by April to allow time for the State to review it and for the 30-day public comment period of their Air Monitoring Plan. The Network Review will provided narrative about monitoring changes in the previous year, expected changes for the coming year, an equipment evaluation, site information that is updated yearly, and a copy of the current Memorandum of Agreement with the State of Georgia.

- Any approved changes in monitoring or monitoring sites during the year requires a change in the information in AQS under Monitor and Sites. Any physical changes around a site, such as the addition of a road, may also require altering monitor and site information in AQS.
- The Network Review, once a small document, has been expanded to include the Equipment Evaluation and the Site Evaluation. Both of these required items are to now be included in the State Air Monitoring Plan for each local agency. The Site Evaluation involves making calculations of the distances from obstructions and the height of trees. This site evaluation is a project to which some time must be devoted. The Network Review and the previous year's certification are due in the same time period.
- There is now an Air Monitoring Quality Assurance Report for the 105 Grant, required to be submitted yearly, that states that the Bureau does have an EPA approved QAPP, QMP, and SOPs and is following Quality Assurance procedures.
- The 105 Grant Air Planning Agreement has a number of data quality assurance questions that must be answered in the affirmative as part of the agreement. For FY 2018 the Agreement requires submittal of the Network Plan in the State Air Monitoring Plan; schedules for the QAAP and QMP submittals; a yearly Equipment Evaluation; updated SOPs; exceptional event compliance; attendance at Region 4 Workshop and the National Air Monitoring Conference; and requirements for data completeness.

10.2. Program Records Policy

Frequently changed documents are published with the date and revision information clearly noted, generally in a document header, occasionally in a footer, depending upon the document. Documents that are notated are QAPPS, the QMP, and SOPs. In other words, any quality assurance document that is expected to be constantly updated will have a header that states the version number and the date. For minor document changes not approved by EPA a list will be maintained at the Bureau, and the minor changes list will only be submitted to EPA with significant changes. This is to prevent resubmission for every minor change.

The document should have the name of the agency and the page number on every page. The name of the agency is important so that anyone reviewing documents from multiple agencies and shuffling pages will know to which document those pages apply.

Documents are submitted to R4sesdairqa@epa.gov, an e-mail address set up by SESD in Athens for document receipt. Because there have been some issues with records of the submissions, the Bureau has found it useful to make the submission to at least two other employees at SESD besides the special e-mail address. The Bureau has also been requesting that someone acknowledge receipt of the document and send an e-mail back. This is important since it could be assumed, if no failure notice was received back, that a document was received, when, in fact, it may not have been received or somehow not electronically recorded as received. Generally it is wise that important correspondence by e-mail be sent to more than one EPA employee in the same office and that the e-mail is checked to send a receipt back. The Bureau rarely sends paper documents that are certified through the US mail, once the Bureau standard means of documenting delivery. If an e-mailed document is sent to more than one employee in an office, it assures that the correspondence was received by someone in that office and assures that if someone is out for leave or on assignment elsewhere the topic is addressed by an EPA employee. Many EPA employees work four-day weeks so they may be out of the office on either Monday or Friday. Also EPA employees have Federal holidays that Bureau employees do not receive, so if there is something important pending, EPA's work schedule should be considered.

A copy of the yearly data certification letter should always be sent by e-mail to a number of parties; paper copies sent to several; and a post office certified copy sent to the Regional Administrator. The certification letter receipt must be well documented. This is one of the few documents in Air Monitoring where proving receipt is crucial. Copies of the yearly data certification letter and AMP required reports should be provided by e-mail to the Region 4 contact in Atlanta, two managers above that employee, the Region 4 Administrator (if required by Region 4), the State of Tennessee monitoring contact, the State of Tennessee AQS responsible employee, and the State of Georgia monitoring contact. Receipts should be retained. Paper copies, at a minimum, should be sent to the Region 4 contact and the two managers above that contact. As employees change and reorganizations occur at EPA, the chosen recipients may be different from year to year.

10.3. Sample Collection Record

10.3.1. Logbooks

Each Instrument Technician will be responsible for Instrument logbooks for monitors for which he/she is responsible. The logbooks will be used to record information about the site as well as document maintenance and routine operations. Each monitor at a site has its own logbook. Thus, at the Siskin site there are multiple logbooks. If something occurs at the site, but does not involve a specific monitor, technicians have been instructed to make a note in one of the three logbooks. All logbooks are copied quarterly and the copies are stored at the Bureau laboratory. The Logbooks will be considered legal documents and must be legally defensible. Logbooks will contain only monitoring information with entries on consecutively numbered pages in the order of occurrence. There will be no pages removed, no personal comments, and no drawings that are not technical schematics. All entries will be in indelible ink. There will be no overwriting. Corrections shall be made by inserting one line through the incorrect entry, initialing and dating this correction, and placing the correct entry alongside the incorrect entry (if this can be accomplished legibly) or by providing the information on a new line if the above is not possible. The idea is so that the information marked out can be clearly read. For a court case, transparency is important. Nothing is to be obscured so that it is not readable.

No documentation shall be added to an entry once the entry has been made. A new addition or change will be made on the date it is added with a reference to the date and page in the logbook to which it refers- if a comment needs to be added about a previous entry in the logbook. A note can be added on the original page to reference the entry at a later date. No pages can be left blank because information can be back-filled. Any blank area must have an X through it.

Each logbook will be copied for the previous quarter by the Instrument Technician responsible for the specific monitor during the following quarter and the copies will be stored on the bookcase in the laboratory. This is to prevent information loss in the event of loss of the logbooks.

Any filled logbook is replaced with a new paginated bound log and the filled one is archived in the laboratory (on the lab bookshelf if there is space). No logbook is to ever be used that does not have consecutive preprinted pagination.

If an employee is signed out at the Bureau to go to a site, there should be a log entry at that site stating what procedure was performed at the site or if the site was inspected for some reason. If an employee is signed out for a site but there is no note in any log book at the site, then the employee is assumed to never have gone to the site.

There is a special log in the laboratory where $PM_{2.5}$ filters and cassettes are logged before they are taken to the site to be loaded into the monitors. This log states the date the cassettes are programmed to be exposed and notes about voiding of a sample. It contains notes if a cassette originally scheduled for one date is reprogrammed for a second date. This log is intended to be a reference if filter numbers or cassette numbers do not match what is entered into the monitor. It is helpful for reference if IML has any questions about filters that were sent. It has been very useful in the past for determining what happened to a filter when there is a filter number or run date discrepancy.

When $PM_{2.5}$ filters are retrieved from monitors by the technician to be sent to the lab, the filter number and the cassette number will be recorded in the appropriate bound log book at the site. This is to enable tracing a filter from installation to retrieval.

Completion of data entry forms, associated with environmental data operations, are required even when the Instrument logbooks contain all information required for the routine operation performed.

- ***Instrument Logbooks*** – Bound Logbooks will be used for each individual monitor at each site. Each notebook should be hardbound and paginated. Appropriate data entry forms may be used instead of logbooks for specific activities.
- ***Copies of Instrument Logbooks-*** Copies of the Instrument logbooks are made each quarter and stored in the Bureau lab on the bookcase. This is to serve as a backup for the logbook in the event the book is destroyed or disappears.
- ***Site Logger Message Files***– An electronic database exists in which the Bureau retains all records pertaining to continuous monitoring equipment calibrations as well as general comments and notations required for support of the Ambient Air Quality Network Data integrity activities. This is done by entering information in the Message to Central in the 8832 or in the Log files for the 8872. Every visit to the site, every maintenance activity, every manual calibration, and every local or State audit result should be documented in the message/log files. The State uses the Operator files, as well, so they can access them when they return to the site to see what was previously noted. The 8832 Message to Central or 8872 Log files are programmed to download hourly with the hourly data downloads. These files should be easily accessible by query in Airvision.
- ***Database***- A historical electronic local Oracle database exists for PM_{10} pre- and post-weights. Those measurements are no longer performed as PM_{10} monitoring has been deleted.
- ***Electronic Reports***- Electronic Reports are supplied by Inter-Mountain Laboratories for $PM_{2.5}$ data. The report is sent electronically in a readable Excel™ spreadsheet type of format with a tab for each site and tabs for blanks. IML is also contracted to prepare AQS text files that are sent electronically in the AQS data line text format to the Bureau. Bureau personnel proof and load the data lines into AQS after receipt. IML is contacted if the AQS files will not load for some reason.
- ***Electronic Files-*** As the Air Monitoring Department moves toward paperless files, much of the documentation is now kept in scanned electronic files on the Air Monitoring Manager's computer or in the data acquisition software Airvision. A Technician downloads minute data to CDs. As a back-up a flash drive is kept on the bookcase in the lab and the QMP, QAPP, SOPs, Five Year Assessment, Network Evaluation, and other critical documents are kept on the drive in the event of the need of an electronic copy or in the event of a computer crisis in the Air Monitoring Manager's office. An electronic copy can be revised and resubmitted. The

flash drive should be assessed once a year to make sure current copies of important documents are on the drive. The information on the drive is useless if it is not kept current. The QMP and the QAPP are done in markup format so that changes are readily apparent.

- ***Filters Archiving-*** Filters are archived in IML's freezer for one (1) year. Then the filters are sent cold to the Bureau and are archived in the Bureau freezer. After five (5) years the filters are discarded unless they are of interest because of monitoring during a pollution event. Filters of interest may be retained longer.

10.3.2. Electronic Data Collection

Agilaire Airvision is the Bureau's automated data collection software. A 16G computer was purchased as the designated Airvision computer, located in the lab in the Ozone Technician's cubical. Minute data and hourly data are downloaded from the data loggers in the hourly poll and retained on the Airvision computer. Two loggers are operated at each ozone site. Minute data and hourly data are downloaded from the primary logger and only hourly data is downloaded from the secondary logger, both logger downloads occurring hourly. Minute data must be downloaded about twice a year from the Airvision computer to free up memory. In order to provide a backup, automated data collection information will be stored on CDs for the appropriate time frame. Air Monitoring data are backed up on CD every two weeks.

Minute data can be loaded back onto the Airvision computer for manipulation in Airvision if minute data older than six months must be studied.

Any data collected in Excel™ Spread Sheets for official purposes (not currently done) must have every formula audited yearly so that the formulas are correct.

Exceptional event (EE) documentation is kept electronically on the Air Monitoring Manager's computer even if the document is not submitted to EPA for EE status. A large event is documented by the Air Monitoring Manager who saves satellite images and roughs out a technical paper in the event the Bureau needs to apply for event status. Under EPA's new EE rule, EPA will not consider an EE request unless it will affect an area's attainment status. Therefore, the procedure now is to document exceedances resulting from exceptional events and retain that documentation for possible future use in case other events should take place leading to nonattainment. The data should be flagged in AQS, the event explanations entered into AQS, and Region 4 should be notified. When the data is flagged, the Bureau must decide whether to flag the data with an informational flag or a flag indicating intent to request exceptional event status.

Real-time reporting to AirNow is a form of electronic data collection. Data is polled and sent to an FTP site for AirNow use. AirNow has a number of quality control parameters that will determine the data to be invalid if the data is not within the parameters. Ozone data mapped on AirNow is not all real. Because the ozone data is in 8-hour forward averaging format, the data will have real hours and hours calculated with an algorithm in some of the 8-hour averages. Real data is supposed to backfill later for the algorithm hours. EPA wants agencies to be aware of data in AirNow, and notify AirNow officials if the data is not being properly reported on the map.

One agency found activist groups registering under their AirNow account. AirNow should be checked occasionally to make sure only the Bureau is listed on the account.

10.3.3. Chain of Custody Forms

Federal Reference $PM_{2.5}$ monitoring involves the collection of particulate on a 47mm filter substrate. These filters are conditioned, weighed by the lab, exposed for 24 hours, then the filters are mailed back to the contract laboratory, IML, where they are reconditioned and reweighed. The filters must be accompanied by a Chain of Custody form since the filters are shipped and handled elsewhere. This form assists in tracking the integrity of the sample through the various stages of transportation and receipt. The form includes:

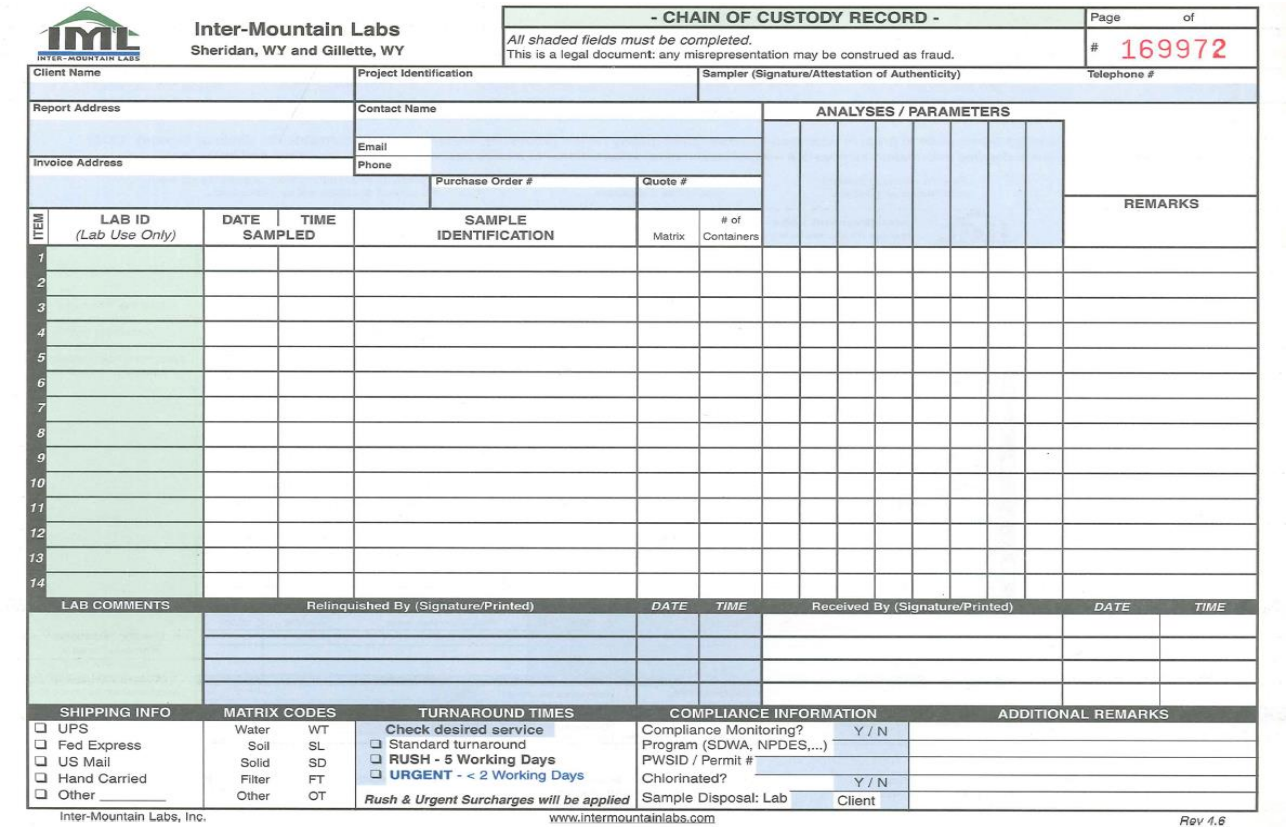
- The itemized filters and their accompanying cassettes submitted
- Dates the filters were exposed.
- Signature of the employee mailing the shipment
- Date of shipment

The filters are packed with freezer cold packs for shipment. A minimum maximum thermometer is shipped with the filters to IML, and IML records the minimum and maximum when the shipment arrives. IML also takes an instantaneous arrival temperature and notes whether the cold packs are still frozen. The $PM_{2.5}$ FRM SOP contains more specific information.

Data is flagged for the filters in the shipment if the cooler arrives at a higher temperature than the filters were exposed. If the data arrives at a higher temperature than the filters were exposed and that temperature is above 4°C, then the data must be voided.

Figure 5 is the IML Chain of Custody form.

Figure 5. IML Chain of Custody



Inter-Mountain Labs
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

Page of

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

169972

Client Name | Project Identification | Sampler (Signature/Attestation of Authenticity) | Telephone #

Report Address | Contact Name | Email | Phone

Invoice Address | Purchase Order # | Quote #

ANALYSES / PARAMETERS

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	REMARKS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME

SHIPPING INFO
- ❑ UPS
- ❑ Fed Express
- ❑ US Mail
- ❑ Hand Carried
- ❑ Other _____

MATRIX CODES

Water	WT
Soil	SL
Solid	SD
Filter	FT
Other	OT

TURNAROUND TIMES
Check desired service
- ❑ Standard turnaround
- ❑ RUSH - 5 Working Days
- ❑ URGENT - < 2 Working Days

Rush & Urgent Surcharges will be applied

COMPLIANCE INFORMATION
Compliance Monitoring? Y / N
Program (SDWA, NPDES,...)
PWSID / Permit #
Chlorinated? Y / N
Sample Disposal: Lab Client

ADDITIONAL REMARKS

Inter-Mountain Labs, Inc. www.intermountainlabs.com Rev 4.6

10.4. Data Archiving and Retrieval

All $PM_{2.5}$ FRM filters collected will be retained for five years from the date of collection in accordance with *40 CFR 58.16(f)* (filter retention). However, if any litigation, claim, negotiation, audit, or other action involving the records has been started before the expiration of the five-year period, the records will be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular five year period, whichever is later.

Table 5. Reporting Information

Categories	Record/Document Type	File Locations
Management and Organization	State Implementation Plan Reporting Agency Information Organizational Structure Personnel Qualifications and Training Training Certification Quality Management Plan Document Control Plan EPA Directives Grant Allocations Support Contracts	Engineering Files Lab Bookcase Operations Dept. Operation's Dept.
Site Information	Network Descriptions Site Files Site Maps Site Pictures	Lab Bookcase State Air Monitoring Plan/ Air Monitoring Manager's Computer
Environmental Data Operations	Quality Assurance Project Plans Standard Operating Procedures Instrument and Laboratory Notebooks Sample Handling/Custody Records Inspection/Maintenance Records	Lab Bookcase
Raw Data	Any Original Data (routine and quality control)	Air Monitoring Electronic Files on the Airvision computer
Data Reporting	Air Quality Index Reports Annual SLAMS Report Data/Summary Reports Journals/Articles/Papers/Presentations	Air Monitoring Files/ Computer Discs
Data Management	Data Algorithms Data Management Plans/Flowcharts Data Management Systems Pollutant Data Meteorological data from the airport	SOPS in Lab Bookcase
Quality Assurance	Good Laboratory Practices Network Reviews Data Quality Assessments Quality Assurance Reports Technical System Audits Response/Corrective Action Reports Site Audits	Lab Bookcase

11. NETWORK DESCRIPTION

The primary function of the Air Monitoring Program is to verify compliance with the NAAQS by providing good, valid data. Other purposes include determining trends over time, determining effects on air quality from adjustments to source emissions, developing algorithms based on historical air quality and other conditions which will forecast air quality (forecast performed by the State meteorologists), verifying air quality modeling programs, and providing real time ozone and $PM_{2.5}$ data to the public.,

Sampling network design and monitoring site selection comply with the following appendices of *40 CFR Part 58*:

- *40 CFR Part 58*, *Appendix A* - Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS)
- *40 CFR Part 58, Appendix D* - Network Design for State and Local Air Monitoring Stations (SLAMS)
- *40 CFR Part 58, Appendix E* - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring

The State of Tennessee prepares the State Air Monitoring Plan yearly which covers all the monitoring in the state, including the monitoring performed by the local agencies. The State Air Monitoring Plan is posted for public comment by the State for 30 days before it is finalized. The Bureau, along with the other local agencies, contributes a yearly Network Review where sites proposed for deletion and site moves are discussed. The Bureau includes historical information that may need referencing in subsequent years. The Bureau lists the current sites and the equipment currently at the sites. The Bureau Network Review has attached a page of history of each current site, beginning in 2015, which is updated yearly. Also attached is an equipment evaluation. The Bureau provides a copy of the Memorandum of Agreement with Georgia since Georgia is in the Bureau's designation area for $PM_{2.5}$.

EPA has requested that site move permissions be requested in the State Air Monitoring Plan. EPA also considers the deletion of the Hamilton County PM_{10} monitoring site a waiver of the PM_{10} monitoring requirements. EPA requests that the waiver be identified each year in the State Air Monitoring Plan and the waiver request renewed every five (5) years in the 5-year assessment.

11.1. Network Objectives

The Ambient Air Quality Monitoring Network is designed to meet a minimum of seven basic monitoring objectives. These basic monitoring objectives are to:

- determine the highest concentrations expected to occur in the area covered by the network,
- determine representative concentrations in areas of high population density,
- determine the impact of significant sources or source categories on ambient pollution levels,
- determine general background concentration levels,
- determine the extent of regional pollutant transport among populated areas and in support of secondary standards,

- determine the welfare-related impacts in rural and remote areas (such as visibility impairment and effects on vegetation), and
- utilize the network design criteria specified in *40 CFR Part 58, Appendix D*, to establish the appropriate network configuration necessary to meet these objectives.

11.1.1. Monitoring Objectives and Spatial Scales

Each monitor within Chattanooga-Hamilton County's Ambient Air Quality Monitoring Network is assigned one of the following monitoring objective designations:

- ***Population exposure -*** the monitor is located in an area associated with high population density.
- ***Background -*** the monitor is located where manmade pollutant emissions are minimal.
- ***Transport -*** the monitor is located to measure pollutants transported from other areas.
- ***Maximum concentration -*** the monitor is located where a high concentration of the pollutant is expected (often based on results of receptor models).
- ***Comparison study -*** the monitor is located adjacent to other instrumentation measuring the same pollutant to compare different sampling/monitoring methodologies.
- ***Air Quality Index -*** the monitor provides data primarily for reporting to the Air Quality Index (previously called the Pollutant Standards Index).

Data collected within the network must be representative of the spatial area under study. The goal in siting a monitoring station is to match the spatial scale represented by the samples obtained with the spatial scale most appropriate for the monitoring objective of the station.

11.2. Site Selection

The selection of a monitoring site is more of a process than an instantaneous decision. Many variables must fall into place for a site to be established or moved. In the final analysis, EPA may not approve the site, and the process must begin again.

The selection of a specific monitoring site includes the following activities:

- developing and understanding the monitoring objective and appropriate data quality objectives
- identifying the spatial scale most appropriate for the monitoring objective of the site
- identifying potential locations where the monitoring site could be placed
- identifying the specific monitoring site
- adhering to the site selection criteria specified in *40 CFR Part 58*, *Appendix E*
- review of population density
- impacts of known pollutant emission sources (area and point) on air quality
- representativeness of air quality
- determining availability of utilities
- determining if the site instruments can be protected
- determining safety for employees
- geography - since Hamilton County has mountains and ridges
- location of other established monitoring sites including the site in North Georgia
- ease of procuring property usage permission
- cost of installation

- acquiring approval from EPA SESD (requires site visit)

11.2.1. Site Types

Although there are a number of different types of networks as part of EPA supported monitoring, Air Pollution Control operates SLAMS sites and one special purpose monitor (a T640 continuous $PM_{2.5}$ monitor). The Bureau only operates $PM_{2.5}$ and ozone monitors. The network has been reduced since about 2015 when $PM_{2.5}$ speciation (470654002) was defunded, PM_{10} collocated monitors were deleted (470650006), and the Soddy Daisy SPM $PM_{2.5}$ (470651011) was deleted. $PM_{2.5}$ speciation is still performed in this designation area by the State of Georgia in Walker County, Georgia (132950002). That data is available through AQS.

11.2.2. Site Location

Comparison of the site with comparisons to requirements in *40 CFR*:

A site move may be evaluated on all of the previously listed evaluation factors for establishing a site and:

- Proximity of the proposed site to the established site
- Whether the same AQS number can be assigned to the new site

Selection according to these criteria requires detailed information concerning the location of sources, geographic variability of ambient pollutant concentrations, meteorological conditions, and population density. Selection of the number, geographic locations, and types of sampling stations is, therefore, a complex process.

The sampling site selection process also involves consideration of the following factors:

Economics - The quantity of resources required to accomplish all data collection activities, including instrumentation, installation, maintenance, data retrieval, data analysis, QA, and data interpretation, must be established.

Security - In some cases, a preferred location may have associated problems that compromise the security of monitoring equipment (i.e., high risk of theft, vandalism, etc.). If such problems cannot be remedied through the use of standard measures such as additional lighting, fencing, etc., then an attempt to locate the site as near to the preferred location as possible shall be made.

Logistics - This process includes procurement, maintenance, and transportation of material and personnel for the monitoring operation. The logistics process requires full knowledge of all aspects of the data collection operation: planning, reconnaissance, training, scheduling, safety, staffing, procuring goods and services, communications, and inventory management. Logistics may be something as simple as whether parking is available. For example, a site may require use of a crane, but the location is too close to power lines to use a crane to put the shelter in place.

Atmospheric Considerations - These considerations may include spatial and temporal variability of pollutants and their transport. Effects of buildings, terrain, and heat sources or sinks on air trajectories can produce localized anomalies of pollutant concentrations. Meteorology must be considered in determining the geographic location of a site as well as the height, direction, and extension of sampling probes. Evaluation of a current local wind

rose is essential to properly locate many monitoring sites (e.g., siting either to detect or avoid emissions from specific sources).

Topography - Evaluation of the local topography based upon land use maps, U.S. Geological Survey topographic maps, and other available resources must be completed. Minor and major topological features that impact both the transport and diffusion of air pollutants must be identified and evaluated. Minor features may consist of an adjacent tree lined stream or tall structures either upwind or downwind of a point source, each of which may exert small influences on pollutant dispersion patterns. Major features include river canyons or deep valleys, mountain ranges, and large lakes. Major features significantly impact the prevailing wind patterns or create their own local weather such as katabatic or anabatic winds. The topography of Hamilton County is particularly problematic as the county is bordered on the eastern and western borders by mountains and split partially down the middle by a ridge.

Pollutant Considerations - The monitoring site location for a specific pollutant may or may not be appropriate for another pollutant. Evaluation of the changes that pollutants undergo temporally and spatially must be considered in order to determine the applicability of each particular site for a specific pollutant. An example would be the temporal delay in peak concentrations of NO_x and volatile organic compounds (VOCs), compared to the peak concentration of resulting O_3. A micro scale site used to monitor CO may be appropriate for measuring O_3 precursors, such as VOCs and NO_x, but entirely inappropriate for measuring O_3 itself. Due to the time delay in the creation of the secondary pollutant, O_3, a more distant neighborhood or urban scale monitoring site may be appropriate for directly monitoring O_3.

Interdependence exists between all of the factors listed. Consequently, a procedure must be employed in order to successfully select appropriate sites that can provide the data necessary to accomplish the objectives. Site selection can be complicated as there are so many variables that must be addressed.

Modelers can be employed to assist in selecting a site if emissions from a particular facility are of interest.

It is the responsibility of the Air Monitoring Manager, with the assistance of the Technicians, to select a monitoring site. Whenever possible the Bureau uses government or Hamilton County school property to avoid paying property rental and for ease of permissions. Sometimes a government agency with high power usage will supply power. A large map of the area is obtained from the mapping department of Hamilton County (GIS Department). If a specific area is desired, then a radius can be drawn on the map by the GIS department when the map is ordered. Then all air monitoring employees have a scouting expedition to try to find a safe location that meets siting criteria in the area of interest. When a location is identified and local permission seems attainable, a letter and pictures are sent to EPA, and SESD schedules a site visit. Region 4 from Atlanta may also send a person. Once permission is granted from EPA, the Bureau attorney will author a formal agreement with the property owner, and arrangements will be made to install power, phone, shelter foundation, shelter or platform, and a fence, if needed.

As part of the site selection process trees may have to be trimmed or cut so that the site will be appropriate. Arrangements may have to be made before EPA approves the site.

The site selection and permission process requires months of work. One should estimate four to six months for the process. It can be difficult, therefore, to move a site on short notice. If a site must be moved on short notice, the Bureau must work with EPA to speed up the process. If a site must be moved on short notice, a temporary site most likely will have to be selected until a permanent site can be approved.

It is the responsibility of the Air Monitoring Manager to contact appropriate authorities if access to a site is blocked for some reason. The Bureau has had problems with a site in an employee parking lot where employees blocked access to the site by parking on the grass in front of the site rather than in the parking lot.

It is the responsibility of air monitoring personnel during site visits to pay attention to what is happening around a site. In the last fifteen (15) years the Bureau has had to move several sites on short notice. In one case employees found stakes around a site, the site was in the middle of what was shortly to be a new road, and Air Pollution Control had not been informed.

11.2.3. Monitor Placement

The placement of each monitor is determined by the defined monitoring objective. Monitors are usually placed according to potential exposure to pollution. Because there are so many considerations for site selection, tradeoffs are often necessary to locate a site for collection of optimally representative data. Placement of a particular monitor at a selected site is dependent on physical obstructions, activities in the immediate area, employee safety, and the availability of power and telephone services. Monitors are required to be placed away from obstructions such as trees and buildings in order to avoid their effects on airflow. To prevent sampling bias, airflow around monitor sampling probes must be representative of the airflow in the area.

11.3 Siting Criteria for Pollutant Sampler/Analyzer

General probe and monitoring path siting criteria for criteria pollutants shall adhere to the requirements listed in *40 CFR* Part 58, Appendix E, and the instructions outlined below.

11.3.1. Ozone (O3)

The probe intake is to be located from 3 to 15 meters (m) above the ground. The probe is to be more than 1 m horizontally or vertically away from any supporting structures. It should be at least 20 m away from any trees or shrubs. Because of their ability to alter normal wind flow patterns and provide surfaces for absorption or reactions (the scavenging effect of vegetation is greater for ozone than for the other criteria pollutants), trees and shrubs shall not be located between a nearby source and the sampler. Samplers monitoring O_3 transported over a long distance, such as from an urban city core area, should be sited so that no trees are within 20 m of the sampler along the predominant summer daytime wind direction. The distance shall be measured from the dripline or outside edge of the crown, not the trunk. For monitors to be operated at the same site for several years, it is best to allow some additional space for vegetation growth. In situations where trees or shrubs could be considered an obstruction, the trees or shrubs must be at least 10 m from the probe. The distance between the probe and any obstruction must be at least twice the height that the obstruction extends above the probe. The sampler must have unrestricted airflow in at least a 270° arc around the sampler. The arc must include the predominant wind direction for the season of maximum concentration. *40 CFR* Part 58, Appendix E gives the required separation distance from the nearest traffic lane.

11.3.2. Solar Radiation Sensors

All solar or net radiation sensors must be positioned so they are horizontal. These sensors must have an unobstructed view of the sun during the entire year, from sunrise to sunset. They should not be positioned within 50 m of any light colored walls or sources of artificial light.

Chattanooga-Hamilton County sometimes operates solar radiation sensors that are hand-built by a Technician and not part of a meteorological system. They are positioned within 10 degrees of horizontal, have unobstructed views of the sun during the entire year, but they are within 50 m of street lights.

11.3.3. $PM_{2.5}$

When monitoring for $PM_{2.5,}$ it is important to select a site or sites where the collected particulate mass is representative of the monitored area.

Optimum placement of the sampling inlet for $PM_{2.5}$ is at breathing height level. However, practical factors such as prevention of vandalism, security, and safety precautions must also be considered. Given these considerations, the sampler inlet for micro scale $PM_{2.5}$ monitors must be between 2 and 7 m above the ground. For middle or larger spatial scales the inlet must be 2 to 15 m above the ground. If the sampler is located on a roof or other structure, there must be 2 meters separation from walls, parapets, or penthouses. No furnace or incineration flues should be nearby. Collocated samplers must be at least 1 m. but not greater than 4 m. away from each other. Samplers should be located at least 20 m from the dripline of the nearest trees, but must be 10 meters from the dripline when it acts as an obstruction.

The sampler must be located away from obstacles such as buildings, so that the distance between the obstacle and the sampler is at least two times the height that the obstacle protrudes above the sampler. There must be unrestricted airflow in an arc of at least 270° around the sampler. The predominant wind direction for the season with the greatest pollutant concentration potential must be included in the 270° unrestricted arc. If the sampler is to measure concentrations from a road or point source, there must be no obstructions between a road and point source, even when other spacing from obstruction criteria are met.

There are many factors to be considered in establishing a particulate sampling location. These include accessibility under all weather conditions, availability of adequate electricity, and the security of the monitoring personnel and equipment. The sampler must be situated where the operator can reach it safely despite adverse weather conditions. If the sampler is located on a rooftop, care should be taken that the operator's personal safety is not jeopardized by a slippery roof surface. Consideration should also be given to the fact that routine operational procedures such as calibration, maintenance, and filter installation and recovery involve transporting supplies and equipment to and from the monitoring site. There have been sites in the past that were not good selections because of parking too far away or required climbing.

The lack of suitable power source can often result in the loss of many samples because of power interruptions or fluctuations. To ensure that adequate power is available, consult the manufacturer's instruction manual for the sampler's minimum voltage and power requirements. The security of the sampler depends mostly on the location. Sites with intermittent power outages of short duration can have a UPS installed. The Agilaire 8872 logger is Windows driven so it is less tolerant of short repeated power outages because of the windows booting time.

Rooftop sites with locked access and ground level sites with fences are common. In all cases, the security of the operating personnel, as well as the sampler, should be considered.

The Bureau CORE $PM_{2.5}$ site was established in 1999 to be in the highest populated area of Hamilton County. The CORE site was placed initially on the University of Tennessee at Chattanooga campus and moved just off campus when university construction projects required the site to be moved several times.

11.4. Sampling Frequencies

Minimum sampling frequencies are established by EPA. In instances requiring every third and sixth day sampling, specific days are selected for sampling so that the entire nation is sampling on the same day. The national sampling schedule is published annually by EPA. Monitoring is required to be on those established days. The minimum number of samples required for appropriate summary statistics should be taken.

The data completion requirements are in Appendix N to Part 50—Interpretation of the National Ambient Air Quality Standards for $PM_{2.5}$ must be met before summary statistics are calculated to be compared against the national standards and Appendix P to Part 50—Interpretation of the Primary and Secondary National Ambient Air Quality Standards for Ozone. The minimum number of samples required for appropriate summary statistics should be taken.

12. SAMPLING METHODS

12.1. Purpose

There are two sampling methods employed at the Bureau: noncontiguous or intermittent monitoring and continuous monitoring. The filter based $PM_{2.5}$ FRM monitoring is an example of filter based intermittent monitoring (one in three day sampling) where the filter handling requires delayed data reporting because of the laboratory reweighing of the filter.

Ozone and continuous particulate monitoring are examples of continuous monitoring where the data is reported real-time. Currently the Bureau's continuous monitoring for $PM_{2.5}$ is not used for regulatory purposes, only to determine the AQI and for mapping purposes through Air Now. The Bureau began operating a T640, regular model, in February, 2017, as a Special Purpose Monitor. The T640 has FEM status for $PM_{2.5}$, but not PM_{10}.

EPA only allows Federal Reference Monitors or Federal Equivalent Monitors' data to be compared against the NAAQS standards. The instruments must meet EPA specifications set forth in *40 CFR* to receive FRM or FEM designations. The Bureau, therefore, is using FRMS for $PM_{2.5}$ and FEMs for ozone. The detailed specifications upon which the instruments have received FRM or FEM status are listed in the *List of Designated Reference and Equivalent Methods*, issued by the EPA Office of Research and Development, found at the following webpage:

http://www3.epa.gov/ttn/amtic/criteria.html

Each FRM or FEM designation number ends in the 3-digit method code that must be used in AQS to indicate the instrument and method. At one time several methods of $PM_{2.5}$ FRM monitoring were allowed to be entered into AQS under the same code of 118. EPA currently requests agencies to use the correct code for the specific method.

Table 6. Methods and FRM/FEM Designation

Pollutant	Analyzer	Method	EPA Reference/Equivalence Method Code
$PM_{2.5}$	TEI/Rupprecht & Patashnick/2025 and 2025i models	Intermittent Filter based Gravimetric Microbalance/ VSCC	EQPM-0202-145
$PM_{2.5}$	Teledyne T640	Continuous- Light Scattering	EQPM-0516-236
PM_{10}	TeledyneT640	Continuous-Light Scattering	Not FEM
Ozone	TEI 49i	UV	EQOA-0880-047
Ozone Calibrators	TEI 49iPS	UV	EQOA-0880-047
TEI: Thermo Environmental Instruments,LLC			

Table 7. Approved SOPs

Pollutant/Task	Title	Control#	Date
$PM_{2.5}$	$PM_{2.5}$ FRM Sites TEI R & P Model 2025 470654002,470650031	QT 14-0130	3/24/16
$PM_{2.5}$	T640 SOP		Submitted 9/5/17 EPA comments returned 9/20/17
Ozone	TEI Ozone 49C and I series, ESC 8816, 8832 Data loggers, MTEK 2801 Strip Chart Recorders	QT16-0032	12/17/2015
Data Handling	Data Handling SOP-Revision 5	QT16-0033	5/23/2016

12.2. Monitoring Technology/Methodology

12.2.1. Ozone (Ultraviolet Photometry)

The physical principle used to measure O_3 relies on the absorption of UV (Ultraviolet) radiation by the O_3 molecule. The O_3 molecule has an affinity for specific wavelengths between 240 nanometers (nm) and 320 nm. The affinity peaks in the UV range at approximately 254 nm. Utilizing this phenomenon and employing the Beer-Lambert relationship, one can measure the quantity of O_3 present in a sample by determining the quantity of UV radiation absorbed along a specified path length.

To employ these concepts, a UV photometer splits the sample stream. The first stream is directed into a measurement cell, while the second stream is passed through a catalytic converter to remove all traces of O_3. The measurement cell has a specified length, a UV source at one end, and a photometer at the other end. The analyzer allows a specified time to pass, determined by the cell volume and the sample flow rate, to insure that a clean, uniform sample is present in the cell. A measurement is taken of this sample over the subsequent, equal time span. Next, the instrument cycles the catalyzed sample into the cell, utilizing the same time spans to insure a clean, O_3-free sample exists in the cell, prior to measuring the O_3-free UV attenuation level. The cycle is then repeated with a new O_3 containing sample.

The monitors used by the Bureau employ a duel path design whereby the sample stream and zero air measurement paths switch back and forth.

12.2.2. Particulate Matter (Intermittent operation)

This methodology utilizes precisely weighed filters that are placed in a carefully controlled volumetric flow for a specified period of time. The combination of flow and duration identify a controlled volume that has passed through the clean filter. The mass added to the filter has been applied during the period when the flow was present. Determining the amount of mass added, and dividing by the volume of air filtered, yields a particulate concentration that is an average of the time the flow occurred.

These intermittent operating filter monitors require that the filters be changed between each sampling period, which usually occurs once every three days. The filters are precisely weighed at IML prior to Instrument installation. They are once again precisely weighed at IML, at the same humidity level as at the initial weighing, after the filtering operation. The resulting difference yields the mass trapped during filtering.

$PM_{2.5}$ is measured by using a small cyclone on the inlet stream to cut down the amount of particulate deposited on the filter to 2.5 microns or less. Bureau $PM_{2.5}$ monitors switched to all VSCC cyclone operation January 1, 2017.

12.2.3. Particulate Matter (Continuous Operation, TEOM)

Until May 2018 the Bureau operated a TEOM. The TEOM has been replaced by the T640.

12.2.4. T640

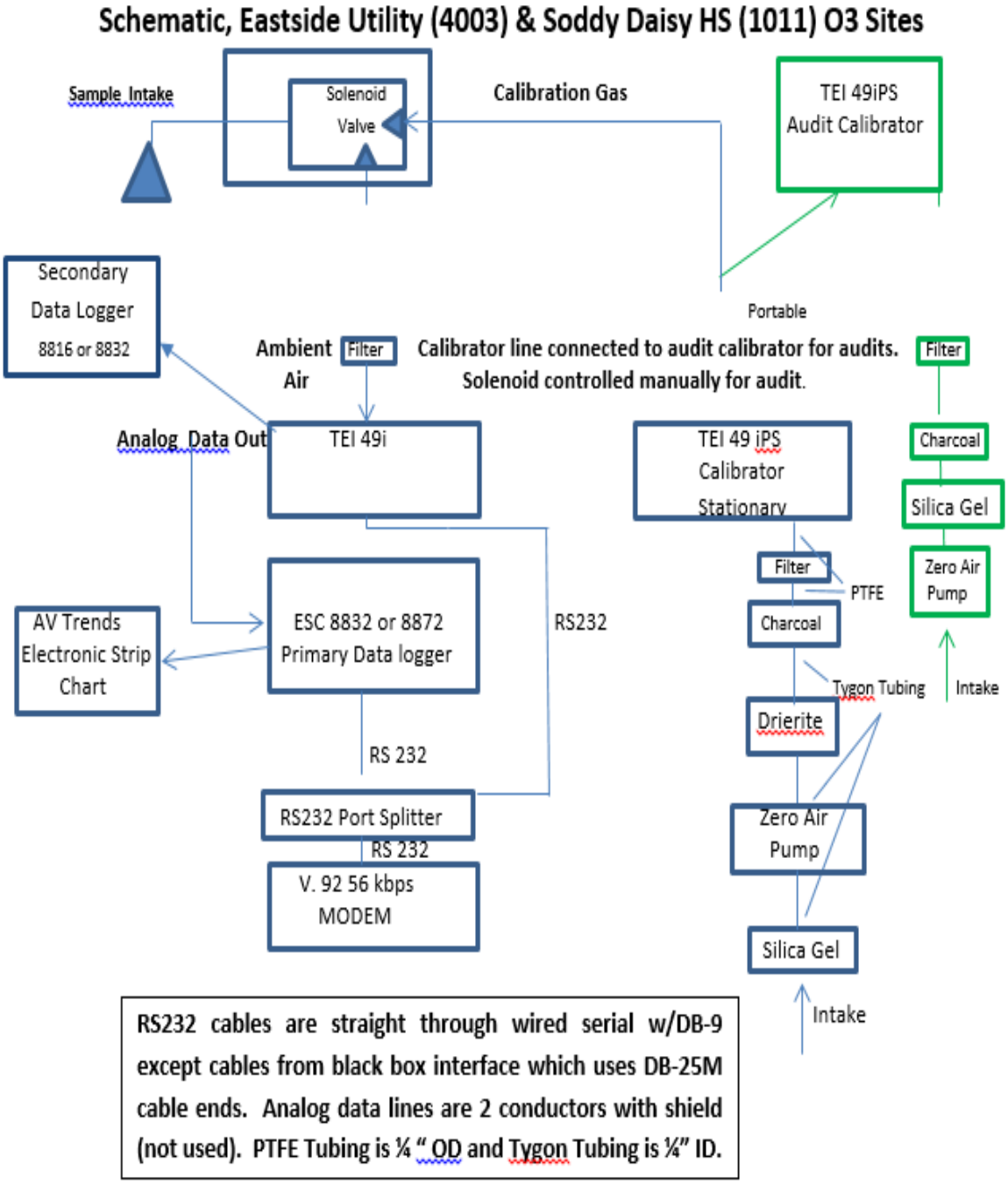
The Teledyne T640 is an optical aerosol spectrometer that converts optical measurements to mass measurements by using the wavelengths of the scattered light to determine the diameters of the scattering particles. This concept uses the Lorenz-Mie Theory, also known as the Mie Theory. The instrument operates by sampling ambient air containing different sized particles. The air is dried moving through an aerosol sampler conditioner (ASC), and then the air is moved into the optical particle sensor where scattered light intensity is measured to determine particle size diameter. The particles move separately into the T-aperture through an optically differentiated measurement volume that is homogeneously illuminated with polychromatic light. The polychromatic light source, an LED, combined with a 90 degree scattered light detection achieves a precise calibration curve in the Mie range, resulting in a large size resolution. Amplitude and signal length are measured for each particle by detecting a scattered light impulse at an 85-95 degree angle. The amplitude is directly related to the particle size diameter (credit to T640 Operations Manual).

In May 2018 the Bureau began reporting to AirNow with the T640 data. The building where the TEOM was housed was no longer available, and the TEOM was taken out of service. The T640 is housed in a minishelter.

12.3. Sample Collection Methodology

12.3.1. Physical Collection

The physical collection particulate filter samples, sample transport, and sample preservation techniques adhere to the requirements of *40 CFR* Part 50, Appendix J, and *Quality Assurance Handbook for Air Pollution Measurement Systems,* Volume II, Ambient Air Specific Methods. For ozone collection a schematic is provided in Figure 6 indicating the instrumentation and the configuration of the site. **Figure 6**



12.3.2. Electronic Data Collection

Electronic data collection is possible for the two ozone monitors and the T640 through the instrument's internal loggers, external data loggers, and modems. The ozone monitors are located in shelters where data loggers record the data history and modems provide a path to download the data for analysis. The T640 is located in a stand-alone shelter where it is also linked to a data logger. Chattanooga-Hamilton County's data acquisition system is configured to automatically call the ozone monitors hourly during ozone season and the continuous $PM_{2.5}$ monitors hourly for the entire year to retrieve data for analysis.

Continuous data is sent to an FTP site for AirNow mapping use and a separate FTP site for the State to use for forecasting. During the part of the year when ozone is not required to be monitored, the connection to AirNow will be turned off in Airvision so no ozone data is reported to AirNow.

Bureau monitoring personnel can call the stations manually using the data software to retrieve data between polls or determine the status of the systems. The status page is normally left showing on the Airvision monitor so that a red warning is apparent from a failed poll.

12.4. Support Facilities

12.4.1. Monitoring Station Design

The monitoring station design must accommodate the operational needs of the equipment, provide an environment that supports sample integrity, and allow the operator to safely and easily service and maintain the equipment. Winter weather conditions must be considered during site selection in order to meet the station safety and serviceability requirements.

12.4.2. Shelter Criteria

For continuous monitors climate control capabilities are critical considerations. Data that are not collected within the climate control parameters must be voided unless some proof can be provided that the data was valid. For some instruments the critical control parameters have been set by EPA to be more stringent than the vendor's operational parameters of the equipment.

Air pollution gas analyzers and some continuous particulate monitors must be housed in a shelter capable of fulfilling the following requirements:

- For Thermo ozone monitors and calibrators, 49C and I series, the shelter temperature must be maintained between 20° and 30°C. The company has submitted an application to EPA to expand this range, but as of September 2018 it has not been approved. The 49 Genius series has been approved by EPA for an expanded range.
- The power supply should not vary more than ±10% from 117 Alternating Current Voltage (VAC). It is best to provide some type of voltage regulation to accomplish this.
- The shelter must protect the instrumentation from precipitation and excessive dust and dirt, provide third wire grounding as in modern electrical codes, meet federal Occupational Safety and Health Administration regulations, and be cleaned regularly to prevent a buildup of dust.
- The shelter must protect the instrumentation from any environmental stress such as vibration, corrosive chemicals, intense light, or radiation.

12.5. Chattanooga-Hamilton County Network Analyzers

Table 8. NIST Traceable References

Pollutant	Analyzer	EPA Reference/Equivalence
Ozone	TEI 49i, 49iPS	Calibrators to SESD-SRP10
$PM_{2.5}$	TEI R & P FRM 2025 and 2025i, T640 Continuous	Certified BGI deltaCal, tetraCal or Chinooks (critical orifices) - vendor certified NIST traceable yearly

12.6. Sample Collection

All samples for criteria pollutants will be collected using Federal Reference or Equivalent Methods. Procedures set forth in the approved Standard Operating Procedures (SOPs) will be used.

12.7. Sampling / Measurement System Corrective Action

Corrective action measures in the Ambient Air Quality Monitoring Network will be taken to ensure the data quality objectives are attained. There is the potential for many types of sampling and measurement system corrective actions. Each approved Standard Operating Procedure details some expected problems and corrective actions needed for a well-run monitoring network. Table 9 lists some issues encountered in the field, the corrective actions, and the Technician responsible.

Table 9. Corrective Actions

Problem	Corrective Actions	Responsible Person	Impact to Data Set
Instrument malfunction	Troubleshoot or replace parts to correct malfunction	Technician responsible for that instrument	Loss of data
Filter damage discovered while loading filter	Load different unexposed filter	Particulate Technician	Loss of filter, loss of data
Filter run on incorrect day or a void	Run a make-up	Particulate Technician	Requires makeup data
Logger data loss on continuous monitor	Retrieve data from internal instrument logger or back-up logger	Ozone Technician	None
Failure of data acquisition software to poll continuous data hourly	Go to the site, reset the modem if hung, replace modem if necessary	Ozone Technician	When it polls successfully, it will backfill the data
Continuous data does not appear correct	Investigate, recalibrate or troubleshoot as necessary	Ozone Technician (also services continuous $PM_{2.5}$)	Probable loss of data
Heating or Air Conditioning not functioning in shelter	Contact Air Monitoring Manager. Manager or Technician calls repair person immediately- May be required to use City vendor	Whichever Technician discovers the problem /the Air Monitoring Manager	Probable loss of data
Precision or span check >3 ppb difference	Troubleshoot instrument, then recalibrate, check Zero air: make sure no desiccants are spent	Ozone Technician	Determine if the precision difference stays within 7%.
Zero Air not Zero	Change desiccants- pay special attention to charcoal since it has no indicator	Ozone Technician	Zero must be 0. Data will be evaluated if 0 is not 0.

12.8. Analyzer Audits

Audits are performed according to the methodology required by EPA. For each specific method and sampler type, the method followed is according to the procedures outlined in the *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II. Ambient Air Specific Methods.* For each parameter and sampler type, audit procedures are performed following the procedures defined by the approved Standard Operating Procedure. Audits are discussed more thoroughly under "Assessments" in this document.

13. SAMPLE CUSTODY PROCEDURE

Sample custody procedures must be followed due to the potential use of data for comparison to the NAAQS and the requirement for extreme care in sample collection. Having an unbroken Chain of Custody is important for any procedure that might be critical in a legal case. The Chain of Custody procedure for $PM_{2.5}$ filter cassettes is the completion of IML Chain of Custody sheets that are mailed with the exposed filters to the laboratory. In addition, Chattanooga-Hamilton County provides a list of voids or blanks, and the Technician's signature to Inter-Mountain Laboratories in the shipment of exposed filters. The shipment goes directly to the laboratory and is overnighted from the Bureau. The Bureau has overnighted shipments to Sheridan, Wyoming, since the beginnings of the program- after some issues with two-day shipping.

13.1. PreSample Custody

Filters used in the FRM monitoring program are supplied by EPA. The filter vendor can change, year to year with a change of contract, which introduces a new variable into the bias. If the filter vendor changes, the thickness of the filter might be slightly different. The filter may have a different appearance and a different scale of mass, and the filter number may be stamped in a different place.

EPA supplies filters to the agency. The Bureau retains part of the filter supply at the Bureau and sends part to the contract lab, IML. The laboratory inspects, conditions and weighs the filters; loads them into clean numbered cassette rings; then loads the cassettes into new petri dishes for shipment to the Bureau. The petri dishes are marked by the Technician with a black permanent marker the filter number, cassette number, and the date to be exposed. The laboratory records all the filter conditioning data like weigh date, initial temperature mean, and temperature control.

The Technician fills out the filter number, cassette number, and date of exposure in the lab reference log. The Technician transports the unexposed filters to the instrument, including instrument blanks. The filters are transported in plastic petri dishes sealed with blue vinyl tape (where the plate cover meets the base).

Bureau Technicians inspect filters before loading them into the magazines at the sites. The vinyl tape is unwound, the cassette is lifted out, and the empty petri dish is resealed and placed in a zip plastic bag. Filters that are damaged; have pinholes or rips; damage to the filter screen; or damage to the cassette are not loaded into the monitor magazines. A replacement filter will be selected. Compromised or damaged filters are noted, voided, put back into a petri dish, sealed, and sent back to IML. Then an e-mail is sent to the IML supervisor. The Bureau never uses the magazines for transport since transport is done in individual petri dishes.

13.2. Post Sample Custody

The filter cassettes are removed from the magazines within 177 hours of sample collection, and placed back in the individually marked vinyl tape-sealed petri dishes. The dishes are unsealed, the exposed filter loaded cassette is placed in the dish, and the dishes are resealed with the blue vinyl tape. The dishes are transported to the Bureau in a cooler with blue freezer ice packs and a minimum maximum thermometer. Site operators fill out a section on the field data sheet for each exposed filter. Filters are placed in the refrigerator in the lab as soon as the Instrument Technician returns to the Bureau and kept there below 4 degrees C until they are ready to be packed for shipment.

A Chain of Custody is filled out, signed, and dated and shipped with the filters to the lab. A list of void filters is prepared and the reason for the void so IML will know what Null Value Code to add to the AQS data line.

13.3. Shipment

The Bureau ships every other Monday to IML in Sheridan, Wyoming, with the filters/cassettes packed in a cooler with freezer ice packs. Occasionally the filters are shipped in three week intervals. A minimum maximum thermometer is tucked inside. Filters are refrigerated below 4 degrees C until they are shipped. The slab freezer ice packs work especially well for this shipping as they lay flat. If there is a holiday on Monday the Technician is to contact IML for an alternative shipping day. IML is to always know when to expect a shipment, and it is the responsibility of the Technician to make sure IML knows when it is to arrive. Technicians are to ask permission to ship on an “off” day as IML is set up to handle shipments on certain days. Technicians are to never ship without making prior arrangements with IML.

IML observes these holidays: Good Friday at Easter, Christmas, New Years, Labor Day, Memorial Day, 4th of July, and two days at Thanksgiving (Thursday and Friday). Shipments are not to be shipped to arrive on a holiday as Fed Ex will probably be closed. If the shipment should be delayed to accommodate a holiday IML will contact the Bureau. IML, assumes, however, that customers know they will be closed on major holidays like July 4, Good Friday, Thanksgiving, and Christmas.

It is important to be careful about delaying shipment to a third week because it may not leave enough time for IML to condition the filters and reweigh them within 30 days. Once the filters are beyond 30 days after exposure, the data is automatically voided and there is no recovery.

Shipment is on the Bureau’s Fed Ex account. A Technician transports the cooler sealed with shipping tape to the Fed Ex building near the Bureau offices. The Chain of Custody is included along with the Void report and the Instrument data sheet.

Upon receipt IML documents the date the filters are received, records the cooler shipment minimum and maximum temperatures, observes if the cool packs are frozen solid, and takes their own receipt temperature.

13.4. Substitute Samples/Make-Up Samples

To compare data against the National Ambient Air Quality Standards EPA requires specific data completeness. For particulate it is 75% per quarter. EPA allows substitute samples and make-

up samples. In the case of collocated samplers, data acquired on the secondary sampler is substituted for missing data on the primary sampler. Therefore the Bureau operates the POC 2 sampler on a three day schedule so there is more opportunity for substitution, if needed.

EPA establishes a regulatory national sampling schedule for three-day and six-day monitoring and publishes the official schedule every year. If a national sampling day is missed for any reason, then a make-up can be run on the two "off" days, the day after the run was missed or the following day. It would most likely be the following day because the operator would not know the run did not happen until he went to pick up the filters the day after the run was scheduled. The monitors are not to be scheduled for "off" days unless the official run days were voided for some reason. The schedule is a regulatory requirement. A make-up can also be programmed after the next run day but not later than one week from the date missed. The number of make-up samples permitted by EPA in any calendar quarter is limited to 5 samples.

Since Bureau sites are fairly close to the office, there is no excuse for not doing makeups of the voids.

EPA encourages agencies to do the make-up as early as possible after the missed day in order to try to replace the data with data gathered under similar meteorological conditions.

The reason for the void must be documented in every location where documentation about that filter is made- the log in the lab, the log book at the site, the instrument field data sheet and any paperwork for IML. There should never be any question about why a sample was voided as the void should be documented thoroughly.

Currently any reprogramming of $PM_{2.5}$ filter-based FRM monitors must be performed manually as the monitors are not on the internet or directly accessible by dial up.

14. ANALYTICAL METHODS

14.1. Background

The analytical method employed for a specific criteria pollutant evaluation is dependent upon the monitoring technology utilized. For the gaseous criteria pollutants, SO_2, CO, NO_x, and O_3, the analyzers are designed as completely contained monitoring units that do not require additional analytical methods to establish the pollutants' environmental concentrations.

The particulate matter criteria pollutants, $PM_{10,}$ and $PM_{2.5,}$ do require analytical methods to evaluate the captured sample in order to establish the pollutant concentrations present in the environment. The FRM monitors employed for $PM_{2.5}$ particulate matter utilize gravimetric analyses performed on contract by Inter-Mountain Laboratories of Sheridan, Wyoming. The Bureau has never used any other laboratory for $PM_{2.5}$ weighing.

The three continuous monitors, two ozone monitors 49i models and the T640 continuous $PM_{2.5}$ monitor, can be directly controlled from the office using dial-up. The three filter-based $PM_{2.5}$ FRM monitors are not currently accessible remotely

14.2. Preparation of Samples

Inter-Mountain Laboratories has developed their own $PM_{2.5}$ Laboratory SOP outlining activities associated with pre-exposure and post-exposure of the filters. A simplified procedure is that the lab cleans cassettes, pre-conditions and weighs the filters and loads the filters into cleaned cassettes. Cassettes are placed in petri dishes which are then sealed and IML ships a supply every two weeks to the Bureau. IML normally ships back the same amount shipped to them unless IML is notified to ship a different amount. The filters are exposed in an FRM $PM_{2.5}$ monitor for 24 hours or run through the monitor as a blank. Then cassettes are removed from the monitor and placed back in the petri dishes and re-sealed. The petri dishes are shipped back to IML and opened. Filters are removed from the cassettes, re-conditioned, and reweighed. Instrument blanks, lab blanks, and trip blanks are also prepared.

As part of the quarterly report, IML provides 5 minute average control charts for their laboratory's temperature and humidity for the entire quarter. Since temperature and humidity control parameters are very specific in *40 CFR*, these charts are carefully reviewed every quarter by the Air Monitoring Manager. The IML Lab Supervisor will notify the Air Monitoring Manager if any filters were weighed during times of temperature or humidity excursions.

IML records data by the second so five minute mean values are logged from the previous 300 one-second values. The mean calculation is a block average not a rolling average. In addition to the mean; the minimum, maximum and standard deviation of the one-second relative humidity and temperature are also logged for that five minute period. IML's laboratory environmental condition control charts display this five minute data.

Every time a filter is weighed, the previous 86,400 seconds of relative humidity and temperature data are averaged and recorded as the equilibration conditions for that mass determination. During gross mass determination, equilibration conditions are automatically compared to the tare equilibration conditions to ensure that conditions from tare to gross do not differ by more than 5% relative humidity and 2 degrees Celsius. If these conditions are not met, the balance control software prevents further weighing until the room is in compliance for at least 24 hours. IMLs method of sampling every second provides 60 times more data points than a minute recording Dickson recorder. By providing more data points, IML's believes that its method of sampling every second produces a more statistically valid result than sampling every minute (explanation of recording temperature and humidity frequency from IML memorandum to Gravimetric Laboratory clients of May 17, 2016, entitled *Gravimetric Laboratory Environmental Condition Data Recording Frequency*).

A filter's net weight gain is the captured particulate mass. This net weight gain is obtained by subtracting the initial filter weight from the final weight of the exposed filter. For both the initial and final weights the filters are dried under controlled conditions and should be dried for approximately the same length of time. Once calculated, the net weight gain can be used with the total filter flow to calculate the concentration for comparison to the daily and annual NAAQS. Since the method is non-destructive, and due to possible interest in sample composition (e.g., subsequent chemical analyses), the filters will be archived for a minimum of five years, after final gravimetric analyses has occurred.

14.3. Analysis Method

14.3.1. Analytical Equipment and Method

The analytical instruments employed for sample analysis of the gaseous criteria pollutants have been identified and their specific technological methods detailed in the section on Monitoring Technology/Methodology. The analytical instrument (microbalance) that will be used for gravimetric analysis in the FRM $PM_{2.5}$ sampler method will have a readability of 1 µg and a repeatability of 1 µg. The microbalance will be calibrated yearly.

14.3.2. Conditioning and Weighing Room

The primary support facility for the $PM_{2.5}$ network is the filter conditioning and weighing room at the laboratory. Since IML is contracted to perform this service, IML follows their own SOPs developed from *40 CFR* requirements. Chattanooga-Hamilton County no longer maintains a weigh room for PM_{10} filters as PM_{10} monitoring has been deleted from the monitoring program.

14.4. Internal Quality Control and Corrective Actions

IML's SOP covers their Internal Quality Control and Corrective Actions for $PM_{2.5}$ weighing

14.5. Filter Sample Contamination Prevention

Measures are taken at IML for preventing sample contamination. Filters are equilibrated/conditioned and stored in the same room where they are weighed. Extreme care is taken while handling filters, and filters are only handled with smooth, non-serrated forceps. Upon determination of its pre-exposure weight, the filter is placed in its cassette and then placed in a protective petri dish. The petri dish is labeled with a unique ID, originating from the laboratory. Once the filter cassette is taken outside of the weigh room it will remain enclosed to minimize damage to the 46.2 mm Teflon® filter.

The Bureau's utilization of single use microbiology-type petri dishes sealed with vinyl tape for shipping filter cassettes is unique, but it resolves several issues the $PM_{2.5}$ program had in the beginning. There were instances of agencies receiving powder contaminated bags rather than specified powder-free which caused a problem with accurate 2.5 measurement. One agency believed that the plastic shipping bags were off- gassing from the plastic and the filter was absorbing the gas (and consequently the agency believed the weights would increase while the cassettes were bagged). The plastic petri dishes have prevented the filters from being damaged in shipment. Handling the cassettes in bags to pack them for shipment exposes them to punctures and scars. It is almost impossible to damage the filters enclosed in the petri dishes unless the dish is broken.

Some agencies transport clean filters in a capped supply magazine to the site and transport exposed filters stacked in a capped receiving magazine to their lab. The Bureau does not transport filters in the magazines. The clean filters in cassettes are transported to the sites in individual petri dishes loaded at the lab. The petri dishes are resealed after removing the cassette and left at the site in a plastic zip bag. The Bureau Technician removes the filters individually from the magazine after exposure and places them into the individual petri dishes marked with the filter number, cassette number, and date. The dishes are sealed at the site and returned to

the lab refrigerator in a cooler with freezer ice packs. Used petri dishes are discarded at the lab and never reused.

The monitor cabinet should be kept very clean, and the empty petri dishes should be kept in clean plastic zip bags in the monitor cabinet. Handling should not contribute to increased particulate levels. Instrument blank data must be reviewed quarterly to make sure the blanks are not elevated. Blanks can be as high as .030 µg according to the Quality Assurance Handbook but the Bureau does not want them that high. The Manager discusses with the Technician if the Instrument blanks are higher than .010 µg so that cleanliness can be addressed. Fan filters should be changed regularly and not allowed to deteriorate into the monitor cabinet. They will disintegrate into dust.

15. QUALITY CONTROL REQUIREMENTS

Quality from air monitoring measurement is controlled two ways- through broad QA activities and through more specific quality control procedures. Broad QA activities are activities such as establishing policies and procedures, developing DQAs, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. Audits, calibrations, checks, replicates, and routine self-assessments are examples of more specific quality control procedures.

Quality control is 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. In the case of the Ambient Air Quality Monitoring Network, QC activities are used to ensure that measurement uncertainty is maintained within acceptance criteria for the attainment of the objectives. Lists of pertinent QC checks are provided in the standard operating procedures and instrument manuals.

QC procedures for each pollutant type are addressed in the EPA-approved SOP for each pollutant.

15.1. Quality Control Procedures

Quality control is achieved through periodic maintenance; flow rate audits; acceptance test procedures; accuracy, bias, and precision checks; collocated instruments, control charts, and other verification techniques.

15.1.1. Calibrations

Calibration is the process employed to verify an instrument's measurements in order to minimize deviation from a standard. This multiphase process begins with certifying a calibration or transfer standard against an authoritative standard, normally an NIST traceable standard.

The Bureau certifies three ozone calibrators, two for standard operation and one for audits, against the SRP-10 in Athens, Georgia, at SESD. The Bureau does not own a bench standard. The stationary instrument calibrators are Level 2 standards, rather than the common Level 3. This eliminates a calibration step and makes the data closer to the standard. The Bureau sends an employee and the calibrators to be certified to Athens EPA SESD once a year in January or February. Since the calibrators are secondary standards, only one trip a year is required.

The monitoring instrument's measurements are then compared to this secondary calibration/transfer standard located at the site by introducing a known amount of ozone into the instrument from the calibrator and determining if the reading is accurate. If significant deviations exist between the instrument's measurements and the calibration/transfer standard's measurements, corrective action is implemented to rectify the analytical instrument's measurements. Corrective action is recalibration which means that the instrument is adjusted.

For the 3-day FRM single day particulate monitors, the flow rate is adjusted when performing a calibration. After the flow rate is adjusted, the rate is verified to make sure the calibration was successful. A certified flow transfer standard (FTS) is used to measure the flow and compare the actual flow against the flow rate given by the monitor. The percent difference is calculated and the verification must be within 2% for the calibration to be successful (see critical criteria tables for $PM_{2.5}$ filter based).

The Bureau $PM_{2.5}$ standards are two deltaCals (one for operational use and one for audits), one tetraCal, and two Chinooks (one of which may not be sent if no speciation is being done) which are all sent for certification every year to the vendor. The deltaCal and tetraCal are NIST certified for flow, temperature, and pressure. The Chinooks are critical orifices that are certified for flow.

Calibration requirements for the instruments and laboratory equipment are found in the SOP's and in the specific instruments' operations manuals.

A multipoint verification is performed by way of a local audit once a quarter. The Thermo Environmental 49i is such a steady instrument that actual alterations of the calibration are rarely necessary during the ozone season, once the monitor has been calibrated for March 1. An adjustment or calibration will be performed if the quarterly verification exceeds acceptance criteria. Before a recalibration is performed, the usual troubleshooting techniques should be employed. Fittings should be tightened and cylinders for desiccants and charcoal should be changed out. Troubleshooting measures should be performed before the verification.

If a stationary field calibrator fails, one of two solutions can be implemented. All the calibrators, including the Air Monitoring Manager's audit calibrator, are Level 2 or secondary. Since the State performs ozone audits every quarter, the Manager's calibrator could be substituted for the malfunctioning calibrator until the repairs are complete. Or, the stationary calibrator that is functioning properly could be transported between sites, and precision and span checks could be conducted manually. It would be the Air Monitoring Manager's decision as to which solution is selected depending upon the circumstances at the time. Once repairs are made to the malfunctioning calibrator, the calibrator must be certified or verified against another ozone Level 2 calibrator (which would make it a Level 3) or it could be recertified with the SRP10 in Athens- if the repaired calibrator is to be returned to use that season.

15.1.2. Precision Checks/Span Checks

The purpose of precision checks, whether gaseous or particulate, is to provide evidence of deviations from the required precision measurement. Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the DQOs for precision, the measurement process is within statistical control. Various tools will be employed in evaluating and monitoring precision measurements.

Ozone instruments are required to be periodically exercised with zero and span checks and checks of a specific level normally close to the standard (termed precision check) by introducing known amounts of ozone for the span and precision check from an ozone generator in a calibrator. Control charts at the sites have been replaced by AV Trends on individual PCs at the sites. Both Airvision and AV Trends perform electronic charting of data. Airvision is programmed to automatically generate and store daily minute data electronic charts on every continuous monitor. Both Airvision and AV Trends can produce minute graphs on command until minute data is downloaded after a six month period. The minute data can be made available to Airvision if graphs must be run after the minute data is removed. Hourly data is always available.

The Bureau has programmed the data logger to perform precision and span checks automatically. The system performs the ozone span at 180 (full scale is set at 200) and the precision check at 70. For both the span and precision check zero is also performed. Precision checks at 70 are performed every three days from 12:00 and 10 seconds to 12:41 AM and span checks every 6 days from 3:46 to 4:14 AM.

Since the precision and span checks are programmed to run automatically, it is critical that the procedure is operating within the correct time frame. It is the responsibility of the Air Monitoring Department to make sure the precision and span checks are operating within the programmed time frame. If not, then strange numbers will be recorded in the AQS loadable files as the program will record incorrect numbers.

Invalid precision or span checks can occur from spent canisters of desiccants and charcoal, leaky lines (including loose fittings), calibrator malfunctions affecting the production of ozone, internal electronic problems for the calibrator, weather conditions, and operator error (including incorrect entry in the log book). The ozone scrubbers in the monitors must not be allowed to be spent.

Both the Manager and the Technician review the precision and span reports each morning after they were programmed to run. Weekend precision and span reports are reviewed on Monday morning. The Technician prints a paper copy of the precision and span reports from Airvision and stores them in a notebook kept on the lab bookcase. Both the Manager and the Technician review the report so that any changes are not overlooked.

Precision requirements for the applicable instrumentation are found in the SOP's and, for ozone, in the specific instruments' operations manuals.

EPA's memorandum *EPA Review of Monitoring Organization QAPP's for critical criteria conformance* (Lew Weinstock, July 11, 2017) states that EPA reserves the right to not use the routine data for NAAQS design values that are represented by 1-point QC checks that exceed the acceptance criteria listed in the QA handbook validation templates. The QA Handbook's validation template cites critical criteria of <7.1% or<1.5 ppb difference. This statement was prompted by findings from the February 6, 2017, Office of Inspector General management (OIG) Alert that a few agencies were not meeting critical criteria relating to 1-point precision checks. *Bureau employees should never ignore increasing differences in the 1-point precision check. By the time an exceedance of the critical parameters occurs, it is too late to save the data the precision point represents. Preventive action is necessary so that parameters are never exceeded.*

If precision or span data is 2 ppb above or below the ozone standard, then more scrutiny is placed upon the data. A "wait and see" approach can be taken. If, however, there is a 3 ppb difference, action will be taken immediately. A verification or a recalibration will be performed.

The lower the precision point is set, the more difficult it is to remain within the 7.1%. If the precision point is lowered below 70, the precision numbers must be scrutinized to more closely control drift.

For particulate monitoring, collocated samplers are employed. Collocated data are a requirement for the FRM particulate monitors for each method code employed. Because collocated data can be substituted for primary data in the absence of the primary data, the Bureau operates the collocated monitor on a three day schedule to match the primary monitoring schedule. Collocated data should be very similar- the amount of tolerance allowed relates to the magnitude. If the data are not close in magnitude, then an investigation will be conducted to determine which data from the two monitors are not accurate. The two monitors' data can be graphed against data from the East Ridge site 470650031, the Walker County Maple Street Georgia site (132950002) and nearby monitoring sites to determine which data is not correct. The data that is incorrect often appears as an outlier on graphs of nearby sites so it is normally not difficult to determine which data is wrong. Data from the primary monitor and data from the secondary monitor are loaded into AQS and the AMP reports will do the comparison. IML, the contract weigh lab for $PM_{2.5}$, prepares a bar graph in their report that compares the primary and collocated monitor.

Figure 7 is a copy of the collocated bar graph from an IML report.

Figure 7. IML Comparison of Collocated FRM Monitor Data

Chattanooga Air Pollution Control Bureau

Siskin Drive/UTC

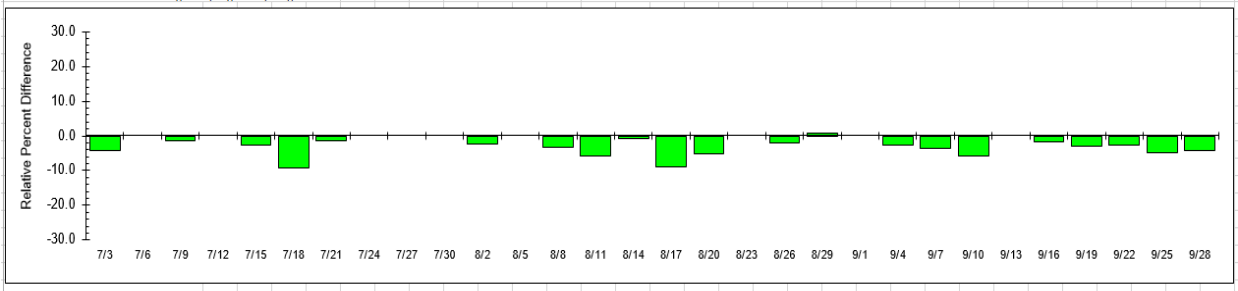
Precision Report For Collocated Samplers

LTP PM2.5 Concentrations(µg/m³)

July 1, 2017 - September 30, 2017

Date	7/3	7/6	7/9	7/12	7/15	7/18	7/21	7/24	7/27	7/30	8/2	8/5	8/8	8/11	8/14	8/17	8/20	8/23	8/26	8/29	9/1	9/4	9/7	9/10	9/13	9/16	9/19	9/22	9/25	9/28
20781-Siskin Drive/UTC Primary	7.1	4.6	7.7	10.4	3.6	8.3	15.8	5.1	11.8	4.8	12.2	4.0	6.0	3.4	11.6	7.6	11.4	6.8	10.0	10.7	2.2	11.4	5.6	6.8	5.3	12.3	10.3	11.1	10.2	9.3
20775/90709-Siskin Drive/UTC Col	7.4	4.6	7.8	10.4	3.7	9.1	16.0				12.5	4.0	6.2	3.6	11.7	8.3	12.0	6.8	10.2	10.6	2.1	11.7	5.8	7.2	5.3	12.5	10.6	11.4	10.7	9.7
Rel. %Diff.	-4.1	0.0	-1.3	0.0	-2.7	-9.2	-1.3	*	*	*	-2.4	0.0	-3.3	-5.7	-0.9	-8.8	-5.1	0.0	-2.0	0.9	*	-2.6	-3.5	-5.7	0.0	-1.6	-2.9	-2.7	-4.8	-4.2

Relative Percent Difference = ((X - Y) / ((X + Y) / 2)) * 100 X=20781-Siskin Drive/U Y =20775/90709-Siskin Drive/UTC Col



Statistical Calculations:

n=	26.0	S Dev=	2.6 %
Mean=	-2.8	** CV=	2.3 %

*** Both sample concentrations must be greater than or equal to 3 µg/m³ to be used for these precision calculations.**

For a detailed discussion of these precision calculations, refer to 40 CFR 58, Appendix A.

**** CV - Upper 90% Confidence bound for Coefficient of Variation**

15.1.3. Accuracy or Bias Checks

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value. Accuracy is a combination of random error (precision), and systematic error (bias). Although collocated monitors are primarily used for evaluating and controlling precision, they can also be used to determine accuracy or bias. By employing percent difference calculations and plotting the results on control charts, trends can be observed that indicate bias occurring within the measurements. In addition to collocated monitors, zero and span checks can also provide data capable of identifying bias. Accuracy or bias requirements for various types of instrumentation are found in the SOP's and in the specific instruments' operations manuals. EPA's AMP reports calculate bias as part of the report.

There are so many variables in air monitoring that bias can be easily affected. For example, a change in a monitor's cleaning schedule can change the bias or a change in personnel can change the bias. A change from WINS to VSCC models for FRM monitoring will change the bias. EPA uses national PEP audit data for comparisons against agencies' data to determine bias when EPA's does bias studies.

15.1.4. Flow Rate Audits

For $PM_{2.5}$ FRM instruments, a flow rate audit will be performed every month by the operator and every quarter normally by the State auditor. The audit is made by measuring the analyzer's normal operating flow rate using a certified flow rate transfer standard. The flow rate standard used for auditing will not be the same flow rate standard used to calibrate the analyzer. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Document the audit (actual) flow rate using the transfer standard, and the corresponding flow rate measured by the sampler in the calibration worksheet associated with the equipment undergoing calibration. Details for implementing flow audits may be found in the applicable instruments' operations manuals and in the appropriate SOP's.

The bottom of the flow audit worksheet requires the calculation of the % difference between the transfer standard and the instrument's reporting and also the calculation of the method against the instrument's reporting. This must be filled out and signed by the Technician, and the QA reviewer signs the bottom of the page.

The Bureau has placed flow rate audits in AQS quarterly for many years. The Air Monitoring Manager prepares and loads those files.

15.1.5. Balance Checks

IML will perform balance checks according to their SOP.

15.1.6. Blanks

Instrument blanks are exposed in the monitors in the Instrument per *40 CFR* Part 50 Appendix L 8.3.7.1. The Instrument blank is treated as a regular filter but it is run through the filter exchange mechanism and immediately expelled without collecting particulate. The purpose of an instrument blank is to determine how much the monitoring environment is contributing to filter weights. For example, it is anticipated that blanks will increase if the monitor housing is not kept reasonably clean on the inside. EPA acceptance criteria for Instrument blanks is .030 µg. The

Bureau, however, believes that if the monitor and magazine are kept reasonably clean, the numbers should be below .015 µg, if not below .010 µg. If all the blanks are higher at one monitor it may be an indication that the particular monitor should be cleaned more thoroughly. It is also possible that a particulate monitoring site might have some affecting circumstance such as more frequent mowing. Blanks are collect 10% of the sampling runs scheduled per site. Instrument blanks are run every 10 monitoring dates so they are spread out over the year and not concentrated in a short period of time. Blanks can provide valuable information so employees must pay attention to the magnitude of the blanks each quarter. If the blanks are abnormally high, it can be assumed that whatever is causing elevation of the blanks is also causing an increase in the magnitude of the particulate on the filters.

The Bureau was one of the first agencies to adopt the use of trip blanks. These are filters that are treated the same as the regular filters in that they are conditioned and preweighed and placed in cassettes, then in sealed petri dishes in the laboratory. When they arrive at the Bureau, they are never opened, then they are sent back with the shipment to the lab to be conditioned and reweighed. The Bureau does not transport them to the sites. Bureau employees make up metadata to go with the blanks to try to disguise them in the shipment. Since the trip blanks are not opened at the Bureau, any change in the weight is from the laboratory. These have provided valuable information several times through the years. If the data increase, it has normally been from the cassette cleaning procedure. The Bureau believes that the trip blanks should be at or below about .010 µg even though the instrument blank acceptance criteria is much higher. Also the Bureau believes that there should not be huge variations in the trip blanks- they should be about the same magnitude. If several trip blanks are higher than .010 or they jump up and down considerably, the laboratory supervisor is notified at IML. It is assumed that if the trip blanks are abnormally elevated, that some procedure at the laboratory is contributing to particulate weights.

IML is responsible for required laboratory blanks according to their SOP.

16. TESTING, INSPECTION, AND MAINTENANCE

16.1. Instrument Acceptance Testing

All gaseous criteria and particulate matter pollutant monitors used in the Ambient Air Quality Monitoring Network to be compared against the NAAQS shall be certified to adhere to EPA equivalent or reference methods. Therefore, they are assumed to be of sufficient quality for the data collection operation. The certification certificate should be shipped with each new instrument. The instrument should not be accepted or tested until the NIST certificate is at the Bureau.

When the instrument is unpacked, the parts will be checked against the order to make sure the delivery was the complete order. The parts will be inspected to confirm that no part arrived broken or damaged. The vendor will be contacted if the order is not complete or if there is shipping damage.

Particulate monitors FRM monitors (Thermo/R & P models) should be assembled and run in the lab for several weeks - especially if it is a new model. This is to verify that the filter exchange mechanism is working properly before the monitor is placed in the Instrument. Also software glitches should become apparent during operation. If the instrument is a new model, the manual should be studied carefully. The Technician should look at diagnostics of the sampler for any alarms or warnings and document the status found. Check and calibrate, if needed, the

temperature and pressure sensors. Perform leak and flow checks and make sure they fall within the acceptance criteria. Then move the monitor to the site. There may have to be arrangements to have a crane put the monitor in place if it is on the roof of a shelter. Perform external and internal leak checks, a flow check, and a multipoint verification or calibration, if needed. This should be done according to the manual if a new model or the Bureau's SOP if it is a model that the Bureau has already. After the calibration, perform a second flow check. Data from the new monitor should be specifically scrutinized when it returns from the lab to make sure that the data is reasonable. A new FRM should be collocated with an old FRM briefly to make sure the data is similar.

If any of these checks are out of specification, the vendor will be contacted for initial corrective action. If the sampling instrument meets the acceptance criteria, it will be assumed to be operating properly.

Prior to Instrument installation of the gaseous criteria pollutant monitors, the analyzers will be set up in the laboratory and run for several weeks. For an ozone monitor, the Technician will look at the diagnostics of the analyzer for alarms or warnings. At startup there are a number of alarms that indicate the monitor is not warmed up enough for normal operation. These alarms go off as the instrument runs. Ensure that alarms do shut off as the monitor reaches normal operations. This will indicate that critical parameters are within the operational specifications. If it is a new model, the Technician will familiarize himself with the operating manual. The instruments shall successfully undergo leak checks, zero/precision and span checks and multi-point calibrations. Following site installation, the instrument operators will initiate, observe, and document the successful completion of a zero/span cycle. If the analyzers meet the acceptance criteria, they will be assumed to be operating properly. Performance testing and maintenance during start-up are recorded in the monitor bound log book.

If a new instrument is not performing properly, the vendor will be contacted. Arrangements will be made to ship the instrument back or the vendor will send a representative to the Bureau. In the event of severe damage to an instrument by a storm, the insurance company will be contacted by the Bureau Operations Manager or the Director's designee and the instrument will be sent for repairs to the vendor.

The loggers that are collecting the data are essential to reporting correct data. If the monitor is correct but the logger does not reasonably match the monitor, the data is not accurate. Any new logger should be tested in the lab and Instrument tested before being placed in service. The Agilaire 8872 is very different from the old 8832 and the 8816 models. Employees should familiarize themselves with the manual. AV Trends is operating an electronic graph at each ozone site in conjunction with the loggers. Secondary loggers' data should reasonably match the primary loggers' data.

16.2. Maintenance

Any maintenance to a monitor requires leak checks, flow checks, and calibration verification or recalibration before the instrument is officially monitoring.

If a monitor cannot be repaired and fails to meet Instrument readiness certification testing, the vendor will be contacted. If the instrument cannot be repaired to be usable for data collection, the instrument will be shelved. The instrument will then be tagged as inoperable and will be used for spare parts. If the intention is to use the instrument in the future as a spare for back-up, the

instrument will be sent back to the company for repairs or more trouble shooting will be done until it is repaired.

Maintenance is always documented in detail in the site bound log book for the specific instrument and in the data logger electronic messages. No maintenance should be done to an instrument that is not documented.

Preventative maintenance schedules are adopted and practiced. There should be no procurement crisis for burned out lamps or failing pumps or spent scrubbers. Schedules are developed based on experience, and parts are changed out on the schedule ahead of failure to prevent losing monitoring time. For ozone a refurbishment is normally done to the monitors during the winter downtime. Reasonably priced parts are to be ordered ahead and stocked. Items, except for pumps, above $400 will be ordered as needed. The Bureau now has spare ozone and particulate monitors that can be placed in use in the event of an expensive part failure.

Part of preventive maintenance is keeping the cylinders of drierite, silica gel, and charcoal refreshed on a regular basis so that none of the desiccants are saturated. The drierite and silica gel have color indicators for saturation but the charcoal does not. Silica gel and drierite both turn from blue to pink as they become saturated. It is the responsibility of the Ozone Technician to stay ahead of the saturation of the desiccants.

Some maintenance activities may be performed in the Bureau lab. For example, $PM_{2.5}$ head cleaning may be done in the lab as the Bureau has spare pre-cleaned heads that can be swapped in the Instrument for the dirty head. The dirty head can be transported back for cleaning. VSCCs may also be switched out and the dirty one brought back to the lab for cleaning. Bureau heads and VSCCs are numbered. Each time the head or VSCC is swapped, the new item numbers installed are to be documented in the log book. Thus, the monitoring data using each head and each VSCC can be traced, if needed.

Restoration of the saturated drierite and silica gel are performed by drying them in the Bureau's oven in the laboratory at 205 °C for 3 to 4 hours until the color indicator returns to blue. The desiccants are cooled, and the cylinders are reloaded. Saturated charcoal is disposed, and new charcoal is placed in the cylinder. All newly loaded cylinders must have the date of loading written on tape on the top of the cylinder. Ports on the cylinders should be kept sealed with tape or caps to try to prevent moisture from being absorbed on newly dried desiccants. Spare desiccant cylinders should be prepared so that desiccants are readily available.

Routine preventive activities and schedules are detailed in the specific instrument's SOPs.

16.3. Inspection

16.3.1. Inspections in Conditioning/Weighing Room

There are several items that require routine inspection in the weigh room laboratory. The items to inspect and how to appropriately document the inspections are listed in IML's SOP.

16.3.2. Inspections of Instrument Items

There are items that require periodic instrument inspection. These items are identified and procedures are presented in the applicable equipment SOPs and operations manuals.

The shelters are inspected quarterly by the Air Monitoring Manager during audits. The condition of the monitors and calibrators and the shelter are inspected for deterioration. The sample lines are inspected for moisture, and the heat tape is inspected to make sure it is on. The shelter temperature is inspected to make sure it is within parameters. The shelter temperature is logged in the data logger using a temperature probe. Comparisons of the logger probe against a NIST standard are to be conducted quarterly by the Technician and are recorded in the site log. A mercury thermometer hanging on the wall is also checked against the NIST standard. The Manager reviews the shelter temp comparisons in the log book each visit.

Each time the site is visited by a Technician, the Technician is to inspect the equipment to verify that the entire system is in good working order and is to record in the site log book what activity was performed at the site during his/her visit. Any deviation must be noted in the monitor log book, the Manager must be informed, and corrective actions must be taken.
Continuous minute data are inspected in graph form daily by a Technician and by the Manager for each business day and Mondays for the weekends. If Monday is a holiday, then the inspection will be on Tuesday for the weekend days. The Bureau has a number of daily e-mail reports that enables the Director and the Manager to keep up with the magnitude of the data during the workday, especially during times of high data. These e-mail reports at the beginning and the end of the workday are detailed in the Reports to Management section of this document. Data trends that warrant further investigations are the same numbers reporting for multiple hours in a row or unusual, illogical, spikes or valleys in the data. Satellite pictures will be consulted if it appears that some exceptional pollution event is occurring, and the event will be followed while it is happening. If an event is suspected, a notifying e-mail will be sent to EPA Region 4. There may be interaction with the State of Tennessee and the State of Georgia.

17. INSTRUMENT CALIBRATION AND FREQUENCY

17.1. Calibration of Local Primary Standards

17.1.1 Traceability

40 CFR Part 58, appendix A requires that gaseous standards, photometers, and flow rate standards used in the air monitoring network be traceable, with no more than one step in between the primary and the local standard, to the National Institute of Standards and technology (NIST). There should be an unbroken chain of calibrations, each step in the chain contributing to measurement uncertainty. The idea is to transfer primary standard accuracy to Instrument usable instruments.

All Bureau standards, therefore, are sent to the vendors for NIST certification yearly or taken physically to SESD in Athens, Georgia, to compare against the NIST traceable SR10, a primary standard, in order to meet the requirements of *40 CFR*. A Technician is sent to Athens in January or February before ozone season starts March 1. The Bureau transports the stationary calibrators directly to SESD. The calibrators, therefore, are Level 2rather than the usual Level 3 standards. A level 2 or secondary standard is only required to be calibrated once a year. Traceability certificates are kept together in a notebook on the Bureau bookcase.

Any other agency performing audits of Bureau equipment must provide NIST traceable certification documentation to the Bureau for every audit device used in the audits. Any private contractor employed for audits will be required to supply NIST traceable certification

documentation for every audit device. Any audit data where certificates are not supplied is assumed to be untraceable to NIST will not be loaded into AQS or will be removed before certification if certificates are not provided.

Monitor data traceability is irrelevant if the data loggers are not accurately reporting ozone or continuous particulate levels. Data loggers are the instruments being polled for data, not the monitors.

17.1.1. Local Primary Flow Rate Standard

A distinction must be made between the terms calibration and verification. Calibration is used to indicate an actual adjustment occurred in either the instrument or the software. Verification is used to indicate that the operational data were verified but no physical alterations were made to the instrument. Calibration procedures for each specific instrument are detailed in the SOP for that instrument. According to EPA, calibrations are performed to reduce bias. EPA, however, recommends minimizing adjustments to avoid introducing measurement uncertainty.

The two ozone calibrators and the audit calibrator are calibrated or certified against the SRP10 in Athens according to the Bureau SRP10 SOP once a year in January or February. The Bureau does not own a bench standard so the instrument calibrators are taken directly to SESD. The Instrument calibrators are then Level 2 or secondary devices.

The Bureau, for $PM_{2.5}$ NIST traceable certification, owns two Chinook critical orifice devices, two deltaCals, and a tetraCal that are all NIST traceable certified yearly by the vendors. The certificates are kept in a notebook on the laboratory bookshelf. Only currently certified devices are to be used for flow audits. Some of the previously certified devices are no longer certified because the monitors for which they were used are no longer in service.

17.1.2. Local Primary Temperature Standard

The local primary temperature standard used to verify the accuracy of the Instrument temperature transfer standards are a deltaCal or tetraCal, and they will be certified against a NIST primary temperature standard during their yearly certifications at BGI/Mesa Labs. The data logger at each ozone site has a channel set up for internal shelter temperature monitoring, and the temperature is checked against a temperature standard once a quarter and recorded. There is a mercury thermometer hanging in the shelter. It is also checked against the temperature standard.

17.1.3. Local Primary Pressure Standard

The local primary pressure standard used to verify the accuracy of the Instrument barometer transfer standards will be either the deltaCal or tetraCal, NIST certified for barometric pressure during their yearly certifications at BGI/Mesa Labs. The stationary mercury barometer (wall mounted), Princo brand, maintained by the laboratory can also be used as a primary standard. According to the Princo literature, it is not required to be yearly certified.

17.2. Calibration of Transfer Standards

17.2.1. Flow Transfer Standards

Chattanooga-Hamilton County employs the manufacturer provided streamline flow transfer standards (Chinooks) for instrument calibrations and flow rate verifications of the flow rates of the network samplers. Or the flow can be determined with the Bureau's deltaCal or tetraCal, whichever flow range is applicable. Both these devices have the advantage of providing volumetric flow rate values directly, without requiring conversion for mass flow measurements, temperature, pressure, or water vapor content. A calibration relationship for the flow rate standard, such as an equation, curve, or family of curves, is established by the manufacturer (and verified if needed) as accurate to within 2% over the expected range of ambient temperatures and pressures at which the flow rate standard is used. The flow rate standards shall be recalibrated and recertified at least annually.

17.2.2. Temperature Transfer Standards

The Instrument temperature transfer standards used for calibration of temperature sensors will be the deltaCal or tetraCal because they both are NIST certified for temperature when they are certified yearly.

Bureau digital thermometers can be certified against the deltaCal and tetraCal. Digital thermometers, if needed, will be reverified/recertified at least annually against the local temperature standard, or auditors transfer standard, to within 2 °C over the expected range of ambient temperatures at which the temperature standard is to be used.

17.2.3. Pressure Transfer Standards

The Instrument pressure can be determined directly from the deltaCal or tetraCal that is certified NIST traceable for pressure. A handheld digital aneroid barometer can be used that will have either its own certification, be certified against the deltaCal or tetraCal NIST traceable barometric pressure (yearly certification), or be certified against the Bureau's Princo mercury barometer.

17.2.4. Laboratory Standards

The microbalance, mass reference standards, and any other laboratory standards will be certified according to the schedule in IML's SOP.

17.3. Calibration of Laboratory/Instrument Equipment

The specific calibration procedures for the laboratory and Instrument equipment can be found in the applicable SOPs or operation manuals.

17.4. Document Calibration Frequency

The appropriate instrument SOP will detail Instrument QC checks that include frequency and acceptance criteria and references for calibration and verification tests of single and sequential sampler flow rates, temperature, pressure, and time. The laboratory SOP has a similar summary of laboratory QC checks, including the frequency of primary and working mass standards and conditioning/weigh room temperature and relative humidity. The continuous instrument flow rate, temperature, and pressure sensor verification checks include one-point checks at least monthly

and multipoint checks (calibration without adjustment unless needed as determined independently and then performed by the vendor's authorized service representative) at least annually, as documented by tracking on control charts.

All of these events, as well as sampler and calibration equipment maintenance, will be documented in Instrument data records, Messages to Central or log files in the data logger, and logbooks, and annotated with the flags required in *Appendix L* of *40 CFR Part 50* and the manufacturer's operating instruction manuals. Laboratory activities will be recorded according to IML's QAPP. The Instrument records will normally be controlled by the Air Monitoring Manager and be located in the laboratories/Instrument sites when in use or in the Air Monitoring Department at the Air Pollution Control laboratory when being reviewed or used for data validation.

All certification certificates will be placed in a notebook on the laboratory bookshelf. No instrument can be used for calibration or verification unless its certification is current. Instruments with expired certificates are not to be used.

18. INSPECTION OF SUPPLIES AND CONSUMABLES

The Bureau has parts and supplies that are kept on hand. Vinyl tape and petri dishes are ordered ahead so that a supply is always kept at the Bureau.

The Bureau receives a shipment of FRM filters every year from EPA. They are shipped about twice a year to IML - in order with the lower lot numbers first and the higher lot numbers retained. IML notifies the Bureau when their supply is low and more are sent.

Ozone sample lines are replaced every year with new tubing.

Spare parts are kept at the Bureau of valves and pumps for the noncontinuous monitors and lamps, pumps, scrubbers and filters, are kept at the Bureau for the ozone monitors. Filter pans are kept for the TEOM. Normally expensive items, such a computer boards and filter exchange mechanisms, are not kept in stock.

Of particular importance with the ozone monitors is the zero air system where the charcoal and desiccants must be kept fresh so that the zero air is zero. EPA does not permit zero air to be manually adjusted so the desiccants must be changed out often. It is the Ozone Technician's responsibility to make sure the desiccants and charcoal are not spent and refreshed on a regular basis. Charcoal must be replaced in desiccant cylinders at least twice a season. Charcoal has no indicator so it must be regularly changed before it is spent. Drierite and silica gel have color indicators which dictate when they must be changed. When dry they are indicating a blue color. The desiccants turn pink as they become saturated.

Since the Bureau is a small agency, each of the Technicians and the Manager order for the Air Monitoring Department. Each Technician is responsible for the parts supplies for the monitors for which he/she is responsible, therefore, each Technician keeps his/her own inventory. When each Technician needs to order parts from the same company, the orders are combined. The City of Chattanooga Purchasing Department encourages consolidation of orders. The Manager orders large equipment such as data loggers and instruments.

Any orders over $1,000 must go through City Purchasing and the processing can take a month or more before the order ever gets to the vendor. In instances where time is critical, the process must be taken into consideration. All purchasing must comply with the purchasing requirements of the City of Chattanooga purchasing department and should be coordinated through the Bureau Operations Department.

19. NON-DIRECT MEASUREMENTS/LITERATURE

There are many measurements or documents used in the Air Monitoring Department that are provided by vendors, other entities, or generated at other agencies. Bureau employees need to understand what degree of reliability these measurements or documents have. Some may be more reliable than others.

Equipment operational literature is an example of a document that is generally presumed by Air Monitoring personnel to be correct, complete, and reliable. Operational literature may or may not be complete and reliable. Some vendors' manuals may have significant omissions or inaccuracies.

Google Earth and Hamilton County GIS are used for Latitude/Longitude information. Both mapping systems are often used in the Air Monitoring Department to locate sites, look at new residential and commercial growth around sites, and for reports that need maps.

National Weather Service data is posted on the internet, and monthly and daily summaries are available. Lovell Field is the Chattanooga Metropolitan Airport, and it is near the Bureau office. NWS data is taken from the Lovell Field site for Chattanooga. Accurate weather information is critical for the evaluation of air monitoring data. There are numerous websites on the internet where data can be used to produce a wind rose.

Data can be pulled from AQS to do data comparison graphs. The Bureau must be confident in the data that other agencies have entered into AQS in order to compare the data.
Chemical and physical properties data can be obtained from textbooks, and the properties are very useful for assessing unusually low or unusually high data.

The Bureau reviews the State of Georgia speciation data entered into AQS if the Bureau wants to review speciation. Speciation is monitored at the Walker County, Maple Street, North Georgia site (132950002).

The Bureau Engineering Department is responsible for the Bureau Emissions Inventory. The emissions inventory may be consulted for modeling purposes or to understand monitoring affected by a commercial area. The Bureau Emissions Inventory was updated in 2017.

Any use of outside data will be quality controlled to the extent possible following QA procedures outlined in this document and in applicable EPA guidance documents.

Traffic count data is available from the State website for major roads in Hamilton County by year. Population census data is taken from the US Census website: https://www.census.gov/

20. DATA MANAGEMENT

20.1. Data Collection and Recording

The data collected at continuous sites in Chattanooga-Hamilton County's network are recorded electronically. Each continuous monitoring site is equipped with a data logger that records each monitor's output, performs specific data manipulations, and is collected by data software by dial up/modem that formats the resulting data in preparation for downloading to a database or spreadsheet. Each continuous site is polled hourly by Agilaire Airvision software. The Airvision software also performs data conversion to AQS formats for data loading into AQS. The continuous data is sent to an FTP site for use by AirNow and a second FTP site for use by the State for forecasting.

The Bureau is collecting PM_{10} data from the T640 instrument but is not currently entering the data into AQS. The data is being stored for reference. A secondary logger is being operated at both ozone sites as a data backup mechanism. The data from the second logger is also being polled and stored for reference. At both sites AV Trends is being operated to graph the data logger output. This is a different function from the former chart recorders because the chart recorders were operating with output from the monitor, not the logger.

EDAS, the legacy data collection software, is no longer being operated beginning in May of 2017. The Bureau was operating Airvision as the primary software and EDAS on a second computer as a back-up. The Bureau reserves the right to reactivate EDAS if a second data collection software is desired.

IML is contracted to convert $PM_{2.5}$ data into AQS formatted data lines. The AQS files arrive at the Bureau electronically ready for loading into AQS. They are reviewed again by the Air Monitoring Manager before loading into AQS and a second time when AMP confirming reports are run. IML data is never considered final data until it has been reviewed two more times after receipt from IML. IML data reports are not considered final data. Only data downloaded from AMP reports in AQS are considered final data.

20.2. Data Validation

Each of the network's analytical instruments undergoes periodic audits and calibrations. These procedures are outlined in the appropriate SOPs and in specific sections of this QAPP. Performance audits and calibrations ascertain the accuracy, precision, and repeatability of each instrument in performing its required function.

The Bureau has an EPA-approved Data Handling SOP which details every step of validation and verification.

The data generated by the continuous instruments are stored on site in the data logger. The data are transmitted through phone lines, and they are downloaded to data handling software where they will undergo verification, reduction, and analysis. The Bureau is still using dial-up technology and intends to continue to do so until it becomes cost effective to adopt fiber optics or wireless technology or unless EPA provides funding for converting and operating an upgraded system.

Data verification is performed electronically by searching the data for status flags and comparing reported values to criteria that identify whether the data are within acceptable range criteria.

Once data have been flagged as questionable, the data is evaluated to identify underlying causes and make the decision whether the data are valid. If the data are invalid, they are not used in calculations. If the data are valid, but flagged due to some extenuating circumstance, then the data will be used in calculations, accompanied by a comment flag in AQS documenting the situation.

Metadata is downloaded quarterly from the FRM monitors using a Panasonic Toughbook laptop and RP Comm software. Monitors retain 50 run date's data but one monitor the Bureau owns will not retain that much. The Technician, therefore, must download before the monitor writes over the data. The critical numbers in the metadata are recorded on the Instrument data sheets that are sent to IML so critical metadata is not lost if there is a loss of a file on the monitor. The metadata is reviewed by the Air Monitoring Manager line by line to make sure the filters and cassettes are identified for the correct run date and to review any flags the instrument has put on the data. There is a battery back-up to the file retention feature in the monitor. If the monitor is unplugged for any reason and the batteries are dead, there will a loss of the metadata. There could be a loss for a power failure. Metadata should be downloaded before a monitor is taken down for maintenance.

Continuous ozone data and continuous $PM_{2.5}$ data affected by exceptional events will be flagged in AQS for every hour believed affected, and each hour will be linked to the appropriate comments added to the comment section. The Bureau may or may not apply for the event recognition from EPA. FRM $PM_{2.5}$ 24-hour data affected by exceptional events will also be flagged in AQS with the appropriate flag and comments. EPA has developed two types of exceptional event flags: "I" series flags that indicated that the agency recognizes there is an event but does not plan to officially apply for exceptional event status and "R" series flags that indicate that the agency intends to apply for formal exceptional event status. EPA asks that agencies not flag with the R series if the agency is not planning to formally request exceptional event status. Events should be flagged and notated quarterly as the data is entered into AQS. EPA has very specific rules and deadlines for exceptional event flagging, exceptional event applications, and public comment periods; therefore, current exceptional event guidances and rules should be consulted.

20.3. Data Transformation

The inherent accuracy of an instrument is incorporated into the system accuracy when the instrument is calibrated. Each criteria pollutant-monitoring instrument has its own internal potentiometers, whether digital or analog, adjusted to accurately reflect the concentration at which the instrument is tested. Each instrument is assumed to be linear within the range of 10% to 90% of full scale. As long as the background concentrations do not violate this range, the accuracy of the instrument is not questioned.

The network's O_3 analyzer is equipped with internal subroutines that adjust the zero and span internal calibration variables during the actual calibration operation. The CPU adjusts the internal digital zero and span potentiometer to coordinate the analyzer's voltage output and the indicated calibration gas value. Additional information is available in the O_3 SOP and the individual analyzer's operations manuals.

A photometric ozone calibrator is utilized for generating the necessary O_3 gas concentrations required to calibrate the O_3 analyzers. A description of how the O_3 calibrator functions and step by step procedures can be found in the appropriate SOP and instrument operations manual.

20.4. Data Transmittal

Data transmittal for continuous monitors is accomplished using telephone line access to the site's modem, which is linked to the data logger. Downloading of collected data does not delete the data from the data logger. Data are removed from the data logger continuously by overwriting data on a first-in, first-out basis. This configuration requires that the data be extracted from the data logger on a regular basis, thus preventing any loss of data. If communication problems arise, the data will have to be retrieved either by going to the site and directly accessing the data logger, or retrieving the data remotely once the communications problems have been rectified. A site visit is mandatory if the communications problems are not expected to be corrected in time to prevent data from being overwritten.

There is a primary logger and a secondary Agilaire logger at each Bureau ozone site. If data cannot be retrieved by modem from the 8832 or 8872 Agilaire loggers (external loggers), each monitoring instrument has an internal logger from which data can be retrieved. The capacity of the internal logger does not match the capacity of the external logger, therefore action should be taken immediately if there is an external logger failure or polling problem. The data in the instrument overwrites when the memory fills; therefore, quick retrieval from the instrument is important to minimize the actual loss. Currently data retrieved from the monitor's internal logger has to be retrieved by the minute so the retrieval is laborious. The loading of the minute data into Airvision is time consuming if more than a few hours of minute data are involved
Data not acquired on a dial-up poll are picked up and transmitted by the next poll. Messages to Central or logger messages are polled at the same time.

The Bureau has set up AV Trends at each ozone site on a PC to act as a strip chart. This secondary data-recording device is used to augment the data integrity and to verify suspect data points in the digital database.

Strip charts can also be generated from Airvision software. A daily minute graph for all continuous sites is produced from Airvision electronically and stored on the Airvision computer according to the Data Handling SOP. Daily minute graphs are sent electronically to the Air Monitoring Manager the following morning about 8:30 AM with Friday, Saturday, and Sunday sent on Monday morning. Thus, all minute data is viewed graphically by both the Technician and the Manager daily.

Hourly polled transmitted data sets from the data loggers are stored electronically in Airvision, the Bureau's data acquisition software by Agilaire. A Technician searches the downloaded files for data logger flags when he reviews the data. If flags exist, he determines what incident caused the flag and determines if the data must be voided or if the data can be flagged and kept. Data can be retrieved with queries, and reports can be made directly from Airvision. These data sets are retained intact by archiving the raw minute data on CDs. Data reduction operations can be performed repeatedly without violating the integrity of the original raw data set.

The Bureau is operating a second logger at each site so that data is readily available in the event of the primary logger failure. The Bureau has installed an 8872 Agilaire logger at Eastside and intends to install one at Soddy Daisy before the end of the 2018 ozone season. Since the 8872 is Windows driven which requires a few minutes to reboot, it has been found that repeated power failures can crash it. The Bureau, therefore, has installed an uninterrupted power source (UPS) at each of the ozone sites. The installation of a UPS at each ozone site has prevented further power issues.

If metadata lines are somehow lost from the $PM_{2.5}$ FRMs, the important data can be reconstructed. At the time of filter retrieval much of the information is recorded on the filed data sheets.

The metadata files are flagged by the monitor for less than 24 hours run time, for temperature differentials, for a blank, for a power failure, and a host of other reasons. When the metadata is reviewed it is determined if the flag is because of exceedance of a critical criteria or if it is flagged for some less serious reason. The flags are numerically coded with the coded defined in the manual. The Manager reviews the codes to determine what caused the flag. The instrument flags the Instrument blanks.

The $PM_{2.5}$ FRM monitor data files have battery backup. If a monitor is unplugged and the batteries are dead, the metadata lines will be deleted. It is important, therefore, that the batteries be replaced about twice a year to prevent data line loss in the event of a power failure or power disconnect for maintenance. Monitors are supposed to retain 50 lines of data before writing over them; however, one of the Bureau FRM monitors will only hold about 35. The operator must be aware of where that monitor is currently located and download it more frequently. Data download is performed with a laptop.

20.5. Data Reduction

Data reduction activities aggregate raw data into quarterly averages that are required to compare against the NAAQS criteria pollutant limits. These values obtained from reducing these data sets establish whether or not the NAAQS have been exceeded.

Instrument Technicians review the raw metadata sets from the FRM $PM_{2.5}$ instruments. The Manager then reviews the metadata and compares the data lines with filter numbers, cassette numbers, run dates, and blanks recorded in the lab log. Flags indicating the validity of the data are provided by the monitor on metadata that have issues.

The Instrument Technician, then the Air Monitoring Manager, reviews the data sets for invalid data flags. If the data are deemed invalid, they are disqualified from the data set, and consequently, not entered into AQS or used in the calculations against the NAAQS. Criteria for the quantity of valid data points required within a data set are defined in *40 CFR Part 50*. These parameters termed critical criteria (indicated in pink on the criteria sheets) determine if data must be voided when performing the data reduction operations. Retaining copies of all data sets electronically provides a data audit trail. These data sets are archived on backup CDs in addition to being retained on computers. Data is archived from the continuous monitors - two ozone and one $PM_{2.5}$ particulate monitor- every two weeks. Data is polled and stored on a dedicated computer in the Air Monitoring Department.

The metadata files are reviewed by Air Pollution personnel and supplied to IML who reviews those files and builds the AQS files. Any questions are handled by e-mail exchanges between the Air Monitoring Manager, the Technicians, and the IML Laboratory Manager. AQS files are sent by IML back to the Bureau to proof and load into AQS.

Conversion of continuous $PM_{2.5}$ data and ozone data to AQS format does not require data reduction. Airvision software can, upon command, perform the data conversion to AQS format. The Technician decides the appropriate Null Value Codes for missing data and enters them in the data lines.

Data can be copied from AMP reports into Excel spread sheets or data can be placed by AQS into delimited form and transferred to Excel spread sheets. Data manipulation can be performed. The Air Monitoring Manager will graph Bureau $PM_{2.5}$ FRM data against the Walker County, Georgia, site for comparison since that site is in the designation area. The Manager may also graph data against other nearby sites. There are several EPA web sites that provide graphing functions and other useful tools.

AirNow Tech is very useful for tracking real-time data from areas nearby. During a pollution event the real-time graph can be left running to show all Bureau continuous sites and nearby sites in order to follow the event while it is happening. This was done during the November 2016 wildfire event in the Hamilton County area in order to follow the high data in the region in real-time.

The Bureau does not usually perform modeling of air monitoring data. The MOVES transportation model, however, has been run at the agency in the Engineering Department. Modeling has sometimes been done for the agency by the State modelers.

20.6. Data Analysis

AQS now has a design value AMP report that gives the appropriately calculated yearly averages in the case of particulate or the fourth highest and the design value in the case of ozone. These results are compared to the NAAQS for the specific criteria pollutants under consideration. At least once a year the design values should be hand-calculated and compared against the values on the design value report to check the AMP report for accuracy.

20.7. Data Storage and Retrieval

The storage and retrieval of the air quality monitoring data shall be possible through an archiving system. The data shall be stored for a period of five years, unless any litigation, claim, negotiation, audit, or other action involving the records has been started before the expiration of the five-year period. If this happens, the records will be retained until completion of the action and resolution of all issues that arise from it, or until the end of the regular five-year period, whichever is later.

The data shall be stored on electronic media (such as Write-Once, Read-Many [WORM] CDs or magnetic tapes) or in hard copy, whichever proves most advantageous. After the storage period has passed, the storage media may be disposed or recycled.

Our local regulations require that data be stored for seven (7) years at the Bureau. Paper copies are kept of precision and span checks, calibrations, and audits for seven (7) years. Paper copies of State audits are kept in paper files. Electronic copies of audits files are also kept on the Monitoring Manager’s computer.

21. ASSESSMENTS AND RESPONSE ACTIONS

An assessment is the process used to measure the performance or effectiveness of the quality system, the Ambient Air Quality Monitoring Network and its sites, and various measurement phases of the data operation. In order to ensure the adequate performance of the quality system,

Chattanooga-Hamilton County participates in or performs a number of assessments. Table 10 lists these assessments and their frequencies.

Table 10. Assessment Schedules

Assessment Type	Assessment Agency	Frequency
Technical System Audit	EPA Region 4	Every 3 Years
Network Review	State/EPA	Annually in State Monitoring Plan
Local Audit	CHCAPCB	Quarterly for ozone
State Audit	State	Quarterly for all monitors
Data Qualifiers/Flags Review	CHCAPCB	Quarterly and Annually
Standard Operating Procedures	CHCAPCB	Within 6 months of a new instrument
Data Quality Assessment	CHCAPCB	Quarterly and Annually
$PM_{2.5}$ Performance Evaluation Program (PEP)	EPA Contractor	5 Per Year
National Performance Audit Program (NPAP)	EPA Contractor	As Scheduled

21.1. Local Audits

The Air Monitoring Manager conducts quarterly “through the probe” ozone audits, and all audits are entered into AQS. The “through the probe” audit is controlled by a switch in the data logger. If any issue with the monitor is suspected, more local audits will be performed. First and fourth quarter audits are conducted in March and October. The audits are conducted according to EPA’s requirements for audit levels. The Manager usually performs audits at additional levels than those required. Each audit level is performed for a minimum of 10 minutes. Zero can be shorter because once it reaches 0 it does not increase. The Bureau owns its own auditing calibrator that is not used for any other purpose. It is taken to SESD to be calibrated with the SRP10 in January or February every year. The zero air desiccant and carbon cylinders for the audit zero air mechanism are only used for audits. The Particulate Technician has also performed some additional audits in 2017 for training purposes. No “back of the monitor” local audits are conducted. No audits are to be performed on predicted high particulate or high ozone days. EPA is requesting ozone audits at 15 ppb, and the local audits should include one audit point at each site at 15 ppb. No audits are to be performed with a calibrator that is not currently within certification.

When the audit is completed, the calibration line that has been moved to the audit calibrator is moved back to the stationary calibrator. The switch is tripped in the logger to start sampling ambient air. The auditor must allow the monitor to stabilize before the logger is enabled to officially record data. This is critical because if the logger is enabled to officially collect data and the monitor is not stable, data that appears elevated may be collected.

All back-up instruments are audited during the local audit. Monitoring instruments and attached data loggers are both audited. The logger must be audited because the data polled by telemetry is being polled from the logger, not the monitor. The logger data are placed in AQS, not the monitor data. It has been found that both analog and digital have some variance between the monitor and the logger (i.e. the data will not match exactly) but the variance should not be more than about 0.8 ppb. Because of truncating data, a small variance may appear as a whole ppb - even if the difference is 0.2 ppb. If a second logger is being employed for back-up data, that

logger is also audited. AV Trends has been added at each site as a site electronic strip chart. When the audit is performed, the data on AV Trends is recorded in the log as part of the audit.

A secondary logger may be set up at each ozone site. Since AV trends runs off analog output from the logger, a second logger connected to the monitor (not the logger) is a better backup than instruments reporting off the same logger.

Local audits have a second function unrelated to instrument performance. The Manager, while at the site, looks through the log book at recent entries and inspects the condition and cleanliness of the shelter. The Technician usually is aware when the Manager performs an audit, but the Manager reserves the right to perform a surprise audit anytime.

Because of new 8-hour block retention in new ozone regulations, audits must be completed before noon Eastern Standard Time to prevent risk of data loss due to loss during critical 8-hour blocks.

The Air Monitoring Manager does not usually perform particulate audits since flow and leak checks must be performed monthly by the operator. If there should be an issue with a monitor, the Manager may perform particulate audits.
Local audits are loaded into AQS by the Air Monitoring Manager.

21.2. State Audits

The State of Tennessee has been auditing every functioning instrument every quarter at all sites. All audits are “through the probe” using the logger switch in the same way as the local audits are performed. Ozone first and fourth quarter audits are conducted in March and October, although the instruments could be kept running for a few days into November if necessary. The Air Monitoring Manager enters the audit data into AQS when the report is received from the State. This means that there are two ozone audits per quarter, a local and a State audit. The State also audits all the particulate monitors, FRMs and continuous. The State supplies the report to the Director and the Air Monitoring Manager every quarter. The State notes any findings and the Bureau reports back to the State any corrective actions that are required. The State will provide the audit device or calibrator certifications to the Bureau.

It is a Bureau policy that a Bureau employee accompanies the State auditor to the site with Bureau equipment. In the event of a disagreement between the auditor and the Bureau Technician, the agreement is to be settled at the site before the auditor leaves. The Bureau employee is to use his own equipment to confirm any controversial auditing data by the State auditor. It is very difficult to settle a disagreement after the fact because circumstances may be completely different if the auditor returns to reaudit. The Bureau has requested a reaudit in the past. If the State auditor and the Bureau Technician cannot reach an agreement, the Air Monitoring Manager will be called to the site and will attempt to arbitrate the disagreement.

The State auditor must acclimatize his particulate auditing equipment if it is a deltaCal, tetraCal, or Challenger (by BGI/Mesa Labs) to ambient temperatures, especially during times of extreme temperatures, for at least 30 minutes, if not 45 minutes. If this is not done, the audits can be affected. It is the accompanying Bureau employee’s responsibility to make sure the auditor acclimatizes his particulate auditing equipment, especially in times of extreme temperatures.

State ozone calibrators should warm-up for a minimum of an hour before the audit is conducted. If the State auditor arrives the day before the first audit, the calibrator can be taken to the site and turned on so that it is ready for the audit in the morning. If the auditor arrives the day of the first audit, then the calibrator must warm up for at least an hour before the audit. Alarms and warnings that appear during warm-up must not be showing. The State audit calibrator can be transported to the second site and turned on before the end of the first auditing day. Then, a warm-up will not be required the next morning for the second ozone site.

The State must perform its audits in the morning before 12:00 Eastern Standard Time to prevent losing data during critical 8-hour blocks. This is to be compliant with EPA's memo *Managing Ozone Quality Assurance and Maintenance Activities while maintaining a complete day* where EPA identified critical 8-hour blocks that should remain intact.

21.3 Independent Audits

The Bureau may elect to hire a private contractor to perform an independent audit of all instruments for a supplemental audit. If a private contractor is hired, the company will be asked to perform at least one ozone audit level at 15 ppb at each ozone site to conform to EPA's request for low level audits. A Bureau employee will accompany the auditor and any audit dispute will be settled by using Bureau audit equipment to compare against the independent auditor's equipment. If an agreement cannot be reached, the Air Monitoring Manager is to be called to the site for arbitration.

The independent auditor will acclimatize his particulate auditing equipment for at least 30 minutes if he or she is using a BGI/Mesa Labs auditing device. The ozone calibrator will be warmed up at each site for a minimum of an hour before the audit. Each ozone audit will be performed through the probe using the switch on the data logger.

The auditor will record during the audit what is showing on the secondary logger and on AV Trends at each site. To use back up data, the equipment should be audited.

The auditor will provide a comprehensive report that will include all certificates demonstrating that the audit equipment has current certifications.

21.4. PEP and NPAP Audits

The Bureau participates in the national PEP and NPAP audit programs. The national audit programs are for performance audits of monitoring equipment. The national PEP audits for $PM_{2.5}$ and NPAP audits for ozone are scheduled by EPA employees or an EPA contractor. Information about the two national audit programs can be found at: http://www.epa.gov/ttp/amtic/npepqa.html

For the PEP audit, EPA installs a particulate monitor (BGI single day) in collocation with the collocated FRMs or the FRM at East Ridge to run on the same official monitoring day for the same 24-hour period. EPA loads the data into AQS. This data should be inspected for reasonability by Bureau employees before yearly certification.

For the NPAP audit, EPA brings a vehicle outfitted with ozone generating equipment to do a "through-the-probe" audit. An EPA contractor may be sent with a certified calibrator rather than the van. EPA supplies the report to the Bureau and the Bureau loads the data into AQS.

NPAP audits must be performed in the morning before 12:00 Eastern Standard Time to prevent losing data during critical 8-hour blocks. This is to be compliant with EPA's memo *Managing Ozone Quality Assurance and Maintenance Activities while maintaining a complete day* where EPA identified critical 8-hour blocks that should remain intact.
If there is any question about either the PEP or NPAP audits, the Air Monitoring Manager will contact EPA or EPA's contractor to resolve the issue. Errors by EPA data loaders have been found in the past in AQS so it is important to review the audit data EPA loads into AQS.

21.5. State of Tennessee Certificate of Exemption Audit

Every two years (on an even year schedule) the Bureau is required to renew its Certificate of Exemption that exempts the Bureau from regulatory oversight by the Tennessee Air Pollution Control Board. As part of this renewal, the State requests copies of all grant reports and other significant documentation from every department at the Bureau for the two-year period. The package to the State is substantial. The State reviews the package to determine if the Bureau's Certificate of Exemption should be renewed. This functions as a "paper" audit.

21.6. Technical Systems Audit by EPA

A Technical Systems Audit (TSA) is a qualitative assessment of a data collection operation or organization. A TSA is employed to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate to ensure data obtained are of the necessary type and quality to support the decision process.

A TSA of the Ambient Air Quality Monitoring Program will be conducted every three years by EPA Region 4 quality assurance staff from the Science and Ecosystem Division (SESD) in Athens. The TSA will use appropriate federal regulations and this QAPP to determine the adequate operation of the ambient air monitoring program and its related quality system. The EPA will report its findings to senior management. The report will be filed appropriately. Before a Bureau visit the auditor will send the Air Monitoring Manager a lengthy questionnaire to fill out and return to SESD. The auditor, along with several colleagues, will go over all the answers when he or she arrives on site. The auditor will review print AMP reports from AQS, review all data in the three year period, and will question any unusual data. The Air Monitoring Manager may have a Technician present to answer specific questions. EPA may request specific documentation, such as certification certificates for proof of NIST traceability. The auditors may dismantle inlets to see if maintenance is being performed on schedule.

At the end of the TSA, there will be a formal meeting with the Director and the Air Monitoring Manager. Region 4 in Atlanta and SESD may be teleconferenced into the meeting. This is to begin discussing the findings and corrective actions expected. A draft TSA report is sent to the agency within 30 days of the audit. Region 4 allows a brief comment period, the Bureau sends comments if necessary, then the TSA report will be finalized and resubmitted to the Bureau. The Bureau has 30 days to prepare its formal response to address the findings. This response is in the form of a Corrective Action Plan which will be submitted to Region 4 in Atlanta and SESD. The Bureau will submit progress updates on a periodic basis until the corrective actions have been completed.

For each round of TSA audits EPA may be scrutinizing specific quality assurance activities. For example, in the 2012/2013 time period EPA was particularly focusing on laboratory quality assurance and filter conditioning parameters.

EPA's written evaluation currently is divided into three categories: **Findings** which are regulatory violations or significant guidance deviations, **Concerns** which are practices thought to have a detrimental effect on the data quality, and **Observations** which are infrequent deviations that may not affect work quality but may affect future quality. The final report is submitted by EPA to the Director and the Air Monitoring Manager, and it is discussed with the Instrument Technicians. It is very important that this report uses the three categories. These categories were adopted at the insistence of the agencies as the reports are being supplied to administrators. If all EPA comments are lumped together, the Bureau Director and the Bureau Board have no way of knowing which infractions are important regulatory violations and which ones are within the regulations but are more in the suggestion category. EPA can send many pages of comments but only a few might be significant issues.

The audit report, unless otherwise stated in the report, will require a response letter from the agency stating how corrective actions are expected to be implemented. A further response letter may be required after most or all of the corrective actions are put into place.

EPA may perform a surprise TSA between regularly scheduled TSAs if an agency has had a lot of quality issues.

21.7. State Air Monitoring Plan

Conformance with network requirements of the Ambient Air Quality Monitoring Network as set forth in *40 CFR Part 58, Appendices D and E*, are determined through annual network reviews of the ambient air quality monitoring system. The network review is used to determine if a particular air monitoring network is collecting adequate, representative, and useful data in pursuit of its air monitoring objectives. The network review may identify possible network modifications to enhance the system or correct deficiencies in attaining network objectives. Prior to implementing a network review, significant data and information pertaining to the network will be compiled and evaluated.

The local agency's contribution to the State of Tennessee's Air Monitoring Plan is the Network Review where the Chattanooga-Hamilton County network is discussed and evaluated by site. Ordinal pictures are provided for each site, and any changes or proposed site changes are detailed. The site location and parameters are evaluated in comparison to *40 CFR* requirements, including measurements from obstructions and roads. Also included is the yearly required equipment evaluation. These three regulatory requirements (the Network Review, the site evaluations, and the equipment evaluation) are combined in the document to the State to be included in the State Air Monitoring Plan.

The State may provide maps, population data, and modeling of emission densities for Hamilton County in their portion of the State's plan.

> ***Monitor Locations*.** For SLAMS, the geographical location of monitors is not specified in the regulations, but is determined by on a case-by-case basis to meet the monitoring objectives specified in *40 CFR Part 58, Appendix D*. Suitable monitor locations can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information will be helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions, historical monitoring data, and/or saturation study findings versus monitor locations will also be used.

During the network review, the stated objective for each monitoring site will be reconfirmed and the location's spatial scale will be re-verified. If the site location does not support the stated objectives, or the designated spatial scale, changes will be proposed to rectify the discrepancy.

***Probe Siting Requirements*.** Applicable siting criteria for SLAMS are specified in *40 CFR Part 58, Appendix E*. A Bureau employee will conduct an on-site visit to each monitoring site that will consist of physical measurements and observations to determine compliance with the *40 CFR* Part 58, Appendix E requirements, such as height above ground level, distance from trees, and appropriate ground cover. This check at each site will be performed every year and documented in the Network Review submitted to the State to be included in the yearly State Air Monitoring Plan. The site review will include:

- the most recent hard copy of site description (including any photographs); seasonal, pollutant-specific data identifying the greatest potential for high concentrations; and
- data describing predominant seasonal wind directions.

For the site evaluation the evaluator will:

- check equipment for missing parts, frayed cords, damage
- record findings in Instrument notebook and/or checklist;
- take photographs/videotape in the four directions (E, S, W, and N); and
- document site conditions with additional photographs/videotape.

In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- installation of new monitors,
- relocation of existing monitors,
- siting criteria problems and suggested solutions,
- problems with data submittals and data completeness,
- maintenance and replacement of existing monitors and related equipment,
- quality assurance problems,
- air quality studies and special monitoring programs, and
- other issues such as proposed regulations and funding.

The State of Tennessee Air Monitoring Plan will have a 30 day comment period and will be submitted to EPA by July 1 of each year. The State requests local agency submissions in April.

21.8. Standard Operating Procedures

Standard Operating Procedures (SOPs) are required by EPA for the Air Monitoring Department. They provide written instructions in a stepwise manner through sampling, analysis, data handling, and other operations. SOPs provide some standardization between agencies- especially since there can be multiple operators in a designation area and multiple vendors' equipment. EPA allows each agency to personalize their SOPs. SOPs are particularly useful in training new employees, especially when highly specialized employees retire.

When federal and state regulations change or new types of monitors are purchased, then Bureau SOPs have to be updated to reflect the changes. The SOP for a new monitor is to be submitted to EPA within six months of the initiation of operation. The SOPs must be simple enough for a nontechnical person to be able to follow the directions. They must be complete so that no steps are omitted. They must be consistent with sound scientific principles. The SOPs must provide

routine analysis of environmental data and determine if data type, amount, and quantity are acceptable. They must demonstrate the validation of data at each step of recording, calculation, or transcription.

The SOP approval process at EPA is not fast. The SOP is first submitted to the R4 email address at SESD - R4sesdairqa@epa.gov. The email submission should be set up to send back a receipt to document that it was received by EPA. EPA will assign the review to an SESD employee. SESD will send back extensive comments after the review. The Bureau will make the requested changes and send back the document. EPA may choose again to send more comments. Eventually the document will be approved. The Bureau should follow-up on SOPs sent to SESD in the event they are not acknowledged or returned.

Bureau EPA-approved SOPs, including Instrument operations SOPs, are stored on a bookcase in the Air Monitoring laboratory in a notebook labeled SOPs. Electronic versions are on a flash drive also stored on the bookcase. Bureau employees assist in the writing and review of the SOPs.

Once an SOP is officially approved by EPA, employees are required to read and sign the approved version. The signature is to indicate that the employee understands he or she is to follow the SOP. If the signature is on the document, the employee is expected to know the contents.
In November of 2017 EPA announced that SESD will not be approving SOPs in FY 2018. SESD has been directed to focus on approving QAPPs in 2018.

21.9. Assessment Documentation

21.9.1. Number, Frequency, and Types of Assessments

Audits shall be executed at least at the frequency and quantity indicated by *40 CFR.* Audits at the Bureau are conducted more frequently than required. Ozone audits are performed by the State every quarter and by the agency every quarter. Precision checks are performed automatically every 3 days and span checks are performed every 6 days. All precision checks are entered into AQS.

21.9.2. Assessment Personnel

The following sections identify the responsibilities of individuals within the monitoring organization. These individuals are responsible for executing audits, assessing findings, developing and implementing necessary corrective actions, preparing QA reports, evaluating their impact, and implementing follow-up actions.

21.9.3. Air Monitoring Manager, Instrument Technicians

The Air Monitoring Manager is responsible for all QC activities including submissions to AQS. Both Instrument Technicians submit data to AQS with the Air Monitoring Manager pre-proofing the data and the Manager runs AMP reports afterwards to review the data for accuracy and completeness including appropriate Null Value Codes. Instrument Technicians are responsible for implementing day-to-day QA activities for the Ambient Air Quality Monitoring Program, generating electronic control charts, assisting with data quality assessments and other internal

audits, and calculating and/or reviewing precision and bias data generated by the collocated $PM_{2.5}$ monitors.

The Air Monitoring Manager functions as the local laboratory manager and is responsible for identifying problems, overseeing the corrective action, and assuring that the appropriate documentation is generated, distributed and filed. The Air Monitoring Manager is also responsible for reviewing laboratory QC data, assuring that repairs and preventive maintenance are completed and that the maintenance is effective; and assuring that analysts under his/her supervision maintain their documentation files as defined in the relevant SOPs. The Air Monitoring Manager prepares QA reports and summaries.

21.9.4. Reporting and Resolution of Issues

Any participant in the collection, analysis, audit/assessment, and report generating activities affiliated with the Ambient Air Quality Monitoring Network is responsible for identifying the need for corrective actions. This can occur during site visits, audits, data analysis operations, or other monitoring network activities. This shared responsibility, coupled with diligent attention to detail and accuracy, will assure that the Ambient Air Quality Monitoring Network consistently collects quality data, and that this data is reduced, analyzed, and presented in an accurate and representative manner. Any participant that perceives a need for corrective action(s) shall present the situation to their supervisor within 30 days of perceiving the need.

The Air Monitoring Manager will assess the need for a corrective action. If one is deemed necessary, a suitable corrective action will be selected and implemented by the Technicians. The Air Monitoring Manager is responsible for insuring implementation of corrective actions. Corrective actions may be substituting a monitor with a spare until parts arrive. The Bureau now has spare FRM monitors and spare ozone monitors (old 49C series). Because the Bureau has spares there should be no instrument mechanical excuse for losing more than a day's worth of data. A heating or air conditioning issue, however, could cause data loss for more than a day.

Following implementation of a corrective action, the Air Monitoring Manager, at his or her discretion, may require a TSA to verify the efficacy of the corrective action. Both the action of implementing the corrective action and the influence of the corrective action on the operations of the Ambient Air Quality Monitoring Network must be appraised. Any deficiencies in the correction must be noted and the procedure updated to completely correct the discrepancy.

22. REPORTS TO MANAGEMENT

22.1. Frequency, Content, and Distribution of Reports

In a small agency, reports to management may be less formal than in a large organization where there are a stack of managers. At the Bureau, the Air Monitoring Manager reports directly to the Director. The advent of e-mail communication has provided an opportunity for constant internal communication about monitoring. In a small agency, there is a lot of personal interaction so extensive formal daily reports are not necessary.

Daily AQI Report

Each workday morning an Instrument Technician prepares a daily report that is sent to all Bureau employees and two State meteorologists which indicates the State AQI prediction for the current

day for Hamilton County; the AQI, the 24 hour average $PM_{2.5}$ data and the 8-hour maximum ozone data for the previous 24 hour period; and the pollen and mold count for the previous 24 hour period. The Bureau runs a rotorod pollen/mold sampler Sunday through Thursday. The rotorod collects pollen and mold on a retractable rod that has the leading edge greased with silicon grease. When the sampler is spinning, the rod drops out of its protective housing by centrifugal force. It spins for one minute out of every 10 minutes. When it is not spinning, the rod retracts. A Technician collects, stains, and reads the rods under the microscope the next morning between 8:00 and 8:30 AM and reports the pollen and mold spore count on this report.

Figure 8. Daily Air Quality Report

Chattanooga-Hamilton County Air Pollution Control Bureau Daily Air Quality Report

www.apcb.org

Monday, October 23, 2017

- **AIR QUALITY INDEX (AQI) FORECAST FOR TODAY: 38 (Fine Particles)**
  This is in the **Good** range.

- **YESTERDAY'S AQI: 39 (Good) Fine Particles**

  Fine Particles (PM2.5): **9.3** micrograms per cubic meter **(Good)**
  Ozone: **37** parts per billion **(Good)**

- **POLLEN COUNT: 3 (Low)**
  Pollen present: Ragweed

- **MOLD SPORE COUNT: 531 (Low)**
  Mold spores present: Cladosporium, Alternaria, Drechslera, Periconia

Burning will be allowed today between 9:00 am and 4:00 pm with a valid 2017-18 burning permit from the Air Pollution Control Bureau.

AIR QUALITY INDEX
0 – 50 Good
51 – 100 Moderate
101 – 150 Unhealthy for sensitive group
151 – 200 Unhealthy
201 - 300 Very Unhealthy
Over 300 Hazardous

POLLEN – FALL SCALE
0 – 19 Low
20 – 29 Moderate
30 – 50 High
Over 50 Extremely Heavy

MOLD SPORE SCALE
0 – 899 Low
900 – 2,499 Moderate
2,500 – 25,000 High
over 25,000 Very High

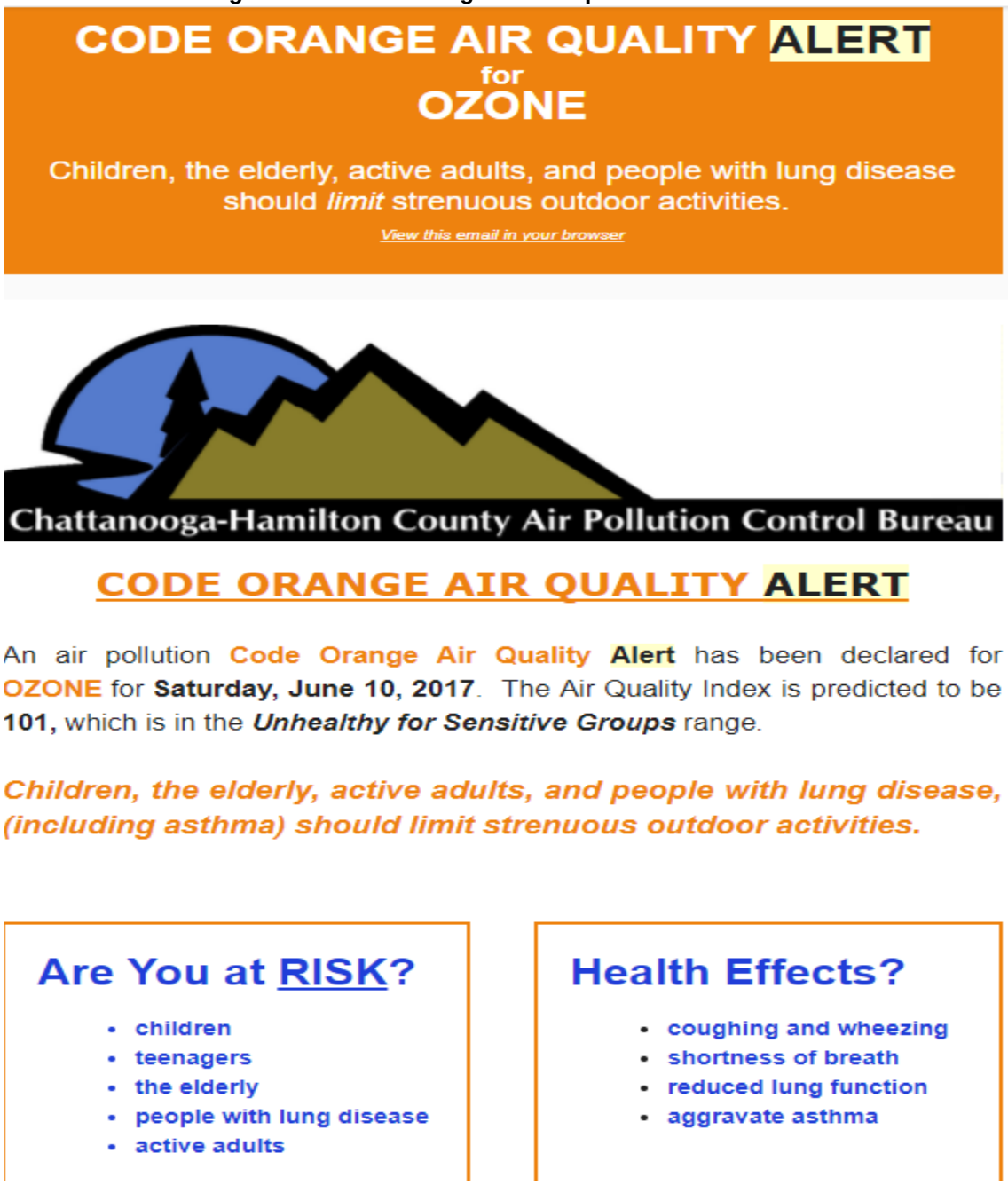
Chattanooga-Hamilton County Air Pollution Control Bureau
6125 Preservation Drive, STE 140
Chattanooga, TN 37416-3740

The Public Relations Coordinator faxes or e-mails the report to the media and interested parties, a total of about 280 combined faxes and e-mails. The Coordinator puts the information on the Bureau webpage, the Bureau's Facebook, and Twitter. The Coordinator makes a daily workday telephone recording that the general public may call to obtain pollution information. On the days when the State predicts high pollution for the next day, the Coordinator sends a Code Orange Alert when she receives the Enviroflash that afternoon and again the next morning on the day of the alert. Figure 9 is how it appears on the webpage at www.apcb.org.

Figure 9. Webpage Daily Air Quality Report

The Public Relations Coordinator publishes an Air Quality Alert when pollution is in an unhealthy range. Figure 10 is a copy of this Alert.

Figure 10. Code Orange Alert Report



CODE ORANGE AIR QUALITY ALERT
for
OZONE

Children, the elderly, active adults, and people with lung disease should *limit* strenuous outdoor activities.

View this email in your browser

Chattanooga-Hamilton County Air Pollution Control Bureau

CODE ORANGE AIR QUALITY ALERT

An air pollution Code Orange Air Quality **Alert** has been declared for OZONE for **Saturday, June 10, 2017**. The Air Quality Index is predicted to be **101**, which is in the ***Unhealthy for Sensitive Groups*** range.

Children, the elderly, active adults, and people with lung disease, (including asthma) should limit strenuous outdoor activities.

Are You at RISK?

- children
- teenagers
- the elderly
- people with lung disease
- active adults

Health Effects?

- coughing and wheezing
- shortness of breath
- reduced lung function
- aggravate asthma

REDUCE EXPOSURE

- **Minimize or reschedule strenuous outdoor activities**
- **Choose less strenuous outdoor activities**
- **Schedule outdoor activities in the morning when ozone levels are lower**
- **Monitor air quality conditions at** apcb.org

What can you do to help?

- **Drive less - combine errands into one trip**
- **Carpool**
- **Refuel after 6 p.m.**
- **Postpone lawn care**
- **Turn the thermostat up 2-4 degrees**

Note: Air quality can change throughout the day. We will notify you if air quality continues to worsen, so you can take action as needed. However, the official AQI for the day will be based on 24 hours of data; so this notification does not mean your area will exceed air quality standards today. Current air quality conditions can be found on Airnow.

Our mailing address is:
Chattanooga-Hamilton County Air Pollution Control Bureau
6125 Preservation Drive, STE 140
Chattanooga, TN 37416-3740

Daily Data Report

Every morning a Daily Data report of the previous day's continuous data is prepared for the Director, the Public Relations Coordinator, the other Instrument Technician, and the Air Monitoring Manager. It is sent to the employees by e-mail. This informs these employees of the comparison of the two ozone sites and the time period of the peak pollution. Figure 11 provides a copy of this report.

Figure 11 Daily Data Report

Daily Data Report

Please note that these are preliminary, non-quality-assured data and are subject to review and revision. All ozone figures are **parts per billion**, particulate figures are **micrograms per cubic meter,** and all times are **Eastern Standard Time**. 8-hour averages are calculated using forward averaging, i.e., the reported hour is the earliest of the eight-hour averaging period.

Mon., 10-23-17

O3 Site	*1Hr. Avg.*	*1Hr. Max Time*	*8Hr. Avg.*	*8Hr. Max Time*
SDHS	42	12 n	34	8 am – 11 am
E. Side	42	11 am, 12 n	36	8 am – 11 am

PM 2.5 Site	*24Hr. Avg. Mid-Mid*
Siskin	2.0

Minute Data Graphs

A minute data daily graph is prepared automatically for particulate and for ozone by programming in Airvision. A Technician sends the graphs each morning to the Air Monitoring Manager. The weekend graphs are sent on Monday. This is to ensure that every continuously monitored minute is viewed by both a Technician and the Manager. Unusual spikes are investigated immediately. Figure 12 is a graph of minute data for particulate PM_{10} and $PM_{2.5}$. Figure 13 is a graph of the minute data from ozone sites.

Figure 12. Continuous Particulate Minute Graph

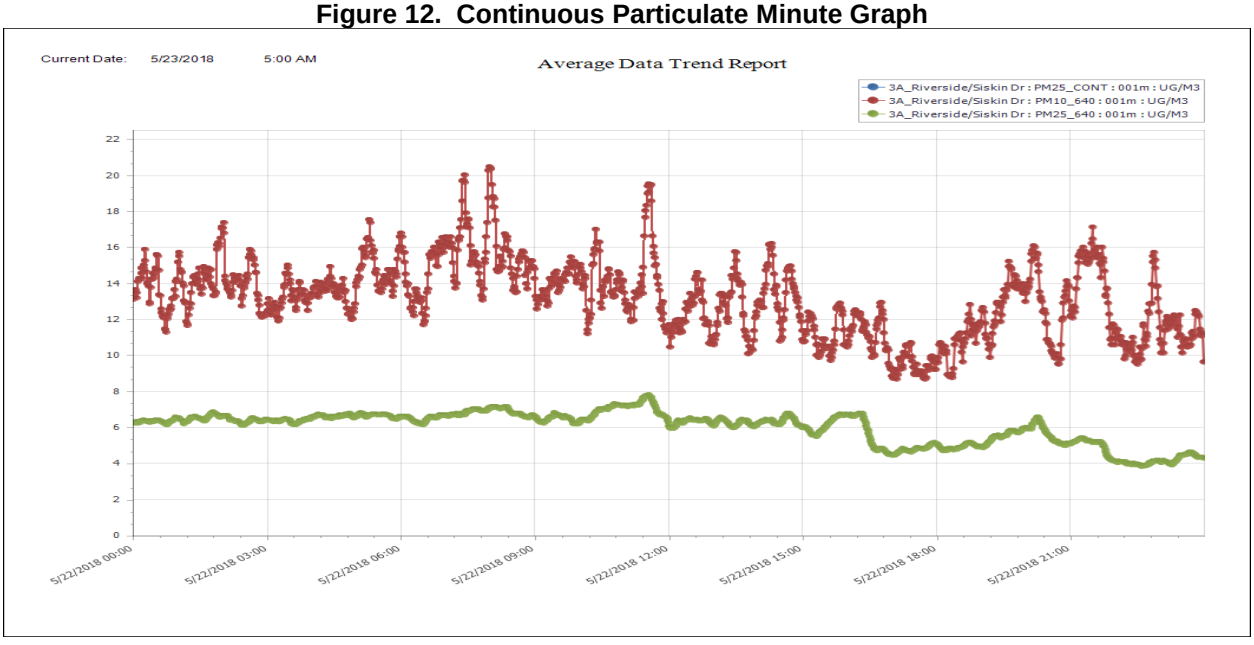
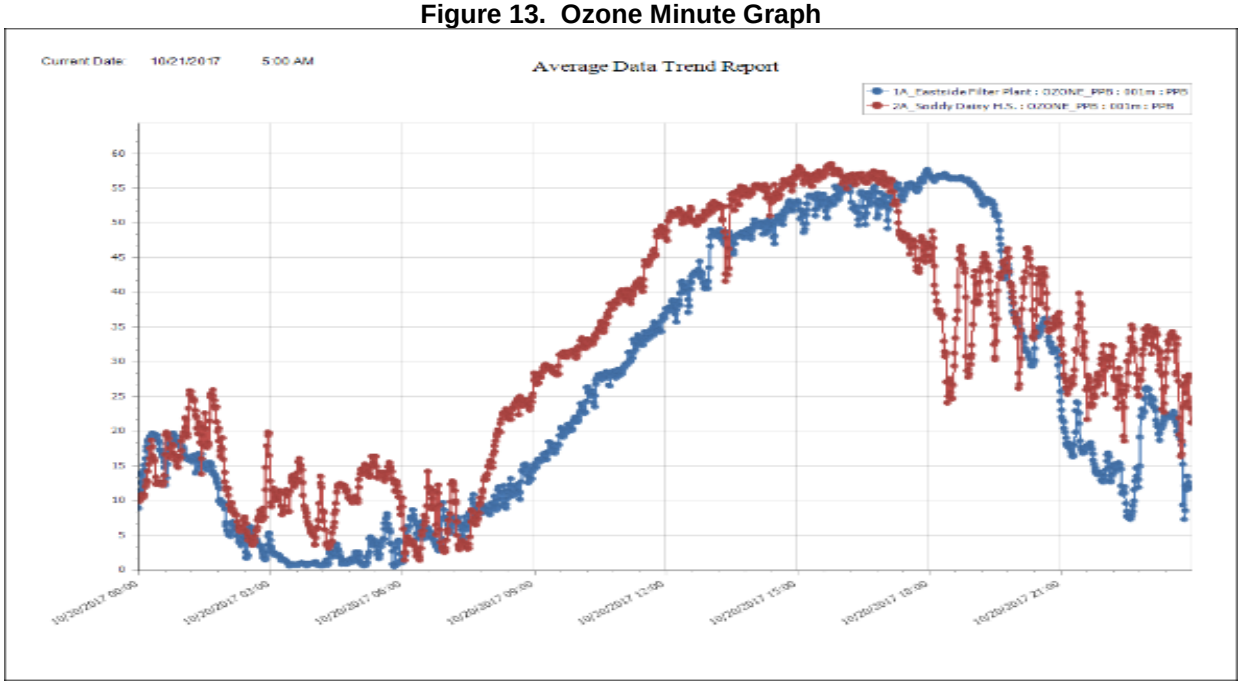


Figure 13. Ozone Minute Graph



Calibration Reports

Every day that a calibration check is run for precision or span or both, a copy is emailed to the Air Monitoring Manager the next morning. Weekend auto checks are e-mailed on Monday. This is to insure that the Manager has seen the report regularly. The Manager may request a verification for confirmation or a recalibration. This reporting is to insure that the auto checks are not allowed to drift without the Manager's knowledge.

Figure 14. Calibration Report

Date Printed: 10/23/2017 06:00

Calibration Report

22-Oct-2017

Site	Parameter	Sequence	Phase	Start Time	End Time	Value		Expected Value	Error	Drift Warning Limit
2A_Soddy Daisy H.S.	02_CALOUT	Z_LOPREC	70_PPB	22-Oct-2017 00:00:10	00:35:10	70		70	.02%	
			CLEAR	22-Oct-2017 00:00:10	00:41:10	0	*	0	.31	
		ZROSPAN	SPAN	22-Oct-2017 03:46:00	04:06:00	180		180	.03%	
			FLUSH	22-Oct-2017 03:46:00	04:12:00	0		0	-.15	
	OZONE_PPB	Z_LOPREC	70_PPB	22-Oct-2017 00:00:10	00:35:10	70		70	.31%	
			CLEAR	22-Oct-2017 00:00:10	00:41:10	0	*	0	-.24	
		ZROSPAN	SPAN	22-Oct-2017 03:46:00	04:06:00	181		180	.71%	
			FLUSH	22-Oct-2017 03:46:00	04:12:00	0		0	0.00%	

* - Drift limit exceeded
** - Out of control limit exceeded

Afternoon Report

During ozone season (March 1-October 31) about 4:20 PM each afternoon an e-mail report is sent to the Director, the Public Relations Coordinator, the Air Monitoring Manager, and the other Instrument Technician that indicates the one hour peak ozone average of the afternoon. Usually the peak has occurred by 4:20. This small report is especially critical during periods of elevated ozone as the Director or the Public Relations Coordinator may receive calls from the media.

Figure 15. Peak Average Report

Afternoon 1 Hour Peak Average

Please note that these are preliminary, non-quality-assured data and are subject to review and revision.

O3 Site	*1Hr. Avg.*	*1Hr. Peak Time EST*
SDHS	42	12 n
E. Side	42	11 am, 12 n

Special Reports

Anytime elevated levels of ozone or particulate matter are detected at a monitoring site, the Director, the Public Relations Coordinator, the Air Monitoring Manager, and the other Instrument Technician are immediately notified. Investigation as to the cause or causes is then launched and steps can be taken to determine what actions, if any, may be necessary.

22.2. Quality Assurance Quarterly Report

Chattanooga-Hamilton County has quarterly audit evaluations of all monitors performed by the State, rather than the one required evaluation per year. The State sends a copy of the quarterly report to the Bureau Director and the Air Monitoring Manager. The State is a third party since the State has no connection to the data. Internal audits are conducted of the ozone monitors quarterly by the Air Monitoring Manager. The internal data are entered into AQS, the bound log, and the logger electronic log but no formal report is made. An AMP 251 report is generated to evaluate the audits. Internal audits are only conducted on $PM_{2.5}$ FRMs and the continuous $PM_{2.5}$ TEOM if the State fails to audit since flow audits are required to be conducted monthly by the operator and are reported to AQS.

22.3. Network Reviews

Chattanooga-Hamilton County prepares a network review yearly in accordance with requirements in *40 CFR 58.10*. The purpose of the network review is to determine if a system meets the monitoring objectives defined in *40 CFR Part 58, Appendix D.* The review identifies needed modifications to the network including termination or relocation of unnecessary stations or establishment of new stations.

22.4. Quarterly Reports

Each quarter, the Air Monitoring Manager will report to AQS the results of all precision and accuracy tests the Bureau and the State have performed during the previous quarter. The quarterly reports will be submitted consistent with the data reporting requirements specified for air quality data as set forth in *40 CFR Part 58*, *Appendix A.* The data reporting requirements of

40 CFR Section 58 apply to those stations designated SLAMS. Required accuracy and precision data are to be reported on the same schedule as quarterly monitoring raw data submittals. In accordance with the Federal Register Notice of July 18, 1997, all QA/QC data collected will be reported and will be flagged appropriately. Air quality data submitted for each reporting period will be edited, validated, and entered into AQS using the procedures described in the *AQS Users Guide, Volume II, Air Quality Data Coding.*

The Air Monitoring Manager will be responsible for notifying the State that the data has been submitted. The Manager runs confirming AMP reports (usually 350, 450, 251, 256, and more) to indicate that the data have been entered. The Manager normally sends AMP350, 450, and 251 to the State each quarter to demonstrate that the data have been entered. The Manager's e-mail to the State will indicate that the raw data and precision and accuracy data are true and accurate to the best of the agency's knowledge taking into consideration the quality assurance findings. Since the Bureau is its own PQAO this e-mail is a courtesy to the State.

The Manager never sends the email to the State until confirming AMP reports are run. AMP reports, therefore, are run quarterly - at least 350, 450, and 251. The reports must prove that raw data and precision and accuracy data have been entered into AQS.

The Air Monitoring Manager runs the design value report several times a year. About once a year the calculations are checked against hand calculations to make sure they are correct. In the past Bureau employees have found errors in this report related to EPA approved exceptional events.

The Air Monitoring Manager flags any data in AQS quarterly that should be flagged due to an exceptional event. EPA has developed two sets of flags: an "I" series flag that is considered informational and indicates the agency does not plan to apply for formal exceptional event status and an "R" series flag that indicates that the agency will formally apply to EPA (??) AQS for exceptional event status for an event. There is a second letter in the flag that specifies the event, such as Canadian Fires. EPA has requested that agencies not use the R flag if they are not going to apply for formal status. AQS has a page of explanation to fill out for an exceptional event which currently does not allow for an explanation of an "I" series flag event. At this writing there are plans to alter AQS so the explanation page can be filled out for an "I" series flag. It is important to be able to fill out that page in AQS since a large recognized event does not always require a submittal if the Bureau does not need to apply to remove that data from consideration against the NAAQS.

EPA will not respond to a request for exceptional event recognition unless a designation status is affected. Therefore, the data is flagged, the report is posted for public comment, the report is submitted to EPA, and that may be all that occurs.

22.5. Response/Corrective Action Reports

The response/corrective action report procedure will be followed whenever a problem is found such as a safety defect, an operational problem, or a failure to comply with procedures established by the local agency or the EPA. A memo to the Director will be prepared by the Air Monitoring Manager so that there is a written record of the corrective action. The response/corrective action report is one of the most important ongoing reports to management because it documents primary QA activities and provides valuable records of QA activities that can be used in preparing other summary reports. Copies of response/corrective action reports

may be distributed twice: first when the problem has been identified and the action has been scheduled (if the action is something that requires time), and second when the correction has been completed. The response/corrective action reports will be generated by the Air Monitoring Manager.

Any large data loss will not only be reported to the Director, but to the State and EPA Region 4. The problem will be defined and a proposal will be made for a correction of the problem. A follow up letter and e-mail will be sent explaining when the issue was remedied and what correction methods were employed. A determination will have to be made if the data loss affected required data completion. A significant data loss can affect attainment status in the three-year designation time period. A loss of attainment status can negatively affect the economic development.

22.6. Control Charts

The Bureau no longer uses paper control charts. They were decommissioned in April, 2017.

23. DATA VALIDATION AND USABILITY

23.1. Sampling Design

Sampling network design and monitoring site selection must comply with:

- *40 CFR Part 58, Appendix A* - Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS)
- *40 CFR Part 58, Appendix D* - Network Design for State and Local Air Monitoring Stations (SLAMS)
- *40 CFR Part 58, Appendix E* - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Additional guidance is provided in *Guidance for Choosing a Sampling Design for Environmental Data Collection,* (EPA QA/G-5S).

Any deviations from the minimum siting criteria (e.g., shelter location, probe placement, and/or monitor sight path requirements) shall be thoroughly documented in the site's documentation. Examples of deviations include, but are not limited to, insufficient distance from roadways (i.e., marginal terrain criteria) and insufficient distance from influencing objects (e.g., dripline of an adjacent tree or a cell phone tower that was installed after the monitoring site was established). The impact of the deviations should be evaluated and appropriate adjustments to the confidence intervals should be determined.

Siting a monitor with deviations from siting criteria requires prior approval from EPA or the data may not be considered valid by EPA. If EPA questions the siting on any monitor and the data validity becomes an issue, there are many types of statistical analyses that can be done to prove there is not an issue with the data. The questionable site can be collocated with a site that meets approval and the data can be compared. Technical papers prepared under these circumstances are a significant investment of time but, if done well, can preserve data. No Bureau air monitoring employee should ever assume that data cannot be salvaged.

Site evaluations are required to be included in the yearly Network Review, part of the State Air Monitoring Plan. The site evaluation is an assurance to EPA that the site is meeting *40 CFR*

siting requirements. A site not meeting *40 CFR* siting requirements is assumed to impact the quality of data collected there. Site maintenance should not be neglected or the site allowed to overgrow.

23.1.1. Sample Collection Procedures

Sample collection procedures are outlined in this QAPP. Potentially unacceptable data points are routinely identified in the database through electronic application of qualifier flags to $PM_{2.5}$ FRM metadata records. Each instrument-specific flag is associated with a unique error. These qualifier flags are routinely reviewed as part of the data validation process. This activity assists in identifying suspect (potentially bad) data points that could invalidate the resulting averaging periods.

If data must be flagged or removed from AQS, the qualifier flags and Null Value Codes that are used by Chattanooga Hamilton County are listed on EPA's website at https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html. EPA requests the codes to be consistently used from quarter to quarter. Agencies tend to have individualized ways of coding, and EPA wants whatever Null Codes are selected to be repeated for the same void reasons each quarter. There should be an effort to maintain the same consistency even when there are personnel changes.

Airvision flags $PM_{2.5}$ data above 50 $\mu g/m^3$ in the daily minute graph. That data is indicated in red rather than blue. Airvision flags hours that are missing data and hours that must be voided because of data loss.

Deviations must be recorded from established sample-handling protocols for each filter physically retrieved from monitoring sites. Deviations shall be recorded on the instrument data sheet for that filter, the logbook in the lab for identifying $PM_{2.5}$ filters, logbook in the monitor, the sample custody sheet assigned the filter shipment for particulate matter, on the filter list sent with the shipment, and recorded on a typed note in the applicable electronic text file.

Accurate and complete documentation of any sample collection deviations will assist in any subsequent investigations. Investigations may be necessary to determine whether the data obtained from a particular site may qualify as a baseline or indicator for other sites.

Sample collection documentation is essential in the event of any legal matter pertaining to data. Every procedure must be documented and defensible. Documentation will be under scrutiny during the TSA.

23.1.3. Analytical Procedures

Data obtained shall be validated utilizing both manual and electronic methods. Specific criteria are employed that identify the range of acceptable data, the minimum and maximum acceptable values, the rate of change of specific values, and other criteria that are indicative of valid qualifying data. Suspect data are flagged utilizing the codes provided by EPA.

23.1.4. Quality Control

Specified QC checks are to be performed during sample collection, handling, and analysis. These include analyses of check standards, blanks, and replicates which provide indications of

the quality of data being produced by specified components of the measurement process. For each specified QC check, the procedure, acceptance criteria, and corrective action (and changes) should be specified. Data validation should document the corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data.

23.1.5. Calibration

Calibration of instruments and equipment is addressed in earlier sections of this document. Calibration results that are acceptable are detailed. When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration should be flagged to alert data users.

23.1.6. Data Reduction and Processing

Both internal and external technical systems audits will be performed to ensure the data reduction and processing activities mentioned in the QAPP are being followed. Periodically, raw data will be reviewed and final concentrations will be calculated by hand. The final values submitted to AQS should match the hand calculations. The data will also be reviewed to ensure that associated flags or any other data qualifiers have been appropriately associated with the data and that appropriate corrective actions were taken.

23. VALIDATION AND VERIFICATION METHODS

Data verification, according to EPA, is the process of evaluating the completeness, correctness, and conformance or compliance of a specific data set against the method, procedural, or contractual requirements. Data validation, according to EPA, is a pollutant and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e. data verification) to determine the analytical quality of a specific data set. These terms are defined in the *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G-8, November 2002. The document states that the two processes are parallel but separate with separate functions.

The Guidance states that validation is an evaluation of performance against a predetermined set of requirements in a document whereas verification is evaluation of specific data for a specific project, such as evaluating data for comparison against the NAAQS. Both validation and verification are performed by sequential steps by different parties. The Guidance states that validation is often by a “third party” evaluator that is neither the collector nor the user. The Bureau, however, has too few employees to have a specific Quality Assurance department; therefore, the final evaluator for verification is the Air Monitoring Manager.

24.1. Validating and Verifying Data

The validation and verification procedures shall conform to the Bureau’s EPA-approved *Data Handling SOP.* Verification and validation issues are also discussed at length in *Guidance on Environmental Verification and Validation,* (EPA QA/G-8). All validation and verification activities shall be performed by the Air Monitoring Department. Each Technician verifies and validates his own data, then verification and validation activities are performed by the Air Monitoring Manager. Thus, two different employees in Air Monitoring review data. Particulate data is reviewed a third time by the Air Monitoring Manager when the data is returned from the lab and a fourth time by

the Air Monitoring Manager after AMP reports are run. Ozone data is reviewed a third time by the Air Monitoring Manager after the data is loaded into AQS and a fourth time after AMP reports are run.

The data under evaluation should be compared to actual events as specified in *Data Handling SOP.* However, exceptional pollution events may occur, and field and laboratory activities may negatively affect the integrity of samples. In addition, it is expected that some of the QC checks will indicate that the data fail to meet the acceptance criteria. Data identified as suspect, or that does not meet the acceptance criteria, may be voided or, if appropriate, flagged and retained.

The review of the routine data and the associated precision and accuracy data will be verified and validated by the monitoring quarter. EPA states that quarterly is the most efficient timetable for verification/validation activities since data is available to the public upon entry into AQS even though it may not be certified until May 1 of the following year. EPA expects that data entered into AQS is reliable. Data, however, that is entered into AQS at the end of a quarter may be removed if deemed questionable. Measurement uncertainty can be controlled in smaller sections of data, then the overall measurement uncertainty will be better. Also, if data is verified and validated by the quarter, then minimal evaluation must be done at the end of the year for data certification. EPA does not want all the validation to be done after the end of the monitoring year.

24.2. Verification

The Guidance states that there are two types of verification: the real-time verification in the field or laboratory that is ongoing, and verification when all the records are collected and reviewed. All activities will have either paper records, electronic records, or both. Records are reviewed for completeness, factual content, and for project specifications.

First, the record requirements must be determined for the project. In this case, the project is to produce data to compare against the NAAQS. Secondly, a standardization of the records must occur. Then, the records must be stored with some organization to be easily accessible. The Air Monitoring Manager determines what records must be verified. All or duplicate records may not require verification.

The $PM_{2.5}$ FRM monitors perform their own verification through the use of instrument-applied flags on the metadata that are downloaded and reviewed. The data loggers flag data for specific reasons, and the flag codes are in the operation manual. Loggers can be programmed to produce specific flags. The continuous instruments also have alarms and warnings for which the instrument can be programmed. Airvision, the Bureau's data acquisition software by Agilaire, has flags and warnings built into the software. For example, the green bar turns to red if a poll fails to complete on the status page. With one glance an employee can instantly determine that the logger failed to poll a specific site. If the poll does not complete on the next hour, corrective action may be required. There is, therefore, automatic verification of sorts by the instruments and loggers, but those verifications require further scrutiny. All of the verification needs will, most likely, not be met by instrument automation or data acquisition software.

The Guidance states that there are two data outputs that must be verified. The actual data must be verified, and records of data acquisition must be verified. Verifying data includes verifying laboratory data from the contract laboratory, IML. Continuous data must be verified even though it is more easily acquired than data that must be calculated from laboratory results. The verification of records culminates in the yearly data certification whereby the Director signs a statement that the data is true and accurate.

After a quarter's data is compiled, a thorough review of the data will be conducted for completeness and accuracy. All raw data lines will be inspected by the Technician and the Air Monitoring Manager prior to entry in AQS. Once the data are entered into AQS, AMP reports will be run to review data for routine data outliers and conformance to acceptance criteria. Unacceptable or questionable data will be removed or flagged - whichever is appropriate. Removed data will be replaced with AQS void lines with the appropriate Null Value Code. All flagged data will be reverified to ensure that the values were entered correctly. AMP reports will be inspected to make sure all Null Value Codes are entered for the quarter as no required data location is to be left blank.

Any data that is questionable will be compared against the critical criteria template for that pollutant. Data exceeding any parameter in the pink section of the criteria tables must be seriously considered for Void status. If the Bureau determines that data exceeding a parameter in the pink section of the critical criteria tables should be retained, then the data must be technically defensible to EPA if questioned in the TSA.

EPA will not be contacted for approval for every small issue. Certainly there are decisions that are made at the local agency level about small amounts of data, providing the decisions are technically defensible.

EPA, however, must be contacted and discussions begun if large blocks of data are affected by some issue. This is especially important if the issue appears to negatively affect a design value for comparison against a standard. If data can be determined to be of retention quality, a technical paper may be required to be submitted to EPA to obtain EPA's approval to use the data. Sometimes additional monitoring may be required if the siting of a monitor is in question. In the event of what might appear to be a major data issue, beginning discussions with EPA early in the process is preferred by EPA.

There are times when operational and or systemic situations can mandate that data is voided. An experienced person reviewing the data can see that the magnitude of the data is not logical compared with other nearby sites or the operational metadata of the monitor appears to indicate the monitoring data is in error.

What appears to be normal data can be deceiving if the operational data is off-kilter. It is important that issues are not perpetuated or multiplied because some operational or systemic problem was not identified early. Precision and span check scrutiny can assist in identifying those kinds of issues with gas monitors. Gas minute data graphs indicate issues that are not apparent in hourly graphs. Graphic comparisons with nearby monitors are useful. EPA has provided graphing tools on AirNow Tech to compare data from AirNow with other agencies' sites. Data comparison from AQS is not real-time enough to identify a problem early enough to be helpful. Regional sites' monitoring with ozone and particulate usually match reasonably well.

Failure to identify an operational or systemic problem may result in significant data loss. If an agency believes their gas data is accurate but it is not, then the instrument will fail an audit (either third party or by the QA department)- usually a surprise failure. The problem, then, becomes major because the determination must be made as to when the system developed an issue, why the issue was not identified, and how much data is in question. This is particularly problematic when the monitor is continuous, and there are a lot of data to scrutinize.

24.3. Validation

Validation is to determine the specific quality of the data. Before the data is acquired, EPA has set specific goals for the quality of the data. Data validation is to determine the reasons for failure to complete the data set, failure to comply with quality assurance critical criteria, and failure to meet method or procedural requirements. Then those failures must be evaluated with respect to their effects on the overall quality of the data. Validation also applies to any contract work done for producing data, such as the laboratory contract. No data provided by an outside entity for use by Air Pollution Control should be used without validation.

The employee validator must be familiar with the critical criteria and with applicable provisions of *40 CFR*, or the validator may not find issues that exist with the data. This task should not be assigned to an inexperienced employee without direction. The validator must be able to document the data decisions that are made - why data is kept or why it is discarded. In a matter involving potential litigation, all documents may become evidentiary. Thus, the requirements of the project should be considered when the records are being validated. The validator focuses on errors, omissions, and anomalies when reviewing the data.

The validator is the final authority on the data qualifier to be used. At the Bureau, the qualifiers are applied by the Technician, and they are reviewed by the Air Monitoring Manager. EPA required qualifiers are to be applied with consistency throughout the data, and EPA requires the correct qualifiers to be applied.

Records of all invalid samples shall be retained. Information shall include a brief summary of why the sample was invalidated. Logbook notes at the site, Instrument data sheets, and the log in the Bureau lab should have more detailed information regarding the reason a sample was flagged.

Certain critical criteria based upon federal requirements and personnel judgment have been developed that will be used to invalidate a sample or measurement. Filters that have flags related to contamination, damage, or Instrument complications shall be examined. The metadata download from the FRM $PM_{2.5}$ monitors may indicate a previously undetected problem and the sample can be flagged or voided according to the seriousness of the issue. Filters that have flags related to contamination, damage, or Instrument complications shall be examined before the filters are mailed back to IML. The Bureau can request that a filter be pulled at IML and inspected visually (electronic photographs have been sent by e-mail). Voids are usually made before the exposed filters are shipped to the lab, the filter is marked “Void” in the shipment, and the post weight is not performed. If a filter is deemed questionable after examination at the lab, these data shall be invalidated with concurrence of the IML Laboratory Manager and the Air Monitoring Manager. The data line is removed from the IML-prepared AQS text files for AQS uploads and replaced with an appropriate Null Value Code data line.

Once the data reports are received from IML as a formal report with an Excel™ spreadsheet and the AQS loadable file, the reports are reviewed by the Air Monitoring Manager. These reports are not considered final data reports as another review by the Air Monitoring Manager can still find data that should be removed from the AQS data set or needs further validation. If data must be removed from the dataset, reasons should be noted in the local lab log and the data is removed from the AQS files by deleting the correct files. The original file from IML should be saved. Appropriate Null Data Codes will be entered in place of the removed file. AMP reports will be run and the report checked to make sure all the Null Codes are properly in place.

Validation is only partially complete when the data is entered into AQS. It immediately becomes available for use by scientists or other users, but is not considered totally validated until the data is certified.

EPA's Guidance says that integrity can be an issue with data production, validation, and verification. The validator is at a disadvantage because the raw data, precision and accuracy data, and laboratory data can be disguised to appear normal. EPA suggests inspecting laboratory data carefully for "manufactured" data or anomalies that indicate something amiss. For a weigh lab there are less problems with integrity than for a wet chemical lab where standards and instruments can be manipulated by employees. The Manager must keep abreast of how data acquisition functions are being handled so that deviations from established practices or unethical behavior can be detected.

EPA recommends developing and promoting a culture of ethical behavior in the agency throughout the data acquisition process. If such a culture is developed, then employees may report unusual occurrences or suspicious activities to management. Ethical behavior is absolutely necessary to producing sound, reliable data**.**

25. RECONCILIATION WITH DATA QUALITY OBJECTIVES

This section of the QAPP will outline the procedures to determine whether the monitors and laboratory analyses are producing data that comply with the DQOs, and what actions will be taken as a result of the assessment process. It will outline who will perform, review, and approve this assessment, and who will generate the report that documents the findings.

25.1. Reconciling Results with Data Quality Objectives (DQOs)

This element includes scientific and statistical evaluations of data to determine if the data are of the right type, quantity, and quality to support their intended use. The EPA document *Guidance for Data Quality Assessment* (EPA QA/G-9) focuses on evaluating data for fitness in decision-making and also provides many graphical and statistical tools.

25.1.1. Five Steps of the Data Quality Assessment Process

As described in *Guidance for Data Quality Assessment* (EPA QA/G-9), the DQA process is comprised of five steps. The steps are outlined below. Refer to *Guidance for Data Quality Assessment* for a detailed description of each step.

Step 1. Review Data Quality Objectives and Sampling Design. The Air Monitoring Manager shall review the sampling design, Data Quality Indicators (precision, bias, comparability, representativeness, and completeness), and DQOs to verify that they are still applicable. This review involves:

- Defining the primary objectives of the Ambient Air Quality Monitoring Network (e.g., NAAQS comparison).
- Translating the objectives into a statistical hypothesis (e.g., the three-year average of annual mean $PM_{2.5}$ concentrations is less than or equal to 12 $\mu g/m^3$).

- Developing limits on decision errors (e.g., incorrectly conclude an area is non-attainment when it truly is attainment no more than 5% of the time, and incorrectly conclude an area is attainment when it truly is in non-attainment no more than 5% of the time).
- If any deviations from the sampling design have occurred, these shall be documented for the DQA, and their potential effect carefully considered throughout the entire DQA.

Step 2. Conduct Preliminary Data Review. The Air Monitoring Manager shall perform a preliminary data review to determine if data is entered into AQS, to determine potential limits on using the data, and evaluate the various AQS reports to attempt to identify any anomalous conditions. The first phase of the preliminary data review is to review the AMP reports to make sure data entry is complete and that Null Value Codes and flags are entered. The second phase of the preliminary data review is to calculate basic summary statistics, generate graphical representations of the data, and review these summary statistics and graphs. EPA has provided some graphical functions on AirData at http://www3.epa.gov/airquality/airdata/.

Review Quality Assurance Reports- The Air Monitoring Manager will review all QA reports that describe the data collection and reporting process. Particular attention will be directed to looking for anomalies in recorded data, missing values, and any deviations from SOPs. This is a quality review.

Calculate Summary Statistics- The Air Monitoring Manager will generate AMP reports from AQS that provide summary statistics for each of its primary monitors and for precision and accuracy data. The summary statistics to be addressed in the appropriate reports are:

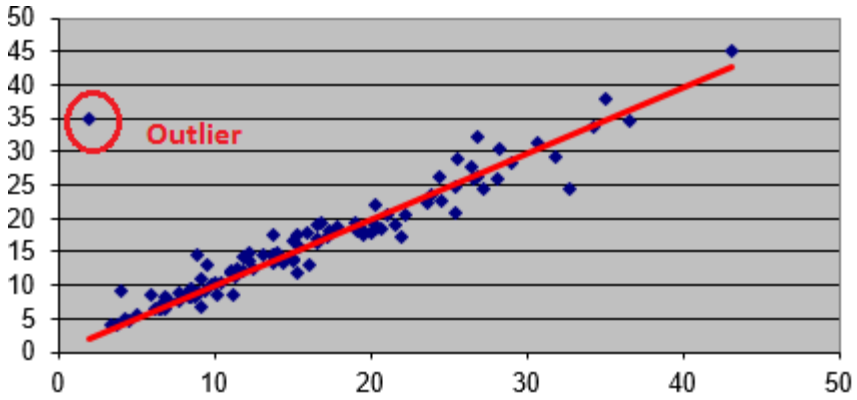
- Sample quantity
- Mean concentrations
- Median concentrations
- Standard deviations
- Coefficient of variation
- Maximum concentrations
- Minimum concentrations

These statistics will also be calculated for percent differences at collocated sites. Particular attention will be given to the impact on the statistics caused by abnormalities noted in the QA review.

Generate Graphical Presentations- Chattanooga-Hamilton County may graph or compare $PM_{2.5}$ data from two local FRMs in a linear regression analysis to identify outliers. Or, data can be represented in a graph against other area data of the same kind to determine if there are outliers or unusual data. The outlier or unusual data can be studied to determine if the data should be voided or retained. The outlier may be a result of some exceptional event, such as a fire near a site, that must be investigated.

An example of a graph that identifies an outlier is provided in Figure 16. The outlier was added to an existing liner regression graph for demonstration purposes.

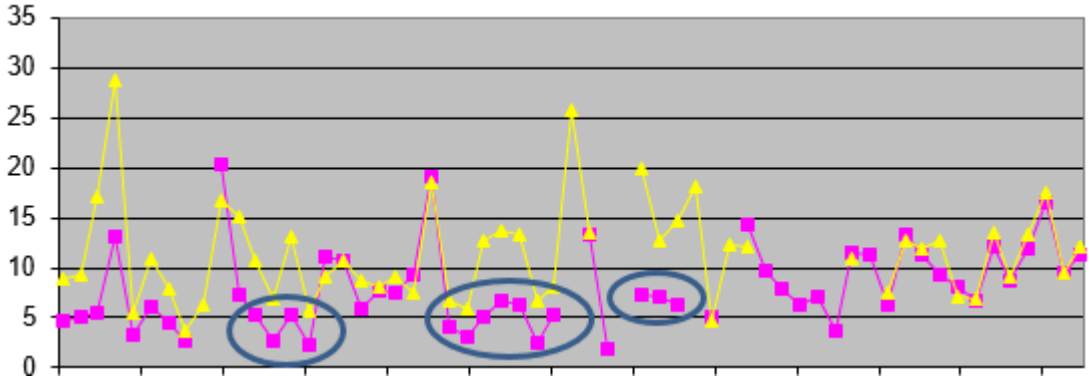
Figure 16. Outlier Particulate Graph



Data from regional sites can be line-graphed for data studies. Sometimes graphing multiple sites will indicate data issues. For example, until recently the Bureau had two (2) PM_{10} monitors and four (4) $PM_{2.5}$ monitors at four sites. The $PM_{2.5}$ data was usually very similar site to site. When all were graphed on the same line graph, anomalies at one site were readily apparent.

A second example of how graphs can be used to validate data is a year graph of two different sites in the same vicinity whose data historically is similar. This graph is from many years ago. After this graph was produced, more monitors were graphed regionally to attempt to confirm if the circled data was valid. The Bureau evaluator assumed the data lower in magnitude to be worthy of investigation. If the lower magnitude data, upon investigation, appeared to be correct, then the higher magnitude data was probably incorrect. The evaluator concluded, after graphing more sites in the vicinity, that there appeared to be some issues with the pink-indicated site data during the circled time periods. In the first two circles from the left the data seems to follow the same trend as the other site, but is lower in magnitude. By the third circle from the left, the data appears to be incorrect entirely. By the last two months of the year the data, once again, is very similar. From looking at the graph of the data it would appear there had been some monitoring or lab issue that was corrected. Thus, graphing data against other sites can reveal issues that may not be readily apparent when reviewing data alone.

Figure 17. Line Particulate Graph for Data Study



Step 3. Select the Statistical Test. The data analyst will determine whether the primary objective of Chattanooga-Hamilton County's Ambient Air Quality Monitoring Network, compliance with NAAQS criteria pollutant concentrations, has been attained for the prior

monitoring period. This will be accomplished by calculation of the design value and employing graphical representation or statistical analysis to evaluate the reasonability of the data.

Step 4. Verify the Assumptions of the Statistical Test. The Air Monitoring Manager and/or and Technician shall evaluate the assumptions upon which the DQOs, and the bias and precision (measurement error) assumptions are based.

Data Quality Objective Assumptions. The DQOs are based on the annual arithmetic mean NAAQS. In the DQO development, it is assumed that the annual standards are more restrictive than the 24-hour, 8-hour, 3-hour, and 1-hour standards. Data quality objectives can be developed for shorter averaging periods and more restrictive bias and precision limits selected.

Measurement Error Assumptions. It is commonly assumed that measurement errors are distributed normally in environmental monitoring. *EPA QA/G-9: Data Quality Evaluation Statistical Tools (DataQUEST)* provides statistical tools for creating normal probability plots. If a plot indicates possible violations of normality, the Bureau may need to determine the sensitivity of the DQOs to departures in normality.

The limits on precision and bias are based on the smallest number of required sample values in a one- or three-year period. In developing DQOs, the smallest number of required samples is used. This is to ensure that the confidence is sufficient in the minimal case. If more samples are collected, then the confidence in the resulting decision will be even higher. Data completeness evaluations will be performed each quarter to ensure that this DQO requirement is upheld.

Measurement imprecision is established at 10% coefficient of variation. For each monitor, the Air Monitoring Manager will review the coefficients of variation. If any exceed 10%, the Air Monitoring Manager may need to determine the sensitivity of the DQOs to larger levels of imprecision. Before determining whether the monitored data indicate compliance with a NAAQS, it must first be determined if any of the assumptions upon which the statistical test is based are violated. If any of the assumptions have been violated, then the level of confidence associated with the test is suspect and must be investigated further.

Step 5. Draw Conclusions from the Data. After preparing graphical representations and statistical analyses, the data should be concluded to be acceptable for comparison to the NAAQS.

25.2. Data Quality Assessment Reports

AMP summary reports (Raw Data, Quicklook, Precision and Accuracy, Design Value, and more) from AQS will serve as data quality assessment reports. These reports document any deviations experienced from the monitoring requirements for each criteria pollutant, on a site by site basis. The basic summary statistics for calculating the NAAQS shall be calculated and compared against the Design Value Report in AQS at least yearly- especially if Exceptional Events (EE) have been concurred by EPA. There have been issues with the accuracy of the summaries on that report when EE have been concurred.

Because the three Bureau FRM monitors have data that closely correlate, outliers can immediately be identified in a graphic representation. If the collocated FRM data are dramatically different (for example: one is indicating 25 µg/$m^3$and the other 5 µg/m^3), the incorrect data of the pair can be determined by graphing FRM data from other nearby sites. Usually, one of the two

FRMs' data will be very similar to the other sites. The other will be considered incorrect unless there is a documented reason for an extreme difference in magnitude.

Data patterns, structures, and relationships can be determined from reviewing the graphs and AMP reports. Careful attention must be provided to identify and document potential anomalous data. Preferred statistical analyses involve using linear regression analyses for correlations between sites and scatter plots for finding anomalous data.

25.3. Action Plan Based on Conclusions from Data Quality Assessments

Each quarter the data is thoroughly assessed before and after it is entered into AQS.
Each year during the certification process, a thorough DQA process will be conducted. Chattanooga-Hamilton County presumes that the assumptions for developing the DQOs have been met. If not, the Bureau must first revisit the impact of the violation on the bias and precision limits determined by the DQO process.

If the conclusion from the DQA process is that each of the ambient air monitors is operating with less than 10% bias and precision, then Chattanooga-Hamilton County may pursue action to reduce the QA/QC burden associated with the monitor. Possible courses of action may include the following:

- **Modifying the QA Monitoring Network -** *40 CFR Part 58* requires that each QA monitor be the same designation as the primary monitor. Once it is demonstrated that the data collected from the network are within tolerable levels of errors, Chattanooga-Hamilton County may request that it be allowed to modify these requirements.
- **Reducing QC Requirements -** Quality Control is integral to any ambient air monitoring network and is particularly important to new networks. However, once it is demonstrated that the data collected from the network are within tolerable levels of error, Chattanooga-Hamilton County may request a reduction in the specified number of QC checks. However, if during any of the annual DQA processes it is determined that data errors approach or exceed either the bias limits or the precision limits, then Hamilton County will return to the originally prescribed levels of QC checks.
- **Violating DQI bias**- If and when the data from at least one of the monitors or sites violates the DQI bias and/or precision limits, then the Air Monitoring Manager will conduct an investigation to uncover the cause of the violation. If all of the monitors/samplers in the network of a similar type or pollutant violate the DQI, the cause may be at the agency level (operator training) or higher (laboratory QC, problems with method designation). If only one monitor/sampler or site violates the DQI, the cause is more likely specific to the site (particular operator, problem with the site). Tools for determining the cause include reviewing:
    - data from a collocated network (local data, nearby reporting
    - organizations, national data),
    - data from performance audits (contracted or NPAP), and QC trails.

Some particular courses of action include:

- **Determining the level of aggregation at which DQOs are violated -** The DQA process tells which monitors are having problems, since the DQOs were developed at the monitor level. To determine the level at which corrective action is to be taken, it must be determined whether the violations of the DQOs are unique to one site, multiple sites, or a network of similar monitors, or are caused by a broader problem. An example of a broader problem may be a particular sampler demonstrating poor quality assurance on a national level. The AQS

generates QA reports summarizing bias and precision statistics at the national and reporting organization levels by method designation. Examination of these reports may assist in determining the level at which the DQO is being violated.

- **Communicating with EPA Region 4 -** If a violation of the bias and precision DQIs are found, the Air Monitoring Manager will remain in close contact with EPA for both assistance and for communication.
- **Extensively reviewing quarterly data until DQOs are achieved –** the Air Monitoring Manager will continue to extensively review the quarterly QA reports and the QC summaries until the bias and precision limits are attained.
- **Reducing Monitoring Requirements**- The Bureau has recently deleted the PM_{10} site and a $PM_{2.5}$ monitoring site. $PM_{2.5}$ speciation (Met One and URG Carbon monitor) were defunded. EPA requested in 2015 that a monitoring change or site change be requested in the State of Tennessee Air Monitoring Plan or the request must go out for public comment. The yearly version of the Air Monitoring Plan is put out for public comment by the State. Including the site change in the plan satisfies the public comment requirement.

26. REFERENCES

Forsyth County (NC) Criteria Air Pollutants QAPP (example provided by EPA SESD)

Guidance on Environmental Data Verification and Data Validation, EPA QA/G-8, November 2002

IML Quality Assurance Project Plan for Laboratory and Data Management Support of the Determination of fine Particulate Matter as PM2.5 and Coarse Particulate Matter as PM10-2.5 in the Atmosphere (Current version: March, 2017, Revision 14)

Memo: November 10, 2010- Lewis Weinstock, "*Use of Expanded List of Audit Levels for Annual Performance Evaluations for So2, No2, for O3, and CO as Described in 40 CFR Part 58 Appendix A Section 3.2.2"*

Memo: July 11, 2017- Lewis Weinstock "*EPA Review of Monitoring Organization QAPP's for critical criteria conformance*"

Notice: Clarification on Use of Automatic Zero Adjustments, 5/26/17

Notice: Guidance on Identifying Annual PE Audit Levels Using Method Detection Limits and the 99th Percentile 05/03/2016

Notice: Guidance on statistics for Use of 1-Point QC Checks at Lower Concentrations as described in 40 CFR Part 58 Appendix A Section 3.1.1.,5/5/16

Notice: Managing Ozone Quality Assurance and Maintenance Activities while maintaining a complete day.

Notice: Steps to Qualify or Validate Data after a Failed Critical Criteria Checks, 8/30/17

QA Handbook for Air Pollution Measurement Systems: "Volume II: Ambient Air Quality Monitoring Program" EPA-454-B-17-001, January 2017-Full document (PDF)

QA Handbook Appendix D Validation Templates: March 2017 (PDF)

QAPP Guidance, September 2017, SESD, Stephanie McCarthy

Tennessee Department of Environment & Conservation Quality Management Plan, August 31, 2016

APPENDIX A

Chattanooga-Hamilton County's Letter Requesting to Delete the PM_{10} site.

EPA's Agreement in the Reply to the State of Tennessee 2014 Air Monitoring Plan.

Chattanooga-Hamilton County Air Pollution Control Bureau

August 28, 2014

Ms. Heather McTeer Toney
Regional Administrator
USEPA Region IV
81 Forsyth Street
Atlanta, GA 30303-8960

Dear Ms. Toney:

The Chattanooga-Hamilton County Air Pollution Control Bureau (the Bureau) is requesting permission from EPA to delete the Bureau's PM_{10} collocated site at 3300 Broad Street, Chattanooga, Tennessee (AQS 470650006).

The Bureau has four $PM_{2.5}$ monitors at three $PM_{2.5}$ sites. The $PM_{2.5}$ data is meeting the 12 $\mu g/m^3$ standard at all sites for 2011-2013. The Broad Street monitoring site was established as a TSP site in 1965 and in 1966, 1968, and 1969 the particulate data averaged over 300 $\mu g/m^3$ per year for TSP due to nearby iron foundries, a tannery, rail yards and lines, coal-burning furnaces for space heat in nearly all buildings, a foundry coke production facility, and coal-fired industrial boilers. According to Bureau records, by the early 1970s there were 27 TSP particulate sites in Hamilton County, 11 of which were operated by Air Pollution Control. Several Bureau sites were converted in the 1980s to PM_{10} or PM_{10} was added to some sites. Except for the Broad Street PM_{10} site, all of the original TSP and PM_{10} sites have been deleted as industries closed and the monitored values continued to be lower and lower.

Wheland Foundry, the largest local iron foundry, and U.S. Pipe & Foundry were adjacent to each other less than one-half mile north of the monitoring site. Both facilities shut down in the early 2000s and the plants have been dismantled. Most other industries have been shut down in that area of Chattanooga and residential and mixed-used development is occurring and planned in those areas once occupied by grossly polluting sources.

Modifications to air monitoring networks must be approved by the Regional Administrator. Table D-4 of Appendix D to *40 CFR* Part 58 indicates that, with our

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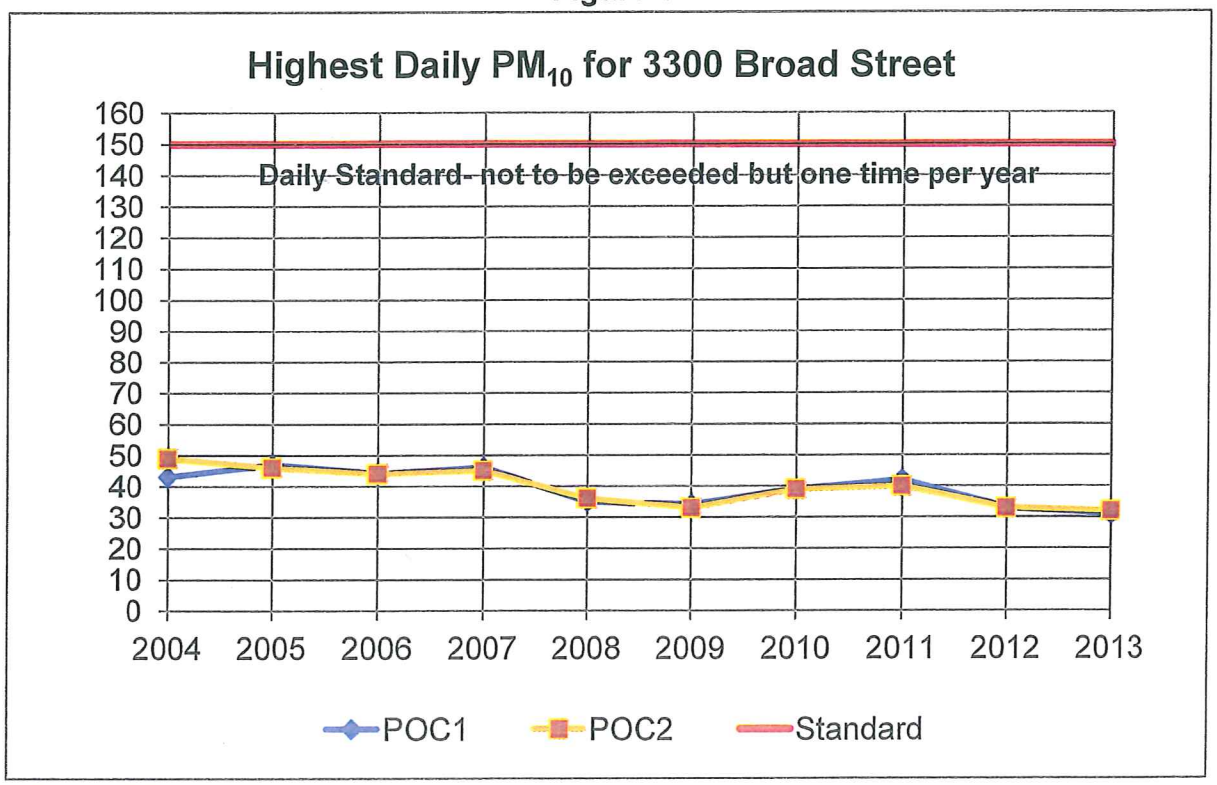
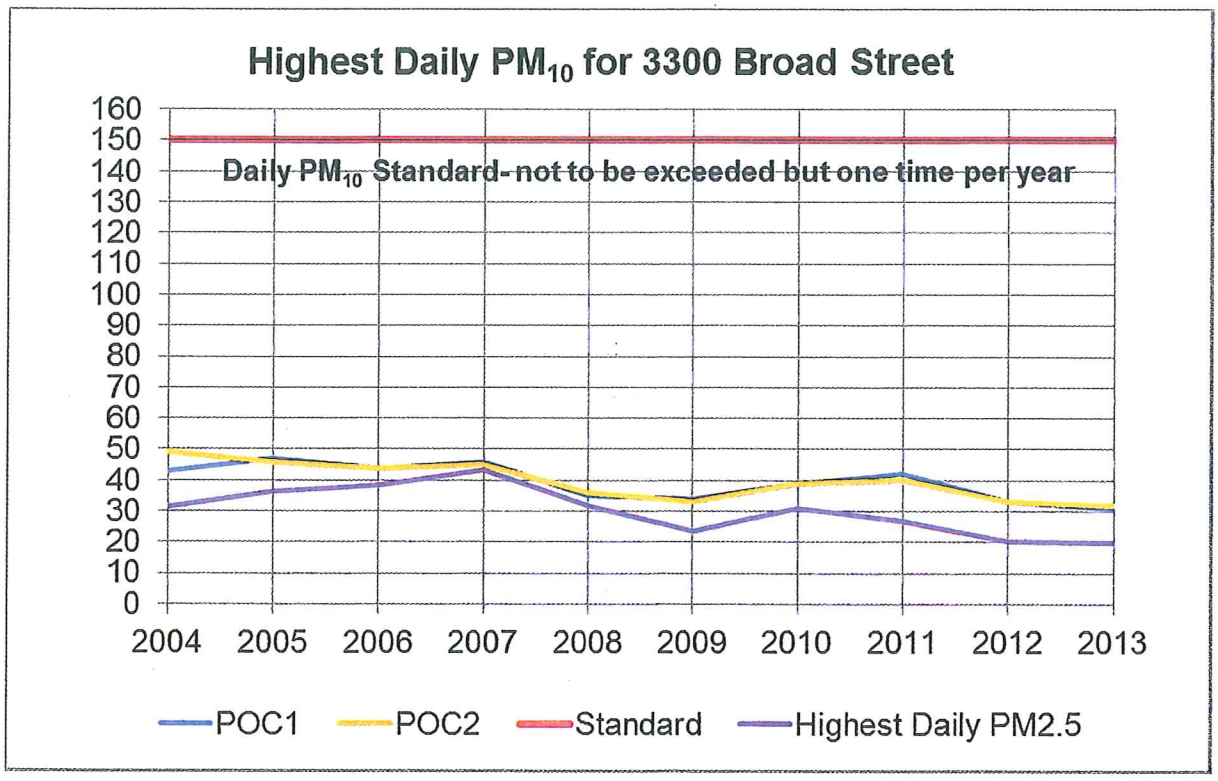
www.apcb.org

CMSA population of 528,143, low concentration areas are required to have 1 to 2 monitors. Low concentration areas are defined in footnote 4 as those for which ambient PM_{10} data show ambient concentrations less than 80 percent of the PM_{10} NAAQS. The footnote 5 under Table D-4 states that the minimum monitoring requirements apply in the absence of a design value. Since Chattanooga Hamilton County has design values for the former yearly and daily PM_{10} standards, it appears that the minimum monitoring requirements do not apply. The Bureau's PM_{10} daily highest data are currently roughly a third of the daily standard of 150. Since 2004 our highest two days of data per year have been 47 and 45 $\mu g/m^3$. The highest year of the last 10 years (2005) the PM_{10} data was at 31% of the standard. Our PM_{10} has continually decreased and there is every indication that it will continue to decrease as $PM_{2.5}$ decreases.

EPA is encouraging agencies to reduce unnecessary monitoring so that personnel resources and funds can be better utilized. The ten-year history of concentrations in Hamilton County, as shown in Figures 1 and 2, justified eliminating PM_{10} monitors. Figure 2 also shows $PM_{2.5}$ monitored values at the closest $PM_{2.5}$ monitoring site which demonstrates that most of the particles being measured at the PM_{10} site are actually fine particles. We believe we can better utilize the resources currently being expended on PM_{10} monitoring since that monitoring effort is capturing between 5 to 8 micrograms of particles not being measured by our $PM_{2.5}$ monitors.

Figure 1





Based upon the foregoing, we are requesting your approval to delete those PM_{10} monitors and that site from our monitoring network.

Sincerely,

Robert H. Colby
Director

c: Gregg Worley, EPA Region 4
Todd Rinck, EPA Region 4
Barry Stephens, TDEC APC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

JAN 13 2015

Mr. Barry R. Stephens, PE
Director
Division of Air Pollution Control
Tennessee Department of Environment and Conservation
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 15th Floor
Nashville, Tennessee 37243

Dear Mr. Stephens:

Thank you for submitting the State of Tennessee's 2014 annual ambient air monitoring network plan (Network Plan) dated June 30, 2014. The Network Plan is required by 40 Code of Federal Regulations (CFR) §58.10. The U.S. Environmental Protection Agency understands that the Tennessee Department of Environment and Conservation (TDEC) provided the public a 30-day review period and no external comments were received.

With this letter, the EPA is approving TDEC's Network Plan with the exception of one aspect. The EPA cannot officially approve a new proposed SO_2 site near the Eastman Chemical Company facility in Kingsport without all the requisite information required by 40 CFR §58.10(b). Once the EPA Region 4 is in agreement with the proposed locations for this site, the state will need to make that information available for public inspection. Upon completion of the public inspection process, an addendum to the Network Plan must be submitted to the EPA Region 4 for approval.

The EPA also requests that TDEC continue to include information about industrial monitors in future Network Plans and assessments. As TDEC states in its addendum to the 2013 Network Plan dated March 28, 2014, these monitors are not comparable to the national ambient air quality standards. However, since many of these monitors are required by TDEC air pollution permits, and the data from these monitors is reported to Air Quality System, the EPA believes that these monitors should be included in the Network Plan to allow for public input and notification about these monitors.

We have enclosed comments on your Network Plan and will continue to work with your agency on the remaining portions of the plan that have not been approved with this letter.

Thank you for working with us to monitor air pollution and promote healthy air quality in Tennessee. Please let us know of any problems in meeting any of the requirements we have identified. If you have any questions or concerns, please contact Gregg Worley at (404) 562-9141 or Darren Palmer at (404) 562-9052.

Sincerely,

Beverly H. Banister
Director
Air, Pesticides and Toxics Management Division

Enclosure

cc: Ms. Lynne A. Liddington, Department Head
Knox County Air Quality

Mr. Robert Rogers, Technical Manager
Shelby County Health Department Pollution Control Section

Mr. Bob Colby, Director
Chattanooga-Hamilton County Air Pollution Control Bureau

Mr. John Finke, Director
Nashville / Davidson County Metro Public
Health Department Pollution Control Division

CY 2014 State of Tennessee Ambient Air Monitoring Network Plan
U.S. EPA Comments and Recommendations

This document contains the U.S. Environmental Protection Agency comments and recommendations on the state of Tennessee's 2014 ambient air monitoring network plan (Network Plan). Ambient air monitoring rules, which include regulatory requirements that address network plans, data certification, and minimum monitoring requirements, among other requirements, are found in 40 CFR Part 58. Minimum monitoring requirements for criteria pollutants are listed in 40 CFR Part 58, Appendix D. Minimum monitoring requirements are listed for ozone (O_3), particulate matter less than 2.5 microns ($PM_{2.5}$), particulate matter less than 10 microns (PM_{10}), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb).

The minimum monitoring requirements are based on core based statistical area (CBSA) boundaries as defined by the U.S. Office of Management and Budget (OMB), July 1, 2013, population estimates from the U.S. Census Bureau, and historical ambient air monitoring data. Minimum monitoring requirements for O_3, $PM_{2.5}$, PM_{10}, only apply to metropolitan statistical areas (MSAs), which are a subset of CBSAs. OMB currently defines 24 CBSAs in the state of Tennessee. These CBSAs and the respective July 1, 2013, population estimates from the U.S. Census Bureau are shown in Table 1.

Table 1: Core Based Statistical Areas and July 1, 2013 Population Estimates

CBSA Name	CBSA Type	Population
Nashville-Davidson--Murfreesboro--Franklin, TN	Metropolitan Statistical Area	1,757,912
Memphis, TN-MS-AR	Metropolitan Statistical Area	1,341,746
Knoxville, TN	Metropolitan Statistical Area	852,715
Chattanooga, TN-GA	Metropolitan Statistical Area	541,744
Kingsport-Bristol-Bristol, TN-VA	Metropolitan Statistical Area	308,283
Clarksville, TN-KY	Metropolitan Statistical Area	272,579
Johnson City, TN	Metropolitan Statistical Area	200,966
Jackson, TN	Metropolitan Statistical Area	130,645
Cleveland, TN	Metropolitan Statistical Area	118,538
Morristown, TN	Metropolitan Statistical Area	115,197
Cookeville, TN	Micropolitan Statistical Area	107,117
Tullahoma-Manchester, TN	Micropolitan Statistical Area	100,787
Sevierville, TN	Micropolitan Statistical Area	93,570
Greeneville, TN	Micropolitan Statistical Area	68,267
Crossville, TN	Micropolitan Statistical Area	57,466
Athens, TN	Micropolitan Statistical Area	52,341
Shelbyville, TN	Micropolitan Statistical Area	45,901
Lawrenceburg, TN	Micropolitan Statistical Area	41,990
McMinnville, TN	Micropolitan Statistical Area	39,965
Dyersburg, TN	Micropolitan Statistical Area	38,213
Union City, TN-KY	Micropolitan Statistical Area	37,516
Newport, TN	Micropolitan Statistical Area	35,479
Martin, TN	Micropolitan Statistical Area	34,450
Dayton, TN	Micropolitan Statistical Area	32,513
Paris, TN	Micropolitan Statistical Area	32,210
Lewisburg, TN	Micropolitan Statistical Area	31,130

Minimum O_3 Monitoring Requirements
40 CFR Part 58, Appendix D, Table D-2

The network described in the 2014 Network Plan meets the minimum O_3 monitoring requirements specified by 40 CFR Part 58, Appendix D, Table D-2 in all areas. Additionally, the proposed O_3 monitoring network described in the Network Plan meets all of the design criteria of 40 CFR Part 58.

The Network Plan states that Chattanooga-Hamilton County plans to relocate the Eastside Utility District O_3 monitor (AQS 47-065-4003) due to continued difficulty in accessing the site. Historical data show that this monitor has the highest O_3 design values of the two monitors in the Chattanooga, TN-GA CBSA. Please note that as soon as a new site is selected, revisions to the network, including discontinuation or relocation of a monitor, must be submitted to the EPA for approval.

Minimum PM_{10} Monitoring Requirements
40 CFR Part 58, Appendix A, 3.3.1
40 CFR Part 58, Appendix D, Table D-4

The state of Tennessee's current PM_{10} primary monitoring network meets the minimum requirements for all areas except as discussed for Chattanooga-Hamilton County in the Monitoring Network Changes Proposed by TDEC section of this document. All PM_{10} collocation requirements for manual methods found in 40 CFR Part 58, Appendix A, 3.3.1 are being met. Fifteen percent of each network of manual PM_{10} methods (at least one site) must be collocated. Also, the sites with collocated monitors should be among those measuring annual mean concentrations in the highest 25 percent of the network. These collocation requirements are assessed at the primary quality assurance organization (PQAO) level. The state of Tennessee and all of its local agencies currently operate under a single PQAO (TDEC) for manual PM_{10} sampling.

Minimum $PM_{2.5}$ Monitoring Requirements
40 CFR Part 58, Appendix A, 3.2.5
40 CFR Part 58, Appendix D, Table D-5

The state of Tennessee's $PM_{2.5}$ monitoring network meets the minimum requirements found in 40 CFR Part 58, Appendix D, Table D-5 for all MSAs. All manual $PM_{2.5}$ collocation requirements found in 40 CFR Part 58, Appendix A, 3.2.5 are also being met. Fifteen percent of each network of manual $PM_{2.5}$ methods (at least one site) must be collocated. Additionally, according to Appendix A, 3.2.5.3, 80 percent of collocated monitors should be deployed at sites with annual mean concentrations within +/- 20 percent of the NAAQS. The $PM_{2.5}$ monitoring network described in the 2014 Network Plan meets all of the design criteria of 40 CFR Part 58. The EPA requires that Knox County local program to change the monitor type of the Davanna Street $PM_{2.5}$ monitor (AQS 47-093-1013) from special purpose monitor (SPM) to state and local air monitoring station (SLAMS) monitor. This monitor continues to measure among the highest concentrations of $PM_{2.5}$ in the Knoxville ambient air monitoring network.

$PM_{2.5}$ Continuous Monitoring Requirements
40 CFR Part 58, Appendix D, 4.7.2

Regulatory requirements for continuous $PM_{2.5}$ monitoring require that "The State, or where appropriate, local agencies must operate continuous $PM_{2.5}$ analyzers equal to at least one-half (round up) the minimum required sites listed in Table D–5 of this appendix. At least one required continuous analyzer

The Pb monitoring network described in the Network Plan meets all of the design criteria of 40 CFR Part 58. The documentation to relocate the existing Gerdau Pb site provided by Knox County in the Network Plan is deemed adequate. The EPA approves this relocation effective immediately. Please also see the Monitoring Network Changes section on Page 7 for additional information.

SO_2 Monitoring Requirements
40 CFR Part 58, Appendix D, 4.4

Ambient air monitoring network design criteria for SO_2 are found in section 4.4 of Appendix D to 40 CFR Part 58. This section requires that "The population weighted emissions index (PWEI) shall be calculated by states for each core based statistical area (CBSA)..." As a result, the SO_2 monitoring site(s) required in each CBSA will satisfy minimum monitoring requirements if the monitor(s) is sited within the boundaries of the parent CBSA and is of the following site types: population exposure, maximum concentration, source-oriented, general background, or regional transport. A SO_2 monitor at a National Core (NCore) station may satisfy minimum monitoring requirements if that monitor is located within a CBSA with minimally required monitors consistent with Appendix D 4.4.

The state of Tennessee has installed a SO_2 monitor at the existing O_3 monitoring site in Anderson County (AQS 47-157-0046) to meet the PWEI requirement of one SO_2 monitor for the Knoxville CBSA. This site satisfies the minimum SO_2 monitoring requirement for the Knoxville CBSA. In the addendum to the 2013 Network Plan dated March 28, 2014, Tennessee indicated that the Sullivan County SO_2 industrial monitor (AQS 47-163-0007) operated by the Eastman Chemical Company is not comparable to the NAAQS and will not be used to satisfy the PWEI requirement of one SO_2 monitor in the Kingsport-Bristol, TN-VA CBSA. Instead, Tennessee will establish and operate a new SO_2 monitoring site taking into consideration meteorological data and modeled emissions impacts.

The 2014 Network Plan does not include enough information for approval of the new SO_2 site near the Eastman facility at this time. Tennessee must submit an addendum to its 2014 Network Plan that includes a complete proposal for the site. At a minimum, the addendum must include all of the required information for proposed sites under 40 CFR §58.10(b). The addendum should also include TDEC's rationale for the location of the new proposed site, any monitoring or air modeling data that TDEC used to select the site, and supporting information about how the site location was selected, such as site photos, maps, wind roses, and about the target sources. The addendum should be made available for public inspection under 40 CFR § 58.10(a)(1), and then submitted to the EPA for approval.

NO_2 Monitoring Requirements
40 CFR Part 58, Appendix D 4.3

Ambient air monitoring network design criteria for NO_2 are found in Section 4.3 of Appendix D to 40 CFR Part 58. Three types of NO_2 monitoring are required: near-road, area-wide, and Regional Administrator. These types of NO_2 monitoring are described in sections 4.3.2, 4.3.3, and 4.3.4, respectively.

The EPA approves the selection of the Metro Archive near-road site (AQS 47-037-0040) in Nashville and the Southwest Tennessee Community College near-road site (AQS 47-157-0100) in Memphis because they meet the near-road NO_2 monitoring requirements for their respective CBSAs. [The Memphis near road site is being approved as the information contained in the Network Plan has satisfied the monitor siting criteria found in Appendix E to 40 CFR Part 58.] We request that the state include

in each MSA must be collocated with one of the required FRM/FEM/ARM [federal reference method/federal equivalent method /approved regional method] monitors, unless at least one of the required FRM/FEM/ARM monitors is itself a continuous FEM or ARM monitor in which case no collocation requirement applies." These minimum continuous $PM_{2.5}$ monitoring requirements are currently met in all of the MSAs in the state. Also, the continuous $PM_{2.5}$ collocation requirements are currently met in all MSAs. Therefore, the continuous $PM_{2.5}$ monitoring network described in the 2014 Network Plan meets all of the design criteria of 40 CFR Part 58.

$PM_{2.5}$ Background and Transport Sites
40 CFR Part 58, Appendix D, 4.7.3

40 CFR Part 58, Appendix D, 4.7.3 requires that "each State shall install and operate at least one $PM_{2.5}$ site to monitor for regional background and at least one $PM_{2.5}$ site to monitor for regional transport." The 2014 Network Plan identifies sites in Blount County (AQS 47-009-0101) and Hamilton County (AQS 47-065-0031 and AQS 47-065-1011) as regional transport sites and sites in Blount County (AQS 47-009-0101) and Lawrence County (AQS 47-099-0002) as regional background sites. Therefore, TDEC has satisfied the requirements of 40 CFR Part 58 for background and transport sites.

$PM_{2.5}$ Chemical Speciation Network

EPA has been conducting an assessment of the $PM_{2.5}$ Chemical Speciation Network (CSN) in an effort to optimize the network and create a network that is sustainable going forward. As a result of this assessment, the EPA is defunding a number of monitoring sites, eliminating the CSN $PM_{2.5}$ mass measurement, reducing the frequency of carbon blanks, reducing sample frequency at some monitoring sites, and reducing the number of icepacks in shipment during the cooler months of the year. In Tennessee, the EPA is defunding the Lockeland School (AQS ID: 47-037-0023), University of Tennessee-Chattanooga (AQS ID: 47-065-4002), and Lawrence County (AQS ID: 47-099-0002) sites. The state of Tennessee will be also be affected at all funded CSN sites by the elimination of the $PM_{2.5}$ mass measurement, the reduction of carbon blank frequency, and the reduction in icepacks. The CSN $PM_{2.5}$ mass measurement was eliminated in October 2014 and all other changes became effective in January 2015. Final changes to the CSN in the state of Tennessee should be reflected in the 2015 Network Plan.

Pb Monitoring Requirements
40 CFR Part 58, Appendix D, 4.5

The monitoring requirements for Pb found at 40 CFR Part 58, Appendix D, Section 4.5 require that "At a minimum, there must be one source-oriented SLAMS [State and Local Air Monitoring Station] site located to measure the maximum Pb concentration in ambient air resulting from each non-airport Pb source which emits 0.50 or more tons per year and from each airport which emits 1.0 or more tons per year..." Currently, monitoring is required near two sources in Tennessee: Exide Technologies in Bristol and Gerdau in Knoxville. Monitors near both of these sources are identified in the plan. 40 CFR Part 58, Appendix D, 3(b) requires that "NCore sites in CBSA with a population of 500,000 (as determined in the latest Census) or greater shall also measure Pb either as Pb-TSP or Pb-PM_{10}." This monitoring was required to begin on December 27, 2011. The Network Plan indicates that Pb-TSP sampling is ongoing at the Memphis NCore site (AQS 47-157-0075).

updated site photos in its Network Plan due July 1, 2015. No other CBSA in Tennessee is currently required to have near-road NO_2 monitoring.

Section 4.3.2 of Appendix D to 40 CFR Part 58 also requires CBSAs with populations between 500,000 and 1,000,000 people to operate a near-road NO_2 monitor starting in January 1, 2017. Tennessee has two CBSAs with populations in this range: Chattanooga and Knoxville. As part of the 5-year NAAQS review cycle, the NO_2 monitoring requirements will be reviewed and may be modified in 2016. The NO_2 near-road monitoring requirements may change for CBSAs with populations between 500,000 and 1,000,000 people, such as the TN CBSAs listed above.

Ambient air monitoring network design criteria for area-wide NO_2 sites are found in 40 CFR Part 58, Appendix D, Section 4.3.3. Any CBSA with a population of 1,000,000 or more persons is required to monitor a location of expected highest NO_2 concentration representing the neighborhood or larger spatial scales. The Trinity Lane site (AQS 47-037-0011) was approved in fulfillment of the area-wide NO_2 monitoring requirement for the Nashville CBSA in 2013. In the Network Plan, Tennessee identifies the monitor type for this site as unknown; however in AQS, the monitor type is listed as SLAMS. The EPA assumes this to be a typographical error in the plan and approves the monitor as a SLAMS monitor. The EPA requests that the Nashville agency correct the monitor type in the Network Plan which is due July 1, 2015. The area-wide requirement for the Memphis CBSA is being met by the monitor operated in Marion, Arkansas by the state of Arkansas. The continued operation of this site is outlined in the memorandum of agreement between the Shelby County Health Department and the states of Tennessee, Arkansas, and Mississippi, which is included in the Network Plan.

Ambient air monitoring network design criteria for Regional Administrator required NO_2 monitoring, often referred to as RA-40 monitoring, are found in 40 CFR Part 58, Appendix D, Section 4.3.4. This section states that "the Regional Administrators, in collaboration with states, must require a minimum of forty additional NO_2 monitoring stations nationwide in any area, inside or outside of CBSAs, above the minimum monitoring requirements, with a primary focus on siting these monitors in locations to protect susceptible and vulnerable populations. The Regional Administrators, working with states, may also consider additional factors to require monitors beyond the minimum network requirement." No monitors have been identified in the state's Network Plan as meeting the requirements of a Regional Administrator required NO_2 monitor. However, not all states are required to have such monitors and none were proposed by the EPA for the state. Thus, there is no deficiency with this requirement in the state's plan. The full list of NO_2 monitors identified by the Regional Administrators can be found on the EPA's website at http://www.epa.gov/ttnamti1/svpop.html.

Operating Schedules
40 CFR § 58.12

The monitoring network proposed in the Network Plan meets the required operating schedules for all continuous analyzers and all manual Pb, $PM_{2.5}$, PM_{10}, $PM_{10-2.5}$, and $PM_{2.5}$ Speciation Trends Network monitors. TDEC has not proposed any changes to its operating schedules in the 2014 Network Plan.

Monitoring Network Changes Proposed by TDEC

On Pages 7-8, the Network Plan identifies proposed changes to the state's ambient air monitoring network. As discussed previously, TDEC plans to establish a new SO_2 monitoring site in the vicinity of the Eastman Chemical Company facility in Kingsport. EPA will work with the state to expedite the

establishment of the site once appropriate documentation is provided to the EPA. The plan also states a need to relocate two sites in Knoxville: the Gerdau steel mill Pb site (AQS 47-093-0023) due to a change in the right of way near the current site, and the Air Lab site (AQS 47-093-1013) due to a request from the property owner. The Network Plan provides all required information and the EPA approves the relocation of both sites.

The Memphis MSA is required to maintain 2-4 monitors. The Network Plan states that the Memphis local agency wishes to shut down its Fite Road PM_{10} monitor (AQS 47-157-0046). Approval was granted to shut down this site in the EPA's response to the state's network plan in 2012. Two other PM_{10} monitoring sites are located in the Memphis MSA and both are in Shelby County. Should further network modifications be warranted, it is recommended that Shelby County coordinate any changes with the states of Arkansas and Mississippi so the minimum requirements continue to be met.

The EPA approves the termination of the Meigs County O_3 SPM (AQS 47-121-0104) retroactive to November 1, 2013. This monitor is not located in a CBSA and is not required under 40 CFR Part 58, Appendix D. The EPA also approves the consolidation of the Loudon Pope site (AQS 47-105-0108) with the Loudon Middle School (AQS 47-105-0109). The Loudon Middle School site will now house an O_3 analyzer and $PM_{2.5}$ sampler.

The addendum to the 2013 network plan correctly states that the EPA provided separate formal approval to discontinue operation of the Broadway CO site in Nashville (AQS 47-037-0021). Please note that the EPA requests, to the greatest extent practicable, any requests to establish, relocate, or discontinue monitoring sites be included in Network Plans.

Finally, in an August 28, 2014, letter separate from the 2014 Tennessee Network Plan, Chattanooga-Hamilton County requested to shutdown two PM_{10} monitors at its site at 3300 Broad Street, Chattanooga, TN (Air Quality System # 47-065-0006). The basis for the request was that the PM_{10} mass concentration levels in the Chattanooga, TN-GA MSA, as measured at the site, are very low and that continued monitoring at that site wastes resources that could be better spent on other monitoring activities. For the last 10 years, the maximum PM_{10} concentrations at the site have been less than a third of the PM_{10} National Ambient Air Quality Standard (NAAQS) of 150 micrograms per cubic meter over a 24 hour average period.

The EPA regulations specify minimum monitoring requirements for PM_{10} in 40 CFR Part 58, Appendix D, Table D-4. This table indicates that based on population, the MSA should have a minimum of one PM_{10} monitor. The Broad Street site is the only site measuring PM_{10} in the MSA. Thus, if it only considered the requirements in Table D-4, the EPA would need to disapprove Chattanooga-Hamilton County's request. However, 40 CFR Part 58, Appendix D 4.6(a), which discusses PM_{10} design criteria, allows modifications from the PM_{10} monitoring requirements with approval by the Regional Administrator. Thus, when the EPA reviewed the shutdown request, it not only considered the minimum monitor requirements, it also reviewed the request in light of the low concentrations measured at the site over the last 10 years and the County's contention that continued monitoring at that site is a waste of resources that could be better spent on other monitoring activities. After much consideration, the EPA agrees with the County on the limited utility of operating this site and approves the shutdown request. EPA has determined that discontinuance does not compromise data collection needed for implementation of the current PM_{10} NAAQS. If the PM_{10} NAAQS is revised, this approval may be reconsidered. Please reflect this shutdown in the state's 2015 Network Plan so that the public is notified.

Air Quality Index (AQI) Reporting
40 CFR § 58.50

AQI reporting is required for MSAs with populations of 350,000 or more. There are four MSAs in the state of Tennessee that meet this criterion: Chattanooga, Tennessee-Georgia; Knoxville, Tennessee; Memphis, Tennessee-Mississippi-Arkansas; and Nashville-Davidson-Murfreesboro, Tennessee. The Network Plan indicates that an AQI is being reported in each of these MSAs. Thus, the state is meeting its AQI reporting requirements. In addition, however, TDEC is also voluntarily reporting an AQI for the Kingsport-Johnson City-Bristol, Tennessee-Virginia Combined Statistical Area and the Clarksville-Montgomery County Combined Statistical Area.

National Core (NCore) Monitoring Network

TDEC has designated two NCore sites in the 2014 Network Plan. The first site (AQS 47-157-0075) is located at Shelby Farms on Haley Road in Memphis. The EPA approval was granted on October 30, 2009. Memphis-Shelby County's quality assurance project plan was submitted to the EPA on June 29, 2010, with a subsequent revision submitted on July 30, 2010.

The Look Rock site (AQS 47-009-0101) is designated as a rural NCore site and is located in the Great Smoky Mountain National Park. The site has been operated collaboratively for many years by the National Park Service (NPS), the Tennessee Valley Authority (TVA), the TDEC and the EPA. In early 2014, TVA informed the EPA, TDEC and NPS of its intention to discontinue all air monitoring activities at the site as of October 2014 and transfer ownership of its monitoring equipment to one or more interested parties. NPS, TDEC and the EPA Region 4 and OAQPS had several discussions and agreed that some of the measurements that TVA had been collecting were valuable and needed to be continued. The EPA decided to fund these activities. Combined with the other measurements taken at the site, the parties have agreed to fund and maintain operations of all required criteria pollutant measurements listed in the definition of NCore in 40 CFR §58.1 for the near future. The pollutants to be monitored and operational guidelines of the Look Rock site will continue to be based on the data needs of NPS, TDEC, and the EPA. The EPA requests that the state update the NCore section in the 2015 Network Plan to reflect these changes.

Memoranda of Agreement (MOA) with Neighboring States

Tennessee and Kentucky have a monitoring memorandum of agreement (MOA) addressing O_3 and continuous $PM_{2.5}$ monitoring in the Clarksville, TN-KY CBSA. In addition, Tennessee, Arkansas and Mississippi have a MOA addressing PM_{10}, $PM_{2.5}$ and O_3 monitoring in the Memphis, TN-MS-AR CBSA. Previous correspondence between TDEC and the EPA indicated that the state would pursue a MOA with the Commonwealth of Virginia governing monitoring responsibilities in the Bristol, Tennessee/Bristol, Virginia area. If and when it enters into a MOA with Virginia, TDEC should update its Network Plan to reflect that change.

APPENDIX B

2017 Memorandum of Agreement with the State of Georgia

MEMORANDUM OF AGREEMENT

ON AIR QUALITY MONITORING FOR CRITERIA POLLUTANTS FOR

THE CHATTANOOGA-WALKER COUNTY

METROPOLITAN STATISTICAL AREA MSA

December 28, 2017

Participating Agencies:

Georgia
Georgia Department of Natural Resources (GA DNR)
Environmental Protection Division GA EPD APB

Tennessee
Chattanooga-Hamilton County Air Pollution Control Bureau (CHCAPCB)

I. PURPOSE/OBJECTIVES/GOALS

The purpose of the Memorandum of Agreement (MOA) is to establish the Chattanooga-Hamilton County-Walker County Metropolitan Statistical Area (MSA) Criteria Pollutant Air Quality Monitoring Agreement between CHCAPCB and GAEPDAPB (collectively referred to as the "affected agencies") to collectively meet United States Environmental Protection Agency (EPA) minimum monitoring requirements for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone; as well as other criteria pollutant air quality monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all parties. This MOA will establish the terms and conditions of this collective agreement to provide adequate criteria pollutant monitoring for the Chattanooga –Hamilton County-Walker Co, GA MSA as required by 40 CFR 58 Appendix D, Section 2, (e) (March 28, 2016)[1].

II. BACKGROUND

The Chattanooga-Hamilton Co-Walker Co, GA MSA consists of the following counties: Dade, Walker, Catoosa, Hamilton, Marion, and Sequatchie. GA EPD APB has jurisdiction over Dade, Walker, and Catoosa Counties in Georgia and CHCAPCB has jurisdiction over Hamilton County, Tennessee. The State of Tennessee has jurisdiction over Marion and Sequatchie Counties in Tennessee, but does not have any permanent air monitoring sites in those counties. The CHCAPCB and GA EPD APB are required by the Clean Air Act to measure for certain criteria pollutants in the ambient air in the Chattanooga-Hamilton County-Walker Co, GA Metropolitan Statistical Area (MSA). The United States Environmental Protection Agency (EPA) has established minimum monitoring requirements based on the size of the MSA and the quality of the air in the

MSA for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone.

40 CFR 58 Appendix D, Section 2, (e)[1] states (in part):

"...The EPA recognizes that there may be situations where the EPA Regional Administrator and the affected State or local agencies may need to augment or to divide the overall MSA/CSA monitoring responsibilities and requirements among these various agencies to achieve an effective network design. Full monitoring requirements apply separately to each affected State or local agency in the absence of an agreement between the affected agencies and the EPA Regional Administrator."[1]

Currently each air pollution control agency (affected agency) conducts monitoring in its respective jurisdiction and coordinates its monitoring with the other air pollution control agencies within the MSA.

I. ROLES AND RESPONSIBILITIES

The parties agree to the following terms and conditions:

- CHCAPCB and GA EPD APB (the "affected agencies") commit to conducting appropriate monitoring in their respective jurisdictions of the MSA; as needed, to collectively meet EPA minimum monitoring requirements for the entire MSA for PM10, PM2.5, and ozone, as well as other criteria air pollutant monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all affected agencies. The minimum air quality monitoring requirement (for PM10, PM2.5, and ozone described in 40 CFR 58) for the MSA shall apply to the MSA in its entirety and shall not apply to any sole affected agency within the MSA unless agreed upon by all affected agencies.

- The affected agencies commit to coordinating monitoring "...responsibilities and requirements...to achieve an effective network design..."[1] regarding criteria air pollutant monitoring conducted in the MSA and commit to communicate unexpected or unplanned changes in monitoring activities within their jurisdictions to the other affected agencies of this MOA. As conditions warrant, the affected agencies may conduct telephone conference calls, meetings, or other communications to discuss monitoring activities for the MSA. Each affected agency shall inform the other affected agencies via telephone or e-mail of any monitoring changes occurring in its jurisdiction of the MSA at its earliest convenience after learning of the need for the change or making the changes. Such unforeseen changes may include evictions from monitoring sites, destruction of monitoring sites due to natural disasters, or similar occurrences that result in a loss of more than 25% data in a quarter or a permanent change in the monitoring network. At least once a year in the second quarter of the year or before June 15th, each agency shall make available to the other agencies who are a party to this agreement, a copy of its proposed monitoring plan for the MSA for the next

year. The CHCAPCB will submit the network review that is submitted to the State of Tennessee for inclusion in the State's monitoring plan.

- Each party reserves the right to revoke or terminate this MOA at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

III. LIMITATIONS

A. All commitments made in this MOA are subject to the availability of appropriated funds and each party's budget priorities. Nothing in this MOA, in and of itself, obligates CHCAPCB or GA EPD APB to expend appropriations or to enter into any contract, assistance agreement, interagency agreement or other financial obligation.

B. This MOA is neither a fiscal nor a funds obligation document. Any endeavor involving reimburse or contribution of funds between parties to this MOA will be handled in accordance with applicable laws, regulations, and procedures, and will be subject to separate subsidiary agreements that will be effected in writing by representatives of the parties.

C. Except as provided in Section III, this MOA does not create any right or benefit, substantive or procedural, enforceable by law or equity against CHCAPCB or GA EPD APB, their officers or employees, or any other person. This MOA does not direct or apply to any person outside CHAPCD or GAEPD APB.

V. PROPRIETARY INFORMATION AND INTELLECTUAL PROPERTY

No proprietary information or intellectual property is anticipated to arise out of this MOA.

VI. POINTS OF CONTACT

The following individuals are designated points of contact for the MOA:

GA EPD APB

DeAnna G. Oser
GAEPD APB Ambient Monitoring Program
4244 International Parkway, Suite 120
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CHCAPCB

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Chattanooga, Tn 37416

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FAX: (423) 643-5972

VII. MODIFICATION/DURATION/TERMINATION

This MOA will be effective when signed by all parties. This MOA may be amended at any time by the mutual written consent of the parties. The parties will review this MOA at least once every 10 years to determine whether it should be revised, renewed, or cancelled. This MOA may be revoked or terminated by an affected agency at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

VIII. REFERENCE

1 – United States Environmental Protection Agency, Title 40 Code of Federal Regulations, Part 58, Appendix D, "Network Design Criteria for Ambient Air Quality Monitoring", Section 2 (e), "General Monitoring Requirements".

IX. APPROVALS

Georgia Department of Natural Resources, Environmental Protection Division
Air Protection Branch (GA EPD APB)

BY: _____

TITLE: DIRECTOR

DATE: 1/24/18

Chattanooga-Hamilton County Air Pollution Bureau (CHCAPCB)

BY: _____

TITLE: Director

DATE: January 3, 2018