
# PARTICULATES

# QUALITY ASSURANCE PROJECT PLAN

## VOLUME I

**B-001-OAQ-AMB-QA-20-Q-R0**

PREPARED BY:

Indiana Department of Environmental Management (IDEM)
Office of Air Quality (OAQ)
Air Monitoring Branch (AMB)
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**Revision 0**

**January 1, 2020**

**QAPP Revision History**

| Revision Number | Date | Responsible Party | Description of Change |
|---|---|---|---|
| 0 | January 1, 2020 | QAS Chief | New QAPP format to replace QA Manual, which served as OAQ AMB QAPP, and was last U.S. EPA approved on March 9, 2018. |

## List of Acronyms

| Acronym | Meaning |
|---|---|
| °C | Degrees Celsius |
| AA | Administrative Assistant |
| AC | Assistant Commissioner |
| AMB | Air Monitoring Branch |
| AMS | Ambient Monitoring Section |
| ANP | Annual Network Plan |
| AQI | Air Quality Index |
| AQS | Air Quality System |
| As | Arsenic |
| AT | Ambient Temperature |
| ATS | Air Toxics Section |
| BAM | Beta Attenuation Monitor |
| BP | Barometric Pressure |
| CAA | Clean Air Act |
| CBSA | Core Based Statistical Area |
| CFR | Code of Federal Regulations |
| CO | Carbon Monoxide |
| CV | Coefficient of Variation |
| CSN | Chemical Speciation Network |
| DART | Data Analysis Reporting Tool |
| EPA | Environmental Protection Agency |
| FEM | Federal Equivalent Method |
| FRM | Federal Reference Method |
| FT | Filter Temperature |
| FTS | Flow Transfer Standard |
| GCMS | Gas Chromatography Mass Spectrometry |
| GD | Guidance Documents |
| GLIMS | Gravimetric Laboratory Information Management System |
| RH | Relative Humidity |
| IDEM | Indiana Department of Environmental Management |
| INDOT | Indiana Department of Transportation |
| IMPROVE | Interagency Monitoring of Protected Visual Environments Network |
| K | Kelvin; 0 Kelvin is -273.15 °C |

| Acronym | Meaning |
|---|---|
| LEADS | Leading Environmental Analysis and Display System |
| LPM | Liters Per Minute |
| Mn | Manganese |
| NAAQS | National Ambient Air Quality Standards |
| NCore | National Core Network |
| NIST | National Institute of Standards and Technology |
| NO | Nitric Oxide |
| $NO_2$ | Nitrogen Dioxide |
| $NO_y$ | Reactive Nitrogen Compounds |
| $O_3$ | Ozone |
| OAQ | Office of Air Quality |
| OPS | Office of Program Support |
| OT | Outdoor Temperature |
| PAMS | Photochemical Assessment Monitoring Station |
| Pb | Lead |
| PE | Performance Evaluation |
| PEP | Performance Evaluation Program |
| PM | Particulate Matter |
| $PM_{1.0}$ | Particulate matter having an aerodynamic diameter less than or equal to 1.0 um |
| $PM_{2.5}$ | Particulate matter having an aerodynamic diameter less than or equal to 2.5 um |
| $PM_{10}$ | Particulate matter having an aerodynamic diameter less than or equal to 10 um |
| $PM_{10c}$ | Particulate matter having an aerodynamic diameter between 2.5 um and 10 um |
| PQAO | Primary Quality Assurance Organization |
| PSD | Prevention of Significant Deterioration |
| QA | Quality Assurance |
| QAPP | Quality Assurance Project Plan |
| QAS | Quality Assurance Section |
| QC | Quality Control |
| QMP | Quality Management Plan |
| REQAS | Recycling, Education and Quality Assurance Section |
| RH | Relative Humidity |
| SASS | Speciation Air Sampling System |
| SCC | Sharp Cut Cyclone |
| SD | Standard Deviation |
| SHARP | Synchronized Hybrid Ambient Real-time Particulate |
| SIP | State Implementation Plan |
| SLAMS | State and Local Air Monitoring Stations |
| $SO_2$ | Sulfur Dioxide |
| SOP | Standard Operating Procedure |
| SPM | Special Purpose Monitoring |
| STN | Special Trends Network |
| T | Temperature |

| Acronym | Meaning |
|---|---|
| TAD | Technical Assistance Documents |
| TAPI | Teledyne Advanced Pollution Instrumentation |
| TEOM | Tapered Element Oscillating Microbalance |
| TSOP | Technical Standard Operating Procedure |
| TSP | Total Suspended Particulate |
| $\mu g/m^3$ | Microgram per Cubic Meter |
| URG | University Research Glassware |
| UVC | Ultraviolet Carbon |
| VFC | Virtual File Cabinet |
| VOC | Volatile Organic Compound |
| VSCC | Very Sharp Cut Cyclone |

## Section 1: Quality Assurance Project Plan (QAPP) Identification and Approval

Indiana Department of Environmental Management (IDEM) – Office Air Quality (OAQ) – Air Monitoring Branch (AMB) – Quality Assurance Project Plan (QAPP) – Particulates – Revision 0

This QAPP is designed to provide an overview of the minimum requirements for a quality assurance (QA) and quality control (QC) program for air monitoring networks which conduct particulate sampling in the state of Indiana. Requiring monitoring networks to meet these criteria allows the data from all monitoring networks to be consistent, scientifically defensible and comparable. Particulate sampling consists of:

- Continuous $PM_{1.0}$
- Intermittent and continuous $PM_{2.5}$
- Intermittent and continuous $PM_{10}$
- Intermittent TSP for metals
- Intermittent and continuous $PM_{2.5}$ speciation

A QC/QA program encompasses all phases of ambient air sampling and data analysis. These phases include such activities as site selection, monitoring equipment selection, calibration/verification/audit equipment and procedures, sampling procedures, lab analysis, data verification/validation, chain of custody, data reporting, precision/accuracy reporting, and meteorological criteria. Prior to the implementation of any ambient monitoring network becoming operational, a working knowledge of this QAPP is necessary by those personnel designated as QC and QA.

There are three basic sections of the CFR Title 40, Protection of the Environment, which deal with Ambient Air Monitoring. 40 CFR Part 50 lists the National Primary and Secondary Ambient Air Quality Standards. 40 CFR Part 53 lists alternate equivalent air monitoring methods and procedures for obtaining equivalency. Finally, 40 CFR Part 58 gives detailed descriptions of monitoring methodology, network design and siting, Prevention of Significant Deterioration (PSD) requirements, and QA criteria. Additional federal requirements are also given in U.S. Environmental Protection Agency (EPA) Technical Assistance Documents (TAD) and U.S. EPA QA Guidance Documents (GD). Designated QC and QA personnel should maintain a working knowledge of all applicable requirements. All monitoring and QA program requirements must be

kept current and accessible.

## Document Approval

**Particulates Quality Assurance Project Plan Volume I**
Indiana Department of Environmental Management
Office of Air Quality
Air Monitoring Branch
Indianapolis, IN 46219

**B-001-OAQ-AMB-QA-20-Q-R0**

**Approval Signatures and Date Signed:**

IDEM AMB Chief **Signature: _____ Date: _____**

IDEM AMB AMS 1 Chief **Signature: _____ Date: _____**

IDEM AMB AMS 2 Chief **Signature: _____ Date: _____**

IDEM AMB ATS Chief **Signature: _____ Date: _____**

IDEM AMB QAS Chief **Signature: _____ Date: _____**

IDEM OAQ Assistant Commissioner **Signature: _____ Date: _____**

IDEM OPS QA Staff **Signature: _____ Date: _____**

U.S. EPA Region 5 QA Coordinator **Signature: _____ Date: _____**

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## Section 2: Table of Contents

**List of Tables**

## Section 3: Distribution / Notification List

All members of the IDEM/OAQ play an important role in the collection, verification, validation, data analysis, assessment, planning, and reporting of air monitoring data. All entities that are part of the primary quality assurance organization (PQAO) are provided electronic copies of this QAPP and must adhere to the elements of the QAPP. Copies of the QAPP are also provided to those who conduct air monitoring in Indiana under their own PQAO. Table 1 shows how the QAPP is distributed. An official copy of the QAPP is also available on the IDEM air quality web page and the IDEM SharePoint™ QA Library.

**Table 1. QAPP Distribution**

| Name | Organization | Phone |
|---|---|---|
| Air Monitoring Branch Chief | IDEM/OAQ/AMB | 317-308-3264 |
| Quality Assurance Section Chief and Staff | IDEM/OAQ/AMB/QAS | 317-308-3257 |
| Ambient Monitoring Section (1 and 2) Chief(s) and Staff | IDEM/OAQ/AMB/AMS(s) | AMS#1 317-308-3263<br>AMS#2 317-308-3272 |
| Air Toxics Section Chief and Staff | IDEM/OAQ/AMB/ATS | 317-308-3248 |
| Office of Program Support Recycling, Education and Quality Assurance Section Chief | IDEM/OPS/REQAS | 317-234-6562 |
| Environmental Coordinator | Industries conducting air monitoring in Indiana | Contact QAS Chief |
| Environmental Coordinator | Consultants conducting air monitoring in Indiana | Contact QAS Chief |
| QA Manager | U.S. EPA Region 5 | 312-353-2325 |
| IDEM Quality Management Staff | IDEM Office of Program Support | Contact OPS REQAS Chief |

## Section 4: Project/Task Organization

### 4.1 Personnel Roles and Responsibilities in IDEM

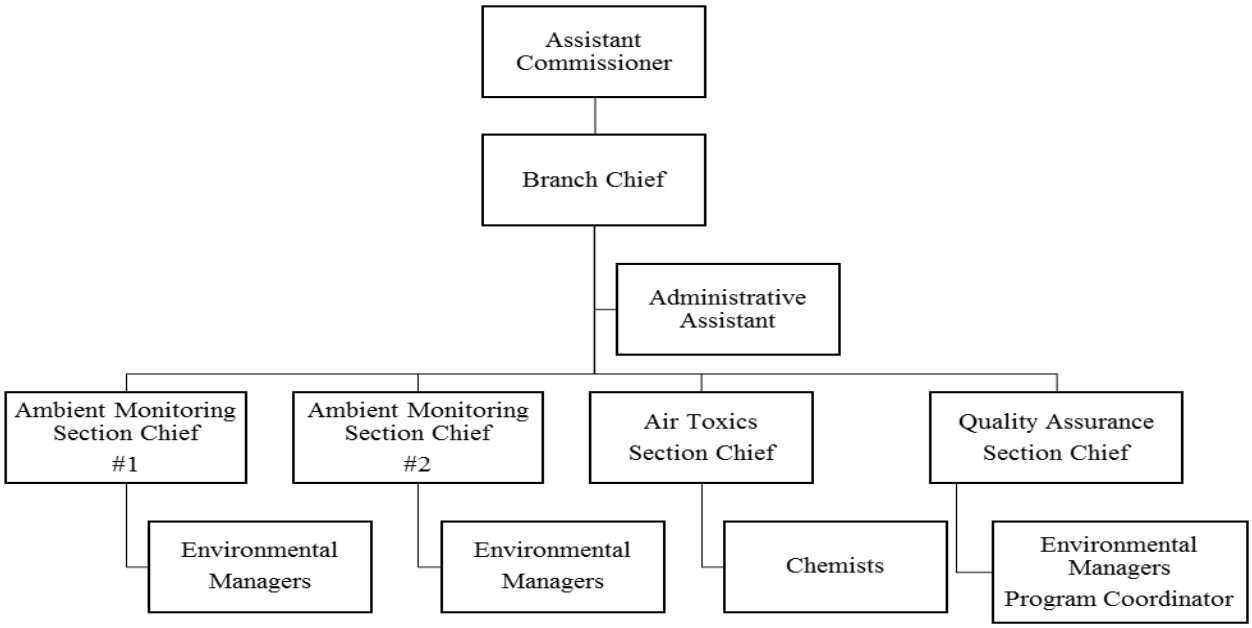
Key functions and responsibilities in IDEM are:

1. OAQ program management: Assistant Commissioner
2. AMB management: AMB Chief; AMS (1 and 2) Chief(s); ATS Chief; QAS Chief
3. Initiate equipment and supplies request: AMS (1 and 2) Environmental Managers, QAS Environmental Managers, and ATS Chemists with oversight by AMS (1 and 2) Chief(s), QAS Chief, and ATS Chief
4. Procurement of AMB equipment and supplies: final approval by AMB Chief; tracking by AA
5. Air monitoring site selection, maintenance, and operation which includes calibrations,

verifications, span, zero, and QC checks: AMS Environmental Managers and ATS Chemists with oversight by AMS (1 and 2) Chief(s) and ATS Chief. As needed assistance for site selection and parameters by OAQ Programs Branch

6. Air monitoring data handling, review, verification, and retrieval requests: AMS Environmental Managers and ATS Chemists with oversight by AMS (1 and 2) Chief(s) and ATS Chief
7. Air monitoring network review and project grants: AMB Chief; AMS (1 and 2) Chief(s)
8. QA performance and system audits, site evaluations, data validation, and audits of data quality: QAS Environmental Managers and Program Coordinator with oversight by QAS Chief
9. QA laboratory: Designated QAS Environmental Manager oversees most of the work performed in the QA laboratory with some assistance from other QAS Environmental Managers and oversight by QAS Chief
10. QMP development/updates, QAPP/TSOP/SOP approval; TSOP/SOP agency distribution; review, authorization, and management of QA documentation (part 5 of QMP discusses documents and records): OPS
11. Programs Branch, Permits Branch, and Compliance and Enforcement Branch: utilize AMB data; see https://www.in.gov/idem/airquality/ for specific duties of these areas

## 4.2 AMB Organizational Chart




## 4.3 AMB Roles and Responsibilities

Table 2 lists general duties of the positions within the AMB. The AMS #2 has an Environmental Manager designated as the AQS administrator, whose responsibilities include data submittal and AMS flow rate verification data being uploaded into AQS. Also in the AMS #2 is an Environmental Manager designated as the LEADS administrator, whose duties include reviewing and evaluating data outputs as well as setting limits, overseeing programming within

LEADS, and coordinating specific work functions of LEADS with MeteoStar. The QAS has an Environmental Manager designated to upload the QA flow rate audits into AQS. The environmental managers/program coordinator listed under the QAS maintain separate equipment from the AMS(s) and the ATS which ensures that an independent QA program is maintained. However, there may be some occasion when the same equipment is used for a flow rate verification and a flow rate audit but the equipment used to calibrate is always independent from the audit. Data is also validated by the QAS once it has been verified by the AMS(s) and the ATS. The QAS maintains the QAPP(s) and has final decision on data validity.

**Table 2. Duties of Air Monitoring Branch Positions**

| Position | Duties |
|---|---|
| Air Monitoring Branch Chief | Overall program management; supervises section chiefs and AA; approves the purchase of major equipment; approves QAPPs/TSOPs/SOPs; and approves annual certification of data. |
| Ambient Monitoring Section Chiefs | Approves and makes sure AMS staff adhere to the QAPPs/TSOPs/SOPs; oversight and direction of all ambient monitoring functions which includes calibrations, verifications, QC checks, data analysis, site location/setup/shutdown, site maintenance, and the development/update of the ANP/5-year network assessment; ensures data meets quality standards; approves annual certification of data; and supervises AMS staff. |
| Air Toxics Section Chief | Approves and makes sure ATS staff adhere to the QAPPs/TSOPs/SOPs; oversight and direction of all toxic functions which include laboratory and field GCMS; instrument calibration and sample analysis; ensures data meets QC standards; provides assistance for the update of the ANP/5-year network assessment; approves annual certification of data; and supervises ATS staff. |
| Quality Assurance Section Chief | Responsible for the creation, maintenance, revisions, and adherence to the QAPPs/TSOPs/SOPs; oversight and direction of all QA functions which include PE/systems audits, meteorological audits, toxic audits, site evaluations, and operation of the QA laboratory; ensures data meets quality standards with authority to make final decision on data validity; will track the completion of corrective actions and determine the success of these actions; approves annual certification of data; and supervises QAS staff. |

| Position | Duties |
|---|---|
| Air Toxics Chemists | Performs the daily operations that are required for the air monitoring data to be properly collected, analyzed, and verified; perform site visits to conduct maintenance on air toxics monitoring equipment; and reviews, writes, and updates TSOPs/SOPs. |
| Ambient Monitoring Environmental Managers | Performs the daily operations that are required for the air monitoring data to be properly collected, analyzed, and verified; performs site/equipment location/setup/maintenance/shutdown and calibrations/verifications/QC checks on air monitoring field equipment; and reviews, writes, and updates TSOPs/SOPs. |
| Quality Assurance Program Coordinator | Assists with meteorological audits and site evaluations; distributes, tracks, and validates data; performs audits on the PM clean rooms; reviews, writes, updates; and distributes QAPP/TSOPs/SOPs; communicates QA work to AMB Chief for bi-weekly report, which includes TSOP/SOP approval/revision updates; and will track the completion of corrective actions and determine the success of these actions. |
| Air Monitoring Branch Administrative Assistant | Organizes the tracking and surplus of air monitoring equipment and maintains the QA documentation used to implement that monitoring program. |

## Section 5: Problem Definition/Background

In 1970, the Clean Air Act (CAA) was signed into law. The CAA provided the regulations and framework for the monitoring of criteria pollutants (CO, $NO_2$, $O_3$, $SO_2$, Pb, PM) by state, local, and tribal organizations through the establishment of an Air Quality Monitoring Program.

IDEM's mission is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial and government activities vital to a prosperous economy. The mission of the OAQ is to assure all Hoosiers' ambient air quality meets the NAAQS; provide timely, quality air permits without unnecessary requirements; and to verify compliance with applicable state and federal air pollution laws and regulations. Five branches are part of the OAQ, which includes Programs, Permits, Compliance and Enforcement, Operations, and Air Monitoring. A description and a flowchart of these is available in the QMP at https://extranet.idem.in.gov/standards/docs/quality_improvement/qmps/idem_qmp_2018.pdf. The AMB is divided among four sections (See 4.2. AMB Organizational Chart, above) which includes two site monitoring sections (AMS's), an air toxics laboratory (ATS), and a quality assurance section (QAS).

This QAPP covers all of the particulate parameters, as stated in Section 1. The QAPP is reviewed annually and updated if needed. Any TSOPs/SOPs associated with this QAPP are updated a minimum of every four years or if the procedures change. Air monitoring data is collected to:

- Demonstrate that the NAAQS are being met
- Develop, modify, or activate control strategies that prevent or reduce air pollution episodes
- Detect and analyze pollution trends throughout the state and/or region
- Provide a database for research and evaluation of effects

## Section 6: Project/Task Description

Air quality is regulated to protect public health and the environment in the state of Indiana and has been going on for decades. This on-going requirement to collect air monitoring data is required by regulation and are used to determine compliance with the U.S. EPA's NAAQS. NAAQS are identified for the criteria pollutants; CO, $NO_2$, $O_3$, $SO_2$, $PM_{2.5}$, $PM_{10}$, and Pb. Indiana monitors $PM_{2.5}$, $PM_{10}$, and Pb which have NAAQS identified for them (see table 3). Other particulates in this QAPP which do not have ambient standards established for them are also monitored, which includes non-criteria metals, $PM_{1.0}$, and $PM_{2.5}$ speciated compounds.

Measuring pollutant concentrations in outdoor air and comparing the measured concentrations to corresponding standards determines whether the ambient air quality status of an area is attaining or not attaining the standards. The NAAQS are separated into primary and secondary standards. Primary standards are those established to protect public health. Secondary standards are those established to protect the public welfare from adverse pollution effects on soils, water, vegetation, manmade materials, animals, weather, visibility, property, and economy.

The scientific criteria upon which the standards are based are reviewed periodically by the U.S. EPA, which may retain or change the standards according to its findings. Note that there are hundreds of compounds that are considered pollutants when found in ambient air but whose health and welfare effects are not well enough understood for ambient standards to be defined.

A pollutant measurement that is greater than the ambient air quality standard for its specific averaging time and level is called an exceedance. An exceedance is not necessarily a synonym for a violation. For each pollutant there are specific rules regarding the number of allowable exceedances (or concentration above the level) in a given period of time. In the event the exceedances meet the NAAQS criteria to qualify as a violation, regulatory actions may result to further clean up the area's air. The distinction between one exceedance and exceedances that result in a violation is made to allow leeway in the NAAQS for exceedances caused by unusual weather patterns or unforeseen circumstances.

The design value for a site is the level of pollutant concentration when the rules of the NAAQS calculations are applied to that specific pollutant. For example, the $PM_{2.5}$ design value is calculated by taking the three year average of the annual mean. If this number is above the NAAQS for $PM_{2.5}$, then it is a violation or 'nonattainment' of the NAAQS. If the design value is below the NAAQS then the area is in 'attainment' of the standard. Generally, nonattainment is based on the highest design value reported for a specific geographic area (usually a CBSA), and the entire area would be defined by that monitor, and classified accordingly.

Other important uses of the air monitoring data include the production of a daily AQI report, daily air quality forecast report, support of short and long-term health risk assessments, identification of a localized health concern, and tracking long-term trends in air quality.

**Table 3. NAAQS**

| **Pollutant** | | **Primary/Secondary** | **Averaging Time** | **Level** | **Form** |
|---|---|---|---|---|---|
| **Particle Pollution** | $PM_{2.5}$ | Primary | 1 Year | 12.0 $\mu g/m^3$ | annual mean, averaged over 3 years |
| | | Secondary | 1 Year | 15.0 $\mu g/m^3$ | annual mean, averaged over 3 years |
| | | Primary and Secondary | 24 Hours | 35 $\mu g/m^3$ | 98th percentile, averaged over 3 years |
| | $PM_{10}$ | Primary and Secondary | 24 Hours | 150 $\mu g/m^3$ | Not to be exceeded more than once per year on average over 3 years |
| | Pb | Primary and Secondary | Rolling 3 month average | 0.15 $\mu g/m^3$ | Not to be exceeded |

## 6.1 Overview of Monitored Particulate Parameters

IDEM presents two different types of air quality data, intermittent and continuous, on IDEM's internet website http://www.in.gov/idem/airquality/2346.htm. Monthly and annual summary reports of pollutants collected by manual methods are available as well as hourly values from continuous monitors. The LEADS provides on-line access to Indiana's continuous air quality monitoring network. It has been available to the public since July, 2007. LEADS offers access to near real-time data from approximately 60 active air monitoring sites and historic data from approximately 12 discontinued continuous air monitoring sites across Indiana. This allows anyone to track pollutant and meteorological values throughout the day. In addition, past data back to 1998 are available as raw data and canned summary reports or user specified retrievals. Also available on LEADS is intermittent data from approximately 45 sites. Below are the different particulate parameters which are monitored.

### Criteria Pollutants

### Lead (Pb)

Lead (Pb) is a metal that is highly toxic when ingested or inhaled. It is a suspected carcinogen of the lungs and kidneys and has adverse effects on cardiovascular, nervous, and renal systems.

### Particulate Matter ($PM_{10}$)

Particulate matter with a mean aerodynamic diameter of 10 microns or less ($PM_{10}$) is emitted from transportation and industrial sources. Exposure to particle pollution is linked to a variety of significant health problems ranging from aggravated asthma to premature death in people with heart and lung disease. The $PM_{10}$ can be used with $PM_{2.5}$ to calculate $PM_{10c}$.

### Fine Particulate Matter ($PM_{2.5}$)

Fine particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) is created primarily from industrial processes and fuel combustion. These particles are breathed deeply into the lungs. Exposure to particle pollution is linked to a variety of significant health problems ranging from aggravated asthma to premature death in people with heart and lung disease.

### Non-Criteria Parameters

### $PM_{2.5}$ Speciation

The U.S. EPA implemented the $PM_{2.5}$ chemical speciation monitoring program to understand the chemical composition of the $PM_{2.5}$ mix. This information is important for determining sources of pollution and links between observed health effects. The basic objective of speciation analysis is to develop seasonal and annual chemical characterizations of ambient particulates across the nation. This speciation data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies and regional haze assessments.

The speciation samplers use different inlets and filters to collect the components of the $PM_{2.5}$ mixture. One intermittent process consists of using three different types of filters to separate out such specific compounds as: sulfate, nitrate, organic and elemental carbon, ammonium, metals, and certain ions. A continuous process utilizes an instrument which analyzes for black carbon and UVC.

### Metals

Metals are categorized as toxic air pollutants, also known as hazardous air pollutants, which are those pollutants that are known or suspected to cause cancer, other serious health effects, or adverse environmental conditions. Examples of non-criteria metals include Manganese and Arsenic. Chromium is also sampled but due to this being a very sporadic sampling schedule, it is not addressed in this QAPP in detail. More detailed information on chromium can be found in U.S. EPA SOP(s). Other metals are also analyzed by a contract laboratory when using a 2025 for metals data collection.

### Ultrafine Particulate Matter ($PM_{1.0}$)

Ultrafine particulate matter with an aerodynamic diameter of 1.0 microns or less ($PM_{1.0}$) is created primarily from industrial processes and fuel combustion. These particles are breathed deeply into the lungs. Exposure to particle pollution is linked to a variety of significant health problems ranging from aggravated asthma to premature death in people with heart and lung disease.

## 6.2 Project Schedule

The AMB collects and analyzes samples of particulates to determine the concentration except for the intermittent $PM_{2.5}$ speciation filters, which are analyzed by a U.S. EPA contract laboratory. Checks on the samplers and the ATS lab are also performed. Table 4 lists information outlining the collection of the various types of particulate data, and tables 5 through 8 list specific checks performed on the samplers and the PM laboratory. Specific duties relating to this work are outlined in the following AMB TSOPs/SOPs: "2025 A/B Sequential Air Sampler Calibration and Maintenance"; "URG 3000N Calibration and Maintenance"; "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Calibration/Maintenance"; "Thermo Fisher Scientific SHARP 5030 Monthly Verification and Maintenance"; "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Monthly Verification/Maintenance"; "Tisch Environmental Hi-Vol+ Air Sampler Calibration and Maintenance"; "Thermo Fisher Scientific SHARP 5030 Annual Calibration and Maintenance"; "Tisch Environmental Hi-Vol+ Lead Sampler Verification and Maintenance"; "Aethalometer Quarterly Field Audit"; "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Audit"; "Met One SASS or SuperSASS PM2.5 Chemical Speciation Sampler – Quarterly Field Audit"; "TAPI Model 602 BETAPLUS Particle Measurement System Audits"; "Thermo Scientific Tapered Element Oscillating Microbalance (TEOM) Quarterly Field Audit"; "Thermo Scientific Partisol-Plus Model 2025 Audit Procedures"; "Thermo Synchronized Hybrid Ambient Real-time Particulate (SHARP) Monitor Audit Procedures"; "Tisch Total Suspended Particulate Sampler Audit"; and "URG 3000N Sequential Particulate Speciation System Quarterly Field Audit".

**Table 4. Particulate Data Collection Frequency**

| Sample | Sample Frequency |
|---|---|
| $PM_{1.0}$ Continuous | Continuous |
| $PM_{2.5}$ Intermittent | Once every third day except for collocated samplers, which run every sixth day. Field blanks are ran at least 10% of the time. Make-up samples may also occur. |
| $PM_{2.5}$ Continuous | Continuous |
| $PM_{10}$ Intermittent | Once every six days. Some one in three sampling used with $PM_{2.5}$ to calculate for $PM_{10c}$. Field blanks are ran at least 10% of the time. |
| $PM_{10}$ Continuous | Continuous |
| TSP for Metals Intermittent | Once every sixth day. Some special study sites will sample extra days, e.g. every third day. |
| $PM_{2.5}$ Speciation Continuous – Black Carbon/UVC | Continuous |
| $PM_{2.5}$ Speciation Intermittent | Once every sixth day. One Super SASS and one URG sampler at the NCORE/PAMS site samples every third day. Field blanks are monthly and does vary from every 4-6 sample runs on a 1/6 frequency and every 7-14 sample runs on a 1/3 frequency, based on the U.S. EPA speciation schedule. |

**Table 5. AMS Calibration Checks on Particulate Samplers**

| Parameter | Frequency |
|---|---|
| $PM_{1.0}$ Continuous | Annual – one per year with no more than 13 months between two calibrations |
| $PM_{2.5}$ Intermittent | Annual – one per year with no more than 13 months between two calibrations |
| $PM_{2.5}$ Continuous | Annual – one per year with no more than 13 months between two calibrations |
| $PM_{10}$ Intermittent | Annual – one per year with no more than 13 months between two calibrations |
| $PM_{10}$ Continuous | Annual – one per year with no more than 13 months between two calibrations |
| TSP for Metals Intermittent | Quarterly |
| $PM_{2.5}$ Speciation Intermittent | Annual - one per year with no more than 13 months between two calibrations |
| $PM_{2.5}$ Speciation Continuous | Annual - one per year with no more than 13 months between two calibrations |

**Table 6. AMS Verification Checks on Particulate Samplers**

| Parameter | Frequency |
|---|---|
| $PM_{1.0}$ Continuous | Monthly - with no less than 21 days and no more than 36 days between verifications |
| $PM_{2.5}$ Intermittent | Monthly – with no less than 21 days and no more than 36 days between verifications |
| $PM_{2.5}$ Continuous | Monthly – with no less than 21 days and no more than 36 days between verifications |
| $PM_{10}$ Intermittent | Monthly – with no less than 21 days and no more than 36 days between verifications |
| $PM_{10}$ Continuous | Monthly – with no less than 21 days and no more than 36 days between verifications |
| TSP for Metals Intermittent | Monthly – with no less than 21 days and no more than 36 days between verifications |
| $PM_{2.5}$ Speciation Intermittent | Monthly – with no less than 21 days and no more than 36 days between verifications |
| $PM_{2.5}$ Speciation Continuous | Monthly – with no less than 21 days and no more than 36 days between verifications |

**Table 7. QAS Audit Checks on Particulate Samplers**

| Parameter | Frequency |
|---|---|
| $PM_{1.0}$ Continuous | Quarterly – 5 to 7 months between every other audit |
| $PM_{2.5}$ Intermittent | Quarterly – 5 to 7 months between every other audit |
| $PM_{2.5}$ Continuous | Quarterly – 5 to 7 months between every other audit |

| Parameter | Frequency |
|---|---|
| $PM_{10}$ Intermittent | Quarterly – 5 to 7 months between every other audit |
| $PM_{10}$ Continuous | Quarterly – 5 to 7 months between every other audit |
| TSP for Metals Intermittent | Quarterly – 5 to 7 months between every other audit |
| $PM_{2.5}$ Speciation Intermittent | Quarterly – 5 to 7 months between every other audit |
| $PM_{2.5}$ Speciation Continuous | Quarterly – 5 to 7 months between every other audit |

**Table 8. Checks on ATS PM Laboratory**

| Item | Check | Frequency |
|---|---|---|
| ATS Chemists | Weighing Comparison | Annual |
| Clean Room | Internal Audit by QAS | Annual |
| Clean Room | IST/RH sensors by QAS | Quarterly |
| PM Filter Cassettes | Leak Check by QAS | Monthly |
| PM Filters | Re-weighs by QAS | When field samples are weighed |
| Mass Reference Standards Weights | Working Vs. Primary by ATS and QAS | Quarterly |
| Transport/Storage Cooler Temperature | Min/Max Thermometers by QAS | Annual |

## 6.3 Site Locations

Site locations are available in the IDEM/OAQ/AMB Annual Network Plan and through http://idem.tx.sutron.com/. The locations and particulate parameters measured will depend on the type of monitoring network. Listed below are the different air monitoring networks where particulate parameters are collected.

### State and Local Air Monitoring Stations (SLAMS)

SLAMS consists of a national network of monitoring sites whose size and distribution is largely determined by the needs of state and/or local air pollution authorities.

### Special Purpose Monitoring (SPM)

SPM are designed/intended for use by state and local agencies to collect supportive data for development of SIPs and/or other specific targeted studies such as: point source identification, control strategy effectiveness, etc. If data is used for SIP purposes, SPM sites must meet all federal and state requirements for monitoring methodology and quality assurance.

### National Core Network/Photochemical Assessment Monitoring Station (NCore/PAMS) Monitoring

NCore is a multi-pollutant approach to monitoring. NCore sites are intended to support multiple objectives with a greater emphasis on assessment, research support, and accountability than the traditional SLAMS networks. NCore provides an opportunity to address new directions in monitoring and begin to fill measurement and technological gaps that have accumulated in the networks. Indiana operates one urban NCore site. These sites are required to measure $PM_{2.5}$, speciated $PM_{2.5}$, $PM_{10c}$, $O_3$, $SO_2$, CO, NO, true $NO_2$, $NO_y$, and meteorology. As of June 2019 PAMS is included at NCore sites located in a CBSA with a population of 1,000,000 or more.

### Near-Road Monitoring

On February 9, 2010, the U.S. EPA promulgated monitoring regulations for the $NO_2$ monitoring network. In the new monitoring requirements, state and local air monitoring agencies are required to install near-road $NO_2$ monitoring stations at locations where peak hourly $NO_2$ concentrations are expected to occur within the near-road environment in larger urban areas. Site selection is required to consider traffic volumes, fleet mix, roadway design, traffic congestion patterns, local terrain, and meteorology in determining where a required near-road $NO_2$ monitor should be placed. Indiana operates one near-road monitoring site. IDEM worked with INDOT to obtain a location for the site. The near-road site is required to measure NO, $NO_2$, CO, $O_3$, and meteorology. Toxics VOC's and particulates, such as $PM_{2.5}$, $PM_{1.0}$, and continuous speciation (black carbon/UVC) are also measured at this site.

### Chemical Speciation Network (CSN)

As part of the $PM_{2.5}$ NAAQS review completed in 1997, the U.S. EPA established a $PM_{2.5}$ CSN consisting of STN sites and supplemental speciation sites. The CSN is a component of the National $PM_{2.5}$ Monitoring Network. The goal of the National $PM_{2.5}$ Monitoring Network is to monitor if the NAAQS are being attained. However, CSN data is not used for attainment or nonattainment decisions, but are intended to complement the activities of the larger gravimetric $PM_{2.5}$ measurement network component. CSN data is used for multiple objectives, including:

- The assessment of data trends;
- The development of effective SIPs and determination of regulatory compliance;
- The development of emission control strategies and tracking progress of control programs;
- Aiding in the interpretation of health studies by linking effects to $PM_{2.5}$ constituents;
- Characterizing annual and seasonal spatial variation of aerosols; and
- Comparison to chemical speciation data collected from IMPROVE network.

## Section 7: Quality Objectives and Criteria for Measurement Data

The primary data quality objective is to ensure that the data collected by the AMB are consistent, of known and adequate quality, supported by adequate calibrations and evaluations, and sufficiently complete to describe the atmospheric state with respect to spatial and temporal distribution. Minimum QA requirements are listed in 40 CFR part 58 and its appendices. The data must meet the quality goals for representativeness, precision, bias, detectability, completeness, and comparability. Accuracy has been a term frequently used to represent closeness to "truth" and includes a combination of precision and bias error components. This term had been used throughout the CFR but has been replaced with bias when there is the ability to distinguish precision from bias. The quality system for the AMB air monitoring program focuses on understanding and controlling, as much as possible, measurement uncertainty and because of that, mainly focuses on precision, bias, detectability, completeness, and comparability. Representativeness is addressed through network designs and is not something that the quality system can control through better measurements.

Collecting quality data begins with properly trained staff and adequate funding to provide the necessary equipment that meets required performance specifications. High quality data also

relies on having adequate supplies available, safe monitoring locations that meet U.S. EPA siting requirements, and up-to-date QAPPs and TSOPs/SOPs.

Table 9 lists the objectives and how the AMB approaches each one.

**Table 9. Objective/Approach**

| Objective | Approach |
|---|---|
| Representativeness | The data collected will represent ambient air that the public is exposed to. Monitoring locations are selected to meet this objective and adhere to U.S. EPA requirements for siting. All sample inlets must be the proper height above the ground, and have a minimum distance from objects that could affect the representativeness of the results of the data collected as described in 40 CFR Part 58 Appendix E. Special purpose monitoring, Near-Roadway monitoring, and industrial-based monitoring have different siting requirements designed to meet these special monitoring objectives. Examples of siting include:<br>- Minimum of 10 meters from the dripline of trees<br>- Distance from sampler to any obstruction must be twice the height that the obstruction protrudes above the sampler<br>- Inlet height 2 to 15 meters above ground except $PM_{10}$ microscale, which is 2 to 7 meters above ground<br>- Ground is paved or has vegetative cover |
| Precision | Precision for $PM_{2.5}$, $PM_{10,}$ and TSP (for metals) samplers is estimated using concentration measurements from collocated samplers running concurrently. |
| Bias | The $PM_{2.5}$, $PM_{10}$, and Pb bias estimate is based upon the monthly flow rate verifications. For Pb analysis, relative percent differences between the audit concentrations (in µg Pb/strip) and the corresponding measured concentrations (in µg Pb/strip) are used to calculate analytical bias. |
| Detectability | The determination of the low range critical value of a characteristic that a method specific procedure can reliably discern. Maximum limits also apply. For the AMB particulate program this applies to $PM_{2.5}$ and $PM_{10}$ balances, Metals analysis, and $PM_{2.5}$ and $PM_{10}$ continuous data. |
| Completeness | The AMB strives to obtain the highest level of data capture or completeness as possible. Data completeness is defined as the number of valid measurements (meeting all QC and QA criteria) divided by the number of possible or scheduled measurements. All data must meet a minimum of 75% completeness. |

| Objective | Approach |
|---|---|
| Comparability | Ambient air monitoring is conducted in adherence to the established methods as published in 40 CFR Part 50 and 53 for national consistency and comparability. Participation in the Performance Evaluation Program (PEP), Metals Round Robin, $PM_{2.5}$ Round Robin as well as conference calls help ensure comparability. In addition, those who operate under their own PQAO in Indiana and submit air monitoring data into AQS will be subject to an annual evaluation by the QAS. |

## 7.1 Measurement Quality Objectives

To ensure the quality of the data, sampler calibrations and verifications are performed by the AMS. These checks help determine the validity of the data by ensuring that the samplers meet specific limits. Additional PE checks are performed independently by the QAS. The QA results assist with calculating statistical analysis of the data and can solidify the site operator's decision on the condition of the data. Tables 10 through 13 have the types of checks as well as limits for each type of particulate sampler. The procedures for this work are provided in the AMB TSOP's listed in section 6.2 of this QAPP.

**Table 10. AMS Intermittent Methods Data Assessment Requirements**

| **Type of Check: Calibration and Verification** | | |
|---|---|---|
| **Parameter Method** | **Assessment Method** | **Measured Quality Objectives** |
| $PM_{2.5}$ | Check of sampler flow rate; AT/FT; BP; External leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT/FT <±2.1ºC; BP <±10.1 mmHg; External Leak Check ≤25 mmHg; Time ≤5 minutes of local standard time; Date is correct;<br>NOTE: Flow must be calibrated <±2.1% of standard flow |
| $PM_{10}/PM_c$ | Check of sampler flow rate; AT/FT; BP; External leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT/FT <±2.1ºC; BP <±10.1 mmHg; External Leak Check ≤25 mmHg; Time ≤5 minutes of local standard time; Date is correct;<br>NOTE: Flow must be calibrated <±2.1% of standard flow |
| TSP for metals | Check of sampler flow rate; AT; BP; Time; Date | Flow <±7.1% of standard flow and must be in the range of 1.1 to 1.7 $m^3$/min. actual conditions; AT <±2.1ºC; BP <±10.1 mmHg; Time ≤5 minutes of local standard time; Date is correct; if using a 2025 for TSP, follow the $PM_{2.5}$ Measured Quality Objectives.<br>NOTE: Flow must be calibrated <±5.1% of standard flow |

| Parameter Method | Assessment Method | Measured Quality Objectives |
|---|---|---|
| $PM_{2.5}$ Speciation (SASS/Super SASS/URG) | Check of sampler flow rate; AT/FT; BP; Leak check; Time; Date | Flow <±10.1% of standard flow and must be in the range of 6.03 to 7.37 LPM actual conditions for SASS/Super SASS and 19.8 to 24.2 LPM actual conditions for URG; AT/FT <±2.1ºC; BP <±10.1 mmHg; Leak Check ≤0.1 L/min (SASS/Super SASS) and <225 mmHg (URG); Time ≤5 minutes of local standard time; Date is correct |

**Table 11. QAS Intermittent Methods Data Assessment Requirements**

| **Type of Check: Audit** | | |
|---|---|---|
| **Parameter Method** | **Assessment Method** | **Measured Quality Objectives** |
| $PM_{2.5}$ | Check of sampler flow rate; AT/FT; BP; External leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT/FT <±2.1ºC; BP <±10.1 mmHg; External Leak Check ≤25 mmHg; Time ≤5 minutes of local standard time; Date is correct |
| $PM_{10}/PM_c$ | Check of sampler flow rate; AT/FT; BP; External leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT/FT <±2.1ºC; BP <±10.1 mmHg; External Leak Check ≤25 mmHg; Time ≤5 minutes of local standard time; Date is correct |
| TSP for metals | Check of sampler flow rate: AT; BP; Time; Date | Flow <±7.1% of standard flow and must be in the range of 1.1 to 1.7 $m^3$/min. actual conditions; AT <±2.1ºC; BP <±10.1 mmHg; Time ≤5 minutes of local standard time; Date is correct; if using a 2025 for TSP, follow the $PM_{2.5}$ Measured Quality Objectives. |
| $PM_{2.5}$ Speciation (SASS/ Super SASS/URG) | Check of sampler flow rate; AT/FT; BP; Leak check; Time; Date | Flow <±10.1% of standard flow and must be in the range of 6.03 to 7.37 LPM actual conditions for SASS/Super SASS and 19.8 to 24.2 LPM actual conditions for URG; AT/FT <±2.1ºC; BP <±10.1 mmHg; Leak Check ≤0.1 L/min (SASS/Super SASS) and <225 mmHg (URG); Time ≤5 minutes of local standard time; Date is correct |

**Table 12. AMS Continuous Methods Data Assessment Requirements**

| **Type of Check: Calibration and Verification** | | |
|---|---|---|
| **Parameter Method** | **Assessment Method** | **Measured Quality Objectives** |
| $PM_{1.0}$ | Check of sampler flow rate; Time; Date | Flow <±5.1% of design value; Time ≤5 minutes of local standard time; Date is correct |

| Parameter Method | Assessment Method | Measured Quality Objectives |
|---|---|---|
| $PM_{2.5}$ | Check of sampler flow rate; AT; BP; Leak check; Zero; Dust; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check <1.5 L/min for basic and <0.3 L/min for advanced (BAM 1020), ≤15.0 mL/min for external and ≤5.0 mL/min for internal (TAPI 602), ≤0.2 µg/$m^3$ (TAPI T640 and T640x); Zero for TAPI T640 must be 0; Dust check for API T640 and T640x must be ± 0.5 of the standard bottle on peak channel; Time ≤5 minutes of local standard time; Date is correct;<br>NOTE: Flow must be calibrated <±2.1% of standard flow |
| $PM_{10c}$ | Check of sampler flow rate; AT; BP; Leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check <1.5 L/min for basic and <0.3 L/min for advanced (BAM 1020), ≤15.0 mL/min for external and ≤5.0 mL/min for internal (TAPI 602), ≤0.2 µg/$m^3$ (T640x); Time ≤5 minutes of local standard time; Date is correct;<br>NOTE: Flow must be calibrated <±2.1% of standard flow |
| $PM_{10}$ | Check of sampler flow rate; AT; BP; Leak check | Flow < ±7.1% of standard flow; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check ≤0.15 L/min (Main Flow TEOM), ≤0.60 L/min (Aux Flow TEOM); Time ≤5 minutes of local standard time; Date is correct |
| $PM_{2.5}$ Speciation (Aethalometer) | Check of sampler flow rate; Time; Date | Flow <±15.1% of standard flow; Leakage Test <10.0% (TAPI 633 and AE33); Time ≤5 minutes of local standard time; Date is correct |

**Table 13. QAS Continuous Methods Data Assessment Requirements**

| **Type of Check: Audit** | | |
|---|---|---|
| **Parameter Method** | **Assessment Method** | **Measured Quality Objectives** |
| $PM_{1.0}$ | Check of sampler flow rate; Time; Date | Flow <±5.1% of design value; Time ≤5 minutes of local standard time; Date is correct |
| $PM_{2.5}$ | Check of sampler flow rate; AT; BP; Leak check; Zero; Dust: Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check <1.5 L/min (BAM), ≤15.1 mL/min for external (API 602), ≤0.2 µg/m3 (TAPI T640 and T640x); Zero for API T640 must be 0; Dust check for API T640 and T640x must be ± 0.5 of the standard bottle on peak channel; Time ≤5 minutes of local standard time; Date is correct |

| Parameter Method | Assessment Method | Measured Quality Objectives |
|---|---|---|
| $PM_{10c}$ | Check of sampler flow rate; AT; BP; Leak check; Time; Date | Flow <±4.1% of standard flow and <±5.1% of design value; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check <1.5 L/min (BAM), ≤15.1 mL/min (External API 602), ≤5.1 mL/min (Internal API 602); ≤0.2 µg/m3 (T640x); Time ≤5 minutes of local standard time; Date is correct |
| $PM_{10}$ | Check of sampler flow rate; AT; BP; Leak check; Time; Date | Flow < ±10.1% of standard flow; AT <±2.1ºC; BP <±10.1 mmHg; Leak Check ≤0.15 L/min (Main Flow TEOM), ≤0.60 L/min (Aux Flow TEOM); Time ≤5 minutes of local standard time; Date is correct |
| $PM_{2.5}$ Speciation (Aethalometer) | Check of sampler flow rate; Time; Date | Flow <±15.1% of standard flow; Leakage Test <10.0% (TAPI 633 and AE33); Time ≤5 minutes of local standard time; Date is correct |

### 7.1.1 Field Blanks

Field blanks for intermittent $PM_{2.5}$ and $PM_{10}$ are collected at a frequency of 10% of the sampling runs scheduled per site. The validation acceptance criterion for field blanks is ±30 µg between weighings. If this limit is exceeded, further investigation will be performed, which may result in additional field blanks being deployed and potentially a QA qualifier or a null data qualifier being placed on any samples in question. Further information on field blanks is provided in 40 CFR Part 50 Appendix L and QA GD 2.12. Field blanks for intermittent $PM_{2.5}$ Speciation follow the U.S. EPA sampling schedule and follow U.S. EPA TSOPs/SOPs.

## 7.2 PEP Audits

$PM_{2.5}$ and Pb sampler bias is determined from the results of independent performance evaluation program (PEP) audits. The U.S. EPA or their designated contractor performs these audits. These audits are required as part of 40 CFR Part 58 Appendix A. Requirements for the PEP include:

- Each PQAO with five or less $PM_{2.5}$ and Pb monitoring sites are required to have five valid audits per year distributed across 4 quarters.
- Each PQAO with greater than five $PM_{2.5}$ and five Pb sites would be required to have eight valid audits per year distributed across the 4 quarters.
- One hundred percent completeness.
- All samplers subject to an audit within 6 years.

Results of audit samples are reported to AQS by the U.S. EPA or the designated contractor.

## 7.3 Sampler Collocation

### 7.3.1 $PM_{2.5}$/$PM_{10}$

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is estimated by the use of a duplicate or collocated sampler at a selected monitoring location in a measurement network.

One sampler is designated as the reporting sampler and one sampler is designated as the collocated sampler. The collocated sampler must be maintained, operated, calibrated, verified, and audited in the same manner as the reporting sampler. Precision is calculated from the difference in the concentrations from the reporting and collocated samplers over a calendar quarter. All collocated samplers operate on a 1-in-6 day frequency except for $PM_{2.5}$ continuous collocated samplers, which operate continuously every day. For the intermittent samplers, this allows for approximately 15 data pairs (reporting & collocated concentrations) over each quarter for each site with collocated samplers. Estimates of network precision are made from review of three years of data.

Data is reported to the U.S. EPA AQS database for both the reporting and collocated sampler, regardless of concentration. However, %CV is calculated only from data pairs (reporting and collocated concentrations) when both values are greater than 3 $\mu g/m^3$. In addition, for the continuous method used for IDEM, all 24 hours for a day must be valid for the daily average to be used to calculate %CV. The duplicated sampler's inlet must be within 1 to 4 meters from the inlet of the reporting sampler's inlet, within 1 meter vertically, and must be at least 2 meters from the inlet of any other sampler inlets such as high volume samplers (e.g. TSP or older style $PM_{10}$). Five $PM_{2.5}$ (four intermittent and one continuous) and two $PM_{10}$ (both intermittent) sites have collocated samplers. These numbers meet the CFR/U.S. EPA requirement.

Collocation also is performed between a $PM_{2.5}$ intermittent FRM sampler and $PM_{2.5}$ continuous FEM samplers used in the network. The AMB has one $PM_{2.5}$ intermittent sampler, which is collocated each quarter at a site which operates a $PM_{2.5}$ continuous sampler. The data from the $PM_{2.5}$ intermittent sampler is used only to assist the AMS in determining if and when issues come up with data collection from $PM_{2.5}$ continuous samplers. Although the sampler is treated the same as other intermittent samplers in the network, as for verifications, audits, etc., the $PM_{2.5}$ intermittent data from the traveling sampler is not reported to AQS or used for any type of attainment status.

Equations used to calculate precision from reporting and collocated data pairs are stated in 40 CFR Part 50 Appendix L and 40 CFR Part 58 Appendix A. The U.S. EPA also has an online spreadsheet to calculate the %CV located at https://www3.epa.gov/ttn/amtic/qareport.html.

The %CV will determine what corrective action, if any, is needed. A precision data quality objective of 10% CV is used, which is based upon the evaluation of 3 years of collocated precision data. CV values ≥10.1% may occur within that 3 year period. However, single collocated pairs with values ≥10.1% may require a re-weigh. If a single collocated pair is causing the quarterly CV to be ≥10.1%, then further investigation may warrant a QA qualifier on the reporting value or a null data qualifier is applied to one or both the reporting and collocated samples. The AMS and QAS are alerted by the ATS when filter weights indicate mass differences greater than 10%. Besides reweighs, operation solutions are investigated.

Besides collocated monitoring, precision estimates are also obtained using filter duplicates. During laboratory pre-weighing and post-weighing sessions, a filter from a batch is selected for a second weighing. The acceptable limit for the difference between the first post-weight and the second post-weight is 15 µg for clean filters and exposed filters. Failure may be due to transcription errors, microbalance malfunction, or the samples failing to reach equilibrium. Other

QC checks (balance standards and lab blanks) will eliminate microbalance malfunction. If the duplicate does not meet the criterion, a second sample is selected and re-weighed as a second duplicate check. If this second check fails the acceptance criterion and the possibility of balance malfunction and transcription errors have been eliminated, all samples in the batch are equilibrated for an additional 24 hours and re-weighed. Corrective actions continue until duplicate weights for the batch meet acceptance criteria.

### 7.3.2 Metals

Precision of the TSP monitoring for metals network is measured by the use of duplicate or collocated samplers. 40 CFR Part 58 Appendix A, Section 3.4, has the following requirements for a PQAO:

- Have 15 percent of the primary monitors (not counting non-source oriented NCore sites in PQAO) collocated. Values of 0.5 and greater round up.
- Have at least one collocated quality control monitor (if the total number of monitors is less than three).
- The first collocated Pb site selected must be the site measuring the highest Pb concentrations in the network. If the site is impractical, alternative sites, approved by the U.S. EPA Regional Administrator, may be selected. If additional collocated sites are necessary, collocated sites may be chosen that reflect average ambient air Pb concentrations in the network.
- The two collocated monitors must be within 4 meters (inlet to inlet) of each other and at least 2 meters apart for flow rates greater than 200 liters/min or at least 1 meter apart for samplers having flow rates less than 200 liters/min to preclude airflow interference.
- Sample the collocated quality control monitor on a 1-in-12 day schedule. Report the measurements from both primary and collocated quality control monitors at each collocated sampling site to AQS. The calculations for evaluating precision between the two collocated monitors are described in section 4.2.1 of 40 CFR Part 58 Appendix A.

IDEM adheres to these requirements and operates at least one collocated TSP sampler for Pb. The collocated sampler operates on a 1-in-6 day schedule. The collocated sampler inlet is located between 2 to 4 meters from the reporting sampler inlet, and within 1 meter vertically. While the reporting sampler's data is used for reporting air quality, the collocated sampler's data is used to calculate network precision. Calibrations, verifications, audits, sampling frequency and duration, and analysis are conducted in the same manner for each sampler. The percentage differences between the lead concentrations ($\mu g/m^3$) from the two samplers are used to determine precision, however, for precision assessments, the minimum concentration level for both samplers has to be $\geq .02\ \mu g/m^3$. The calculations are described in detail in 40 CFR Part 58 Appendix A, Section 4.2.

The %CV will determine what corrective action, if any, is needed. The precision data quality objective of 20% CV is based upon the evaluation of 3 years of collocated precision data. CV values of ≥20.1% may occur within that 3 year period. However, if a single collocated pair is causing the quarterly CV to be ≥20.1%, then further investigation may warrant a QA qualifier on the reporting value or a null data qualifier be applied to both the reporting and collocated samples. The AMS and QAS are alerted by the ATS when concentration differences exceed 10%. Besides reanalysis, operation solutions are investigated.

### 7.4 Metals Strip Audits

Metals Strip Audits will consist of Pb, Mn, and As. For Pb, six audit strips prepared by the QAS are required to be analyzed by the ATS each quarter. Although Mn and As have no federal requirement, the QAS will treat these similar to how they do Pb. The QAS uses a factory certified reference standard solution to make the strips. The QAS also uses its own pipettes. The audits are comprised of three strips at each of two different concentration ranges plus a blank. Only the low and high concentration results are reported to AQS. The lower concentration range for Pb is 9-30 μg/strip and the higher concentration for Pb is 60-90 μg/strip. The Manganese and Arsenic ranges will be determined as the program progresses. The strips are provided to the ATS monthly. Six strips (one low and one high concentration for each metal) as well as one blank are analyzed each month. Results are sent to the QAS and evaluated. If results are ≥10.1% then action will be taken by the ATS to see if the difference can be reduced. This may require examining the ATS equipment to see if maintenance is needed, re-run the samples, and report back the findings to the QAS. Data can potentially be impacted with a QA data qualifier or a null data qualifier although each investigation into the differences occurring will dictate the specific actions taken and the final results. Two additional Pb strips, which are obtained by the QAS from a U.S. EPA contracted laboratory, are also provided to the ATS for analysis each month as part of the PEP program. Results of these findings are treated the same as the strips prepared by the QAS and reported to AQS.

## Section 8: Training

Formal staff training is scheduled to train new employees and periodically update employees' skills and program operations. Formal staff training is coordinated with the Section Chiefs, senior level staff, or parameter specialists of the AMS, QAS, and ATS of the AMB on an as needed basis for those person(s) engaged in the following: operating, calibrating, verifying, validating, and auditing analyzers/samplers; laboratory procedures; field duties; safety; and any other items related to work performed by staff in the AMB. The training for staff is tracked and documented by the individual section chiefs, except for any in-house training pertaining to computer safety, which is documented by the IDEM computer staff but able to be tracked by individual section chiefs. Standard literature references are readily available to all staff members including the Federal Register, manufacturer's instrument manuals, and QA GD's related to the program objectives. Courses and other training are also provided through U.S. EPA and vendors.

## Section 9: Documentation and Records

The goal of IDEM is to collect data that is accurate and representative of the actual conditions. For this to occur, documentation and record keeping have to be performed at a high level of accuracy and be consistent amongst all participants who are part of the PQAO. The AMB shared drive is only available to AMB staff which helps secure any tampering issues. Documents on the extranet can only be seen by IDEM staff. Documents on the extranet and internet can only be changed by the IDEM computer staff. Documentation in LEADS is secure and cannot be changed once entered. Data in LEADS can be changed only by AMS(s) Chiefs and staff. This procedure is provided in the AMB TSOP "Gaseous Data Validation Using LEADS". The QA laboratory cabinet is located in a secure location with limited access to others. Table 14

summarizes what documentation is involved, location of these documents, retention time, and the main custodian. All records are either kept at the minimum requirements as addressed in the IDEM QMP, or kept indefinitely.

**Table 14. Documents and Records**

| Document | Location | Retention Time | Custodian |
|---|---|---|---|
| ANP; 5 Year Network Plan; QAPP | IDEM internet and extranet; AMB shared drive | Latest on IDEM internet and extranet; AMB shared drive maintains previous versions | ANP and 5 Year Network Plan – AMS (1 and 2) Chief(s); QAPP – QAS Chief |
| TSOPs/SOPs | IDEM extranet; AMB shared drive | Latest on extranet; AMB shared drive maintains previous TSOPs/SOPs | QAS Program Coordinator and OPS |
| Logs | On-site computer hard drive if available; electronic log available through LEADS; $PM_{2.5}$, $PM_{10}$, and intermittent $PM_{2.5}$ speciation also have paper log books kept at the site | Electronic logs kept indefinitely; Existing site log books kept indefinitely; If paper log book runs out of space or sampler is pulled it is kept at AMS Lab indefinitely; Discontinued site log books retained 7 years | AMS Environmental Manager LEADS Administrator for continuous data; AMS parameter specialist for intermittent data |
| Intermittent $PM_{2.5}$ and $PM_{10}$ Data Sheets | Binders (organized by site) on bookshelf, then VFC | 1 year in binders; VFC maintains indefinitely | AMS parameter specialist |
| Intermittent $PM_{2.5}$ and $PM_{10}$ Gravimetric Data | GLIMS | Minimum of 3 years | ATS Chief |
| Intermittent $PM_{2.5}$ and $PM_{10}$ Calibration and Verification Forms | File cabinets in AMB office area | Kept indefinitely | AMS parameter specialist |
| Intermittent $PM_{2.5}$, $PM_{10}$, TSP, and $PM_{2.5}$ Speciation Audit Forms | AMB shared drive | Kept indefinitely | AMS parameter specialist |
| Intermittent $PM_{2.5}$, $PM_{10}$ and Speciation Field Log Books | Kept with sampler | Stays at the site unless book runs out of space or sampler is pulled; then kept at AMS Lab indefinitely | AMS parameter specialist |
| Intermittent TSP Data Cards | ATS laboratory for 1 year, then warehouse | 5 years | ATS Chief |

| Document | Location | Retention Time | Custodian |
|---|---|---|---|
| Intermittent Metals Lab Analysis Data | AMB shared drive | AMB shared drive maintains previous years of data | ATS Chief |
| Intermittent TSP Calibration and Verification Forms | Kept with parameter specialist and AMB shared drive | Kept indefinitely | AMS parameter specialist |
| Intermittent $PM_{2.5}$ Speciation Data Sheet; Intermittent $PM_{2.5}$ Speciation Calibration and Verification Forms | AMS Files | Minimum of 3 years | AMS parameter specialist |
| Continuous $PM_{1.0}$, $PM_{2.5}$, $PM_{10}$, and $PM_{2.5}$ Speciation Data | LEADS | LEADS maintains data indefinitely | AMS Environmental Manager LEADS Administrator for continuous data |
| Continuous $PM_{1.0}$, $PM_{2.5}$, and $PM_{10}$ Calibration Forms | AMS Files | Kept indefinitely | AMS parameter specialist |
| Continuous $PM_{1.0}$ Verification Form | AMS Files; AMB shared drive | Kept indefinitely | AMS parameter specialist |
| Continuous $PM_{1.0}$, $PM_{2.5}$, $PM_{10}$, and $PM_{2.5}$ Speciation Audit Forms | AMB shared drive | Kept indefinitely | AMS parameter specialist |
| Continuous $PM_{2.5}$ and $PM_{10}$ Verification Forms | AMS Files; AMB shared drive | Kept indefinitely | AMS parameter specialist |
| Continuous $PM_{2.5}$ Speciation Data Disk | Data put on AMB shared drive and uploaded to LEADs after validation; disk then used again | LEADS maintains data indefinitely | AMS parameter specialist |
| Continuous $PM_{2.5}$ Speciation Calibration and Verification Forms | AMS Files | Minimum of 3 years | AMS parameter specialist |
| Continuous $PM_{2.5}$ Verification Form | AMS Files; AMB shared drive | Kept indefinitely | AMS parameter specialist |
| $PM_{2.5}$ and $PM_{10}$ exposed filters | Fridge; then warehouse | 1 year in fridge then warehouse; disposed of after 5 years | ATS Chief |

| Document | Location | Retention Time | Custodian |
|---|---|---|---|
| TSP for metals exposed filters | ATS laboratory for 1 year, then warehouse | 5 years | ATS Chief |
| $PM_{2.5}$ BAM tape | AMS laboratory | 1 year | AMS parameter specialist |
| Quarterly Comparison of Weights used for PM Gravimetric | On balance desktop | 5 years | ATS Clean Room Supervisor |
| PM Diary | Log book in lab; pre-2011 archived on balance desktop | 5 years | ATS Clean Room Supervisor |
| PM Data Memos Generated by ATS | Send via e-mail; not saved by ATS | N/A | QAS Chief |
| $PM_{2.5}$ and $PM_{10}$ balance service logs | Stored on the instrument PC then moved to shared drive | Kept indefinitely | ATS Clean Room Supervisor |
| Atomic Absorption Method Detection Limits as per 40 CFR Appendix B to Part 136 | AMB shared drive | Kept indefinitely | ATS Gases Supervisor |
| QAS Data Memos; QAS Data Checks; QAS Exceedance Reports; and Site Evaluations | AMB shared drive; VFC; site evaluation record also on LEADS | Kept indefinitely | QAS Chief |
| Calibrations, Certifications, and Verifications performed by the QA laboratory | AMB shared drive | Information kept at least 3 years unless item is still in circulation then kept indefinitely | QA Laboratory Manager |
| NIST-traceable Certifications | QA laboratory cabinet file | Indefinitely | QA Laboratory Manager |

## Section 10: Network Description (or Sampling Process Design)

Particulate sampling is primarily conducted in population centers per U.S. EPA requirements. Additional sites are also operated to establish rural background concentrations, provide statewide as well as regional coverage, and for areas of specific interest, such as sources and near road. The IDEM ANP provides information on sites and can be found at https://www.in.gov/idem/airquality/2389.htm

Network design and sampler siting are established based on 40 CFR Part 58 Appendices D and E, and is mentioned in Sections 6 and 7 of this QAPP.

## Section 11: Sampling Method Requirements

Sampling equipment and procedures follow 40 CFR Part 50 Appendices B, G, J, and L. Specific instructions on technical aspects of these procedures can be found in the sampler's manual as well as the following AMB TSOPs/SOPs; "Tisch Environmental Hi-Vol+ Calibration/Maintenance", "Thermo Fisher Scientific SHARP 5030 Monthly Verification/Maintenance", "2025 A/B Sequential Air Sampler Calibration and Maintenance", "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Calibration/Maintenance", "URG 3000N Calibration/Maintenance", "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Verification/Maintenance", "Thermo Fisher Scientific SHARP 5030 Calibration/Maintenance", "URG 3000N Verification/Maintenance", 'Magee Scientific AE21 and AE22 Aethalometer Verification/Maintenance", "TAPI 633 Aethalometer Verification/Maintenance", "2025 A/B Sequential Air Sampler Verification and Maintenance", "TAPI Beta 602 Verification/Maintenance", "Met One Instruments Speciation Air Sampling System (SASS) Calibration/Maintenance", "Met One Instruments Speciation Air Sampling System (SASS) Verification/Maintenance", "Thermo Fisher Tapered Element Oscillating Microbalance (TEOM) 1405 Verification/Maintenance", "Thermo Fisher Scientific 2025i Verification/Maintenance", "TAPI T640 Verification/Maintenance", and "Tisch Environmental Hi-Vol+ Verification/Maintenance". The AMB maintains a complete set of TSOPs/SOPs for all procedures, which is available through the AMB shared computer drive and the IDEM website, https://extranet.idem.in.gov/main.php?section=standards&page=sops.

### 11.1 Sampling Equipment

The AMB utilizes samplers that meet established federal reference or equivalent method requirements except for some particulate sampling designated as non-criteria (see table 15). Documentation of changing out instrumentation or a method change at a site is made in the site LEADs program.

**Table 15. PM Sampling Equipment**

| Parameter | Reference Method | Monitor Type | Sample Frequency |
|---|---|---|---|
| $PM_{1.0}$ Continuous | No Federal Reference Method | TSI 3783 | Continuous |
| $PM_{2.5}$ Intermittent | Manual Reference Method: RFPS-0498-118 | Thermo Scientific 2025<br>Thermo Scientific 2025i | Manual, 3-day, and 6-day |
| $PM_{2.5}$ Continuous | Automated Equivalent Method: EQPM-0609-184 | Thermo Scientific 5030 SHARP | Continuous |
| $PM_{2.5}$ Continuous | Automatic Equivalent Method: EQPM-0912-204 | TAPI 602 | Continuous |

| Parameter | Reference Method | Monitor Type | Sample Frequency |
|---|---|---|---|
| $PM_{2.5}$ Continuous | Automatic Equivalent Method: EQPM-0516-236 | TAPI T640 | Continuous |
| $PM_{2.5}$ Continuous | Automatic Equivalent Method: EQPM-0516-238 | TAPI T640X | Continuous |
| $PM_{2.5}$ Continuous | Automated Equivalent Method: EQPM-0308-170 | Met One Instruments BAM 1020 | Continuous |
| $PM_{10c}$ Intermittent | Manual Reference Method: RFPS-0509-176 | Thermo Scientific 2025<br>Thermo Scientific 2025i | Manual, 3-day or 6 -day |
| $PM_{10c}$ Continuous | Automated Equivalent Method: EQPM-0709-185 | Met One Instruments BAM 1020 | Continuous |
| $PM_{10c}$ Continuous | Automated Equivalent Method: EQPM-0912-206 | TAPI 602 | Continuous |
| $PM_{10c}$ Continuous | Automated Equivalent Method: EQPM-0516-240 | TAPI T640X | Continuous |
| $PM_{10}$ Intermittent | Manual Reference Method: RFPS-1298-127 | Thermo Scientific 2025<br>Thermo Scientific 2025i | Manual, 3-day and 6-day |
| $PM_{10}$ Continuous | Automated Equivalent Method: EQPM-0516-239 | TAPI T640X | Continuous |
| $PM_{10}$ Continuous | Automated Equivalent Method: EQPM-1090-079 | Thermo Scientific 1405 | Continuous |
| TSP for Metals Intermittent | Manual Reference Method: 40 CFR Part 50, Appendix B | Tisch Environmental Sampler<br>Thermo Scientific 2025<br>BGI PQ100 | Manual, 6-day |
| $PM_{2.5}$ Speciation Intermittent | No Federal Reference Method | Met One Super SASS and SASS; URG 3000N | Manual, 3-day at PAMS, 6-day at other sites |
| $PM_{2.5}$ Speciation Continuous | No Federal Reference Method | Magee Scientific AE21-ER, AE22-ER, AE33 and TAPI 633 Dual Channel Aethalometer | Continuous |

## 11.2 Sampling Procedures

Below is a summary on the method of how each particulate is sampled. Specific concepts and procedures are provided in the instrument's operating manual.

### 11.2.1 Intermittent

- $PM_{2.5}$ – Samples are collected on pre-weighed 46.2 mm teflon filters over a 24-hour period. Data is collected from the sampling events on paper records and manually entered into an electronic log. Data from the sampler is also downloaded monthly. Upon return from the field, filters are re-acclimated to clean room conditions and then re-weighed in the AMB clean room(s).
- $PM_{10}$, $PM_c$ – Samples are collected on pre-weighed 46.2 mm teflon filters over a 24-hour period. Data is collected from the sampling events on paper records and manually entered into an electronic log. Data from the sampler is also downloaded monthly. Filters are weighed in the AMB clean room(s) following the same protocol as for $PM_{2.5}$ samples. $PM_{10}$ can be used with $PM_{2.5}$ to calculate $PM_c$.
- Metals – Samples are collected on 8" x 10" high purity glass microfiber filters over a 24-hour period. Data is collected from the sampling events on paper records and manually entered into an electronic log. Data from the sampler is also downloaded monthly. Analysis for metals is performed at the ATS's Laboratory utilizing U.S. EPA method EQL-0380-044, or Flameless Atomic Absorption Spectrometry method.
- $PM_{2.5}$ Speciation – Samples are collected using the SASS, Super SASS, and the URG 3000N. The SASS and Super SASS each use two separate filter media to collect the $PM_{2.5}$ samples. Each medium is analyzed separately for different components. This includes: teflon filter for thirty three (33) trace metals, using Energy Dispersive X-ray Fluorescence; and nylon filter for sulfates, nitrates, and three (3) cations (ammonium, potassium, and sodium), using ion chromatography. The URG uses a quartz filter medium for carbon analysis using thermal optical reflectance. Data is collected from the sampling events on paper records as well as data downloads. Filters are analyzed by a U.S. EPA contractor.

### 11.2.2 Continuous

Continuous particulate samplers are located in some type of shelter, whether it be an IDEM air monitoring trailer or a room located inside a building. The samplers are required to operate under specific operating temperatures. Table 16 lists the temperature range required for each type of sampler for data collected to be valid. The standard deviation limit is to provide temperature stability information and is not necessarily an indication of a temperature infraction resulting in invalid data.

**Table 16. Continuous Particulate Sampler Indoor Temperature Requirements**

| Sampler | Temperature Range |
|---|---|
| TAPI 602<br>Magee Aethalometer AE21, AE22, AE33<br>Thermo Scientific 5030 SHARP<br>Thermo Scientific TEOM 1405 | 0.0 to 40.0 °C; < 2.1°C SD over 24 hours |

| Sampler | Temperature Range |
|---|---|
| Met One Instruments BAM-1020<br>TAPI T640<br>TAPI T640X | 0.0 to 40.0 °C; < 2.1°C SD over 24 hours |
| TSI 3783<br>TAPI Aethalometer 633 | 10.0 to 40.0 °C; < 2.1°C SD over 24 hours |

- $PM_{1.0}$ – The TSI 3783 monitor is a continuous laminar flow condensation particle counter that uses water as its working fluid. It provides rapid, high-precision measurement of the numbers of ultrafine (down to 7 nm) airborne particles. The monitor draws in an air sample through a SCC and counts the number of particles in that sample to provide a particle concentration value that is displayed as the number of particles detected per cubic centimeter of sampled air.
- $PM_{2.5}$, $PM_{10}$, $PM_c$ – Ambient air is drawn into sampler through an air inlet followed by an exchangeable filter cartridge or filter tape, where the particulate mass collects. The inlet system is equipped with a sampling head which separates particles of either a 2.5 µm or 10 µm diameter ($PM_{2.5}$ or $PM_{10}$). The sampled air proceeds through the sensor unit; microbalance for the TEOM, beta attenuation for the BAM and TAPI 602, scattered light spectrometry for the TAPI T640 and TAPI 640X, and hybrid nephelometer/beta attenuation for the SHARP. Data is collected continuously. The TAPI 602 and 640x calculate $PM_c$.
- $PM_{2.5}$ Speciation – An Aethalometer is used to continuously collect a variety of carbon species. The models used in Indiana's air monitoring network allow measurement in two wavelengths of light; 880 nm (infrared) and 370 nm (ultraviolet). This distinction can aid in determining the source of carbon; diesel exhaust, wood smoke, etc. The Aethalometer uses filtration and optical measurement to provide continuous concentration data. The sample gas is pulled through a quartz fiber filter tape, where the aerosol black carbon is deposited. The Aethalometer continually analyzes the sample gas as the sample is collecting. Once the filter tape has reached a set attenuation, it advances. The Aethalometer passes a beam of light through the sample depositing on the filter tape. The detector measures the amount of light transmitted through the sample. This quantity is linear proportional to the black carbon in the filter deposit. The data is collected on a disk. The disk is changed out monthly.

### 11.3 Failed Sample Events

In the event of a failed sample that was not collected according to specific requirements, for intermittent samplers the AMS will record information on the chain of custody form, giving detailed information why the sample is invalid or if a qualifier needs added. If a QAS auditor finds an issue, then a memo will be sent to the AMS, who will then confirm the results. A detailed log is also entered in LEADS for the specific site, whether it be for an intermittent or a continuous particulate sampler. The EPA contract lab for $PM_{2.5}$ intermittent speciation may also apply null codes and qualifiers, which will be reviewed by the AMS and QAS.

## Section 12: Sample Handling and Custody

### 12.1 Sample Handling

The actual handling of samples includes intermittent $PM_{2.5}$, intermittent $PM_{10}$, intermittent TSP for metals, and intermittent $PM_{2.5}$ speciation. Samples are handled as specified in AMB TSOPs/SOPs listed in this QAPP. The major components of sample handling includes: labeling, sample collection, and transportation. The continuous particulate sampling provides its data through telemetry as well as on data disks.

### 12.2 Sample Labeling

The labeling or proper marking of samples and monitoring devices will help to ensure positive identification throughout the sampling and analysis process. When ink is used, it is indelible and unaffected by the gases and temperature to which it is subjected. When errors are made, corrections are made by crossing a single line through the error and entering the correct information. All corrections are initialed and dated by the person who makes the change. If possible, all corrections are made by the individual who made the error. Bar code identification is also used and it does not impair the capacity of the filter to function. An example of this is in the AMB TSOP, "Analysis of Both $PM_{2.5}$ and $PM_{10}$ Particulate Matter Using GLIMS Software". All transport containers have a unique identification to exclude the possibility of interchange. The I.D. number of the filter or sample card is recorded and accompanies the sample. The sample is properly handled to ensure that there is no contamination and that the sample analyzed is actually the sample taken under the condition reported. Any security measures taken are documented by written record.

All intermittent samples are accompanied by a Chain of Custody form. Samples are labeled and identified with the following information using an indelible marking device:

- Sample location
- Sample number
- Parameter(s) sampled (i.e., $PM_{2.5}$, $PM_{10}$, Pb)
- Time of sampling/removal
- Date of sampling/removal
- Operator signature
- Sampling equipment identification (i.e., motor number)
- Flow controlling device identification
- Sampling conditions (i.e., meteorological data, flow readings, etc.)

For samples that the ATS does the actual analysis, laboratory data books serve as Chain of Custody since the following information is contained in those lab books:

- Date samples were received in the laboratory
- Signature or initials of sample custodian
- Identification of samples (filter numbers)
- Date of sample analysis/signature or initials of analyst
- Date the filter was quality assured; includes signature or initials of QAS staff member

- Parameters analyzed/results
- Disposition of samples

After completing the analysis of the $PM_{2.5}$ and $PM_{10}$ samples, they are stored in the original field filter card/slide for 1 year in a fridge located in a limited access area. After one year, filters are stored in a warehouse, then disposed of after five years. TSP for metals are also stored for one year in a limited access area then stored in a warehouse. After five years the filters are disposed.

When samples collected at one location are mailed or hand carried to another agency for analysis, the Chain of Custody procedures are followed. All samples are accompanied by a Chain of Custody form. These forms include who relinquishes the sample and the signature of the person(s) who receives the sample(s). All samples are hand carried or sent by a reputable courier service such as the U.S. mail. The shipping packages are sealed. Once the samples have been delivered to the laboratory, the addressee or a designated substitute makes sure the package has not been tampered with. The addressee will then open the package and verify the contents. The staff person will sign on the accompanying form that the packages were or were not received in the original package and that all appropriate information has been addressed. The samples are logged in at the laboratory facility and placed in a limited access area until and during analysis. When dealing with multiple parameters in the same package container, each technician or analyst handling the samples or portions of the sample indicates handling by signing the Chain of Custody form.

### 12.3 Sample Collection

Once the sampling process has occurred, the sample is carefully removed from the monitoring device and placed in a sealed, nonreactive container. The sealing process depends on the type of container used. This is done to protect the sample from accidentally being exposed, and if there is a possibility of tampering, then self-adhesive stickers are needed that can be signed by the sample handlers.

### 12.4 Sample Transportation

During the transportation of samples and other monitoring data, it is important to eliminate the possibility of tampering, accidental destruction, and any physical or chemical action on the sample. The person who has custody of the samples or other data must be able to testify that no tampering has occurred. Security is maintained continuously.

### 12.5 Sample Custody

A sample or data is considered under a person's custody if:

- it is in a person's physical possession
- in view of the person after he has taken possession
- secured by that person so that no one can tamper with the sample
- secured by that person in an area restricted to authorized personnel

The fewer people handling samples and data, the better, and anyone who does handle such samples or data will be associated with the project. When mailing data to its reduction point, transportation precautions will be followed to avoid tampering.

Intermittent $PM_{2.5}$, $PM_{10}$, and $PM_{2.5}$ speciation samplers will have a logbook kept at the site. Any work performed will be documented in the logbook. All sites will also have an electronics log, which is kept in LEADS.

### 12.6 Continuous Monitoring Data

Unique Chain of Custody problems may occur with fully automated data acquisition systems. No one possesses the data as it travels from the sampling site to the data processing facility. Reporting organizations must maintain Chain of Custody procedures for printouts. When continuous data arrives at the point of reduction (e.g. laboratory, AMB office) and there is a physical exchange of possession, a Chain of Custody form must accompany the data.

### 12.7 Limited Access

The AMS will maintain all monitoring devices in an area of limited access (i.e., lock rooms or stations and allow access to only those personnel whose work requires their entry into the area).

### 12.8 Installation and Removal of Data Cards

Anytime a continuous monitoring data card is installed in or removed from an analyzer, e.g. Aethalometer, the following information is documented:

- Sample location
- Parameter(s) sampled
- Time of installation/removal
- Date of installation/removal
- Operator identification

### 12.9 Storage of Raw Data

After the data is reduced and quality assured, it will be stored for a minimum of three years, according to the OAQ guidelines. These guidelines can be found in the Indiana Archives and Records Administration, Retention Schedules:

https://www.in.gov/iara/3262.htm

### 12.10 Photographs and Digital Still Images

When photographs or digital images are taken for purposes of documenting and to support a field investigation, such as a QAS site evaluation, a record of each exposure or image will be saved as a file on an AMB shared drive on the computer. The following information will be recorded:

- The site name and what it shows will be part of the file's name, which will be stored based on the year it was taken. For example, file name "Gary IITRI SE" stored under the path QA\Site Information\Site Photos\Gary IITRI\2020.
- The name of the individual who took the photograph or digital image will correspond to any paperwork, such as a site evaluation form. If no paperwork is used, a log entry in LEADS is adequate.

### 12.11 Equipment Documentation

Any equipment used in the particulate program to perform calibrations, verifications, and audits

will have documentation kept on it. A certification file will be kept for each item and stored in the QA laboratory and on the AMB shared drive.

## Section 13: Analytical Methods

The staff in the AMS collects filters for intermittent $PM_{2.5}$, $PM_{10}$, $PM_{2.5}$ Speciation, and TSP for metals. These filters are then taken back to the office where they are prepared to be analyzed by the ATS. Intermittent $PM_{2.5}$ speciation filters as well as chromium and other specific metals are analyzed by a U.S. EPA contracted laboratory.

### 13.1 Laboratory Requirements for $PM_{2.5}$ and $PM_{10}$

Laboratory requirements for $PM_{2.5}$ and $PM_{10}$ sampling includes two clean room for the conditioning and weighing of the intermittent $PM_{2.5}$ and $PM_{10}$ filters.

### 13.2 Filter Conditioning and Weighing Area for $PM_{2.5}$ and $PM_{10}$

The AMB has two clean rooms for the conditioning and weighing of the $PM_{2.5}$ and $PM_{10}$ filters. The clean rooms are a restricted access area that meets the criteria in CFR Part 50 Appendix L and U.S. EPA's QA GD 2.12, "Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods". These criteria include:

- mean temperature of 20.0-23.0 °C
- temperature controlled within ±2.0 °C standard deviation over 24 hours
- mean humidity maintained at 30.0-40.0%
- humidity control ±5.0% standard deviation relative humidity over 24 hours
- temperature and relative humidity is continuously monitored with 5-minute averages, collected by a data logger and information saved to a computer hard drive

In addition, NIST-traceable QAS certified relative humidity and temperature measurement instruments are maintained.

### 13.3 Filter Preparation and Analysis for $PM_{2.5}$ and $PM_{10}$

Upon delivery of approved 46.2 mm Teflon filters, receipt of the $PM_{2.5}$ and $PM_{10}$ filters are documented, and the filters are stored in the clean room. Storing filters in the clean room makes it easier to maximize the amount of time available for conditioning. Upon receipt, cases of filters which are already labeled with a lot number and filter numbers are opened one at a time and placed in the pre-sampling weighing section of the clean room for pre-conditioning for 24 hours and used completely before opening another case. When more than one case is available for use, the "First In - First Out" rule applies. Filters are retrieved from the case for candling (inspect filter under light) to check for any damage to the filter. Damaged filters are thrown away. All other filters are put in petri dishes (kept in numerical order) and allowed to equilibrate to the clean room condition for at least 24 hours prior to use for labeling and then filters are ready for sampling procedures accordance with 40 CFR Part 50 Appendix L.

### 13.4 Sample Weighing for $PM_{2.5}$ and $PM_{10}$

The ATS uses a Mettler Model XP2U microbalance for the gravimetric analysis of the samples. This instrument meets all criteria set forth in 40 CFR Part 50 Appendix L and is maintained

under agreement with the manufacturer. Two sets of Troemner weights are used as primary and working standards. The detailed procedure for the handling and analysis of samples is found in the AMB TSOP, Analysis of Both $PM_{2.5}$ and $PM_{10}$ Particulate Matter Using GLIMS Software.

Both pre and post sample filters are weighed on the exact same Mettler XP2U balance. However, if one of the clean rooms would not be in operation due to issues, then weighing on the other's clean room balance may occur. All weighing is done by the same ATS laboratory personnel whenever possible. Refer to table 17 for additional information regarding filter preparation and analysis checks.

**Table 17. Filter Preparation and Analysis Checks**

| Activity | Method and Frequency | Requirements |
|---|---|---|
| Microbalance Use | Annual calibration/certification. | Resolution of 1 $\mu$g, repeatability of 1 $\mu$g. |
| Control of balance environment | QC checks to keep conditions within 2.0˚C SD and 5.0% RH SD. | Climate-controlled, draft-free room or equivalent. |
| Use of Mass reference standards | Annual calibration/certification; also working standards checked every 3 to 6 months against laboratory primary standards. | Standards bracket weight of filter, individual standard's tolerance less than 25 $\mu$g, handle with smooth, clean, nonmetallic forceps. |
| Filter handling | Observe handling procedure. | Use smooth, clean forceps. Replace $^{210}$Po antistatic strips every 6 months. |
| Filter integrity check | Visually inspect each filter. | No pinholes, separation, chaff, loose material, discoloration, or filter non-uniformity. |
| Filter identification | Label filter handling container (petri slide) with printed barcode assigned to the individual site; date and write the site name on protective container (magazine); and, write the filter number (last 3 digits) on laboratory data form in permanent ink. | Make sure numbers are written legibly. |
| Pre-sampling filter equilibration | Determine the correct equilibration conditions and period (at least 24 hours) for each new lot of filters. Observe and record the equilibration chamber relative humidity and temperature; enter on lab data form. | Check for stability of laboratory blank filter weights. Weight changes must be <15 $\mu$g before and after equilibration. Mean RH between 30.0 and 40.0 percent, with a variability of not more than 5.0% SD over 24 hours. Mean temperature is held between 20.0 and 23.0 °C, with a variability of not more than 2.0 °C SD over 24 hours. |
| Initial filter weighing | Observe all weighing procedures. Perform all QC checks. | Neutralize electrostatic charge on filters. Wait long enough so that the balance indicates a stable reading (oscillates no more than ±2 $\mu$g, drifts no more than 3 $\mu$g, in 5-10 sec). |

| Activity | Method and Frequency | Requirements |
|---|---|---|
| Internal QC | Zero the microbalance after each filter and reweigh one of the working standards after every ten filters. Weigh a laboratory blank filter with each weighing. Reweigh at least one filter per 25 filters (duplicate weighing). | The working standard measurements must agree to within 3 $\mu$g of the certified values. The blank and duplicate measurements must agree to within 15 $\mu$g. |
| Post-sampling inspection, documentation and verification | Examine the filter and field data sheet for correct and complete entries. If sample was shipped in a cooled container, verify that low temperature was maintained. | No damage to filter. Field data sheet complete. Sampler worked OK. |
| Filter Archival | Packed and kept in cold storage for one year from the sampling date. Once removed, kept onsite for a minimum of 5 years. | Cold storage (refrigerate, not frozen) for a minimum of 12 months. Then onsite storage in a clean, dry area, protected from light, vibrations, and dust sources. |

### 13.5 Environmental Control Requirements for $PM_{2.5}$ and $PM_{10}$

The temperature and relative humidity requirements for $PM_{2.5}$ are explicitly detailed in 40 CFR Part 50 Appendix L, QA GD 2.12, and detailed in this QAPP as well as the AMB TSOP "Analysis of Both PM2.5 and PM10 Particulate Matter Using GLIMS Software". $PM_{10}$ samples, which are operated on low volume samplers, are handled with the same standards. In the clean room, the filters are conditioned for a minimum of 24 hours prior to pre-weighing. Exposed filters are conditioned a minimum of 24 hours but no longer than 72 hours. The clean room temperature and relative humidity requirements are listed below in table 18. During transport from the clean room to the sample location, there are no specific requirements for temperature control; however, the filters are located in their protective container and excessive heat/cold is avoided. The temperature of the filter cassette during sampling operation and in the period from the end of sampling to the time of sample recovery shall not exceed that of the ambient temperature by more than 5 °C for more than 30 minutes. See table 18 for these temperature requirements.

**Table 18. Temperature and Humidity Requirements**

| Item | Temperature and Humidity Requirements |
|---|---|
| Clean Room | 20.0-23.0 °C; 30.0-40.0 %RH |
| Pre-weighed Filter | 20.0-23.0°C and within 2.0 °C SD, 30.0-40.0 %RH and within 5.0 %RH SD, for 24 hours prior to weighing |
| Filter Temperature Control during sampling and until recovery | No more than 5.0°C above ambient temperature |
| Post Sample Transport so that final weight may be determined up to 10 days after end of sample period | 25.0 °C or less |

| Item | Temperature and Humidity Requirements |
|---|---|
| Post Sample Transport so that final weight may be determined up to 30 days after end of sample period | 4.0 °C or less |

### 13.6 Permissible Holding Times for $PM_{2.5}$ and $PM_{10}$

IDEM adheres to the permissible holding times for the samples which are clearly detailed in 40 CFR Part 50 Appendix L, QA GD 2.12, and detailed in this QAPP as well as AMB TSOP's/SOP's. For the post sample filter storage temperature, IDEM maintains the 10 days even though both time frames are listed. All holding times are listed below in table 19.

**Table 19. Holding Time Restrictions for Filters**

| Item | Holding Time | Time Period |
|---|---|---|
| Pre-weighed Filter | ≤30 days | From date of Pre-weigh to date of sample |
| Recovery of Filter | ≤177 hours | From completion of sample period to time of sample recovery |
| Transport of Filter | <24 Hours (ideally) | From time of recovery to time placed in conditioning room |
| Post Sample Filter continuously stored at ≤25.0 °C | ≤10 days once sampling stops | From sample pickup date/time to date of post weigh |
| Post Sample Filter stored at ≤4.0 °C | ≤30 days once sampling stops | From sample pickup end date/time to date of post weigh |

### 13.7 Laboratory Requirements for TSP Filters for Metals

Laboratory requirements for TSP sampling for metals include an area in the ATS laboratory where unexposed filters are inspected and exposed filters are analyzed.

#### 13.7.1 Laboratory Area

The ATS prepares and analyzes filters in their laboratory. Lead, manganese, and arsenic analysis is conducted in accordance with U.S. EPA method EQL-0895-107. Certified reference standard solutions used for the analysis are stored in the ATS laboratory. Outlined in 40 CFR Part 50 Appendices L and M are the acceptance criteria for filters used in TSP monitoring for metals. Glass fiber filters are brittle and are easily broken. Care is taken at all times to avoid damage or contamination. An identification number is printed on each filter by the manufacturer. If filters are to be mailed to a laboratory for analysis, field personnel are equipped with reinforced envelopes and manila folders for the protection of the exposed filters.

All filters are inspected for defects before use. An effective method to inspect filters for defects is with a light-box. A light-box uses a low wattage light bulb to illuminate a clear or translucent surface. Laying an 8" x 10" filter on this lighted surface aides in the inspection process. Defective filters are not used for sampling. Some common defects include pinholes, loose material, discoloration, and non-uniform appearance.

Once unexposed filters have been inspected, they are placed back in the storage box they were received in then stored in the ATS laboratory until the AMS obtains them to be taken to the site.

Exposed Filters that are not to be analyzed immediately are stored within a protective covering to prevent damage and the loss of particulate matter. A filter holder card provides adequate protection and provides a means to record important sampling information. Care is used when removing the filter from the sampler. The glass fiber filters are brittle and easily damaged. Once the filter has been removed from the sampler, it may be folded along its long axis with the exposed side in and placed in the filter holder card. If any pieces of the filter are broken loose, place the pieces within the card. The holder card containing the folded filter can now be placed in an envelope for transport to the laboratory for analysis.

The AMS loop runner will normally use a filter cassette to transport filters to and from the site. After returning from the site, the exposed filter is returned while inside the cassette to the AMS environmental manager in charge of metals. A cover on the cassette protects the filter from damage or loss of sample. The AMS environmental manager will then remove the exposed filter form the cassette and place the filter in the filter holder card.

## Section 14: Quality Control Requirements

Quality control and acceptance criteria including time frames for field sampling and laboratory is detailed in sections 6, 7, and 13 of this QAPP. Table 20 lists the action taken for field items when results do not meet measured quality objectives. Table 21 lists the action taken for laboratory items when results do not meet measured quality objectives. TSOPs/SOPs mentioned throughout this QAPP describe these procedures. The TSOPs/SOPs are available on the AMB shared computer drive and also listed at the IDEM website, https://extranet.idem.in.gov/main.php?section=standards&page=sops.

**Table 20. Measured Quality Objective Checks and Outcomes**

| Check | Outcome |
|---|---|
| AMS Calibration Frequency | If more than 13 months have passed, data will be assigned a QA qualifier "1" if verifications and other checks indicate accurate data. If additional checks are not available, data is invalid from 13 months after the calibration until a new calibration is performed. Data is replaced with an "EC" null data qualifier. |
| AMS Verification Frequency | If a verification is missed, data may be assigned a QA qualifier "1" depending on further checks of the data, site inspections, QAS audits, etc. Any indication of an issue may invalidate data starting from the last passing verification up to a new passing verification. |
| AMS $PM_{1.0}$, $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation Flow Verification | Data invalid using appropriate null data qualifier back to last passing flow verification, unless there is sufficient evidence to indicate otherwise. |

| Check | Outcome |
|---|---|
| AMS $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation AT Verification | For $PM_{2.5}$, $PM_{10}$, and URG Speciation data invalid back to last passing AT verification using appropriate null data qualifier, unless sufficient evidence to indicate otherwise. For TSP and SASS/Super SASS Speciation, data suspect back to last passing AT verification. Further evidence may require a QA qualifier or a null data qualifier. |
| AMS $PM_{2.5}$, $PM_{10}$, $PM_{2.5}$ Speciation FT Verification | For $PM_{2.5}$ and $PM_{10}$, data suspect back to last passing FT verification. Further evidence may require a QA qualifier or a null data qualifier. For SASS/Super SASS Speciation, data invalid back to last passing FT verification using appropriate null data qualifier, unless sufficient evidence to indicate otherwise. |
| AMS $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation BP Verification | Data suspect back to last passing BP verification. Further evidence may require a QA qualifier or a null data qualifier. |
| AMS $PM_{2.5}$, $PM_{10}$, $PM_{2.5}$ Speciation External Leak Check | Data suspect back to last passing external leak check. Further evidence may require a QA qualifier or a null data qualifier. $PM_{2.5}$ and $PM_{10}$ require an internal leak check. |
| AMS $PM_{2.5}$, $PM_{10}$ Internal Leak Check | Data invalid back to last passing internal or external leak check using appropriate null data qualifier. |
| AMS $PM_{2.5}$ Dust Check | AMS will adjust the sampler. |
| AMS $PM_{2.5}$ Speciation Leakage Test | Data is screened back to last passing leakage test. Further evidence may require a QA qualifier or a null data qualifier. |
| QAS Audit Frequency | If an audit is missed in a quarter, then the next audit will occur as scheduled for the following quarter. Additional audits may be performed based on maintenance being performed on AMS equipment to improve results or for troubleshooting. |
| QAS $PM_{1.0}$, $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation Flow Verification | Data suspect back to last AMB check. AMS must follow up with a flow verification. |
| QAS $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation AT Verification | Data suspect back to last AMB check. AMS must follow up with an AT verification. |
| QAS $PM_{2.5}$, $PM_{10}$, $PM_{2.5}$ Speciation FT Verification | Data suspect back to last AMB check. AMS must follow up with an FT verification. |
| QAS $PM_{2.5}$, $PM_{10}$, TSP, $PM_{2.5}$ Speciation BP Verification | Data suspect back to last AMB check. AMS must follow up with a BP verification. |

| **Check** | **Outcome** |
|---|---|
| QAS $PM_{2.5}$, $PM_{10}$, $PM_{2.5}$ Speciation External Leak Check | Data suspect back to last AMB check. $PM_{2.5}$ and $PM_{10}$ require an internal leak check. AMS must follow up with an external leak check. |
| QAS $PM_{2.5}$, $PM_{10}$ Internal Leak Check | Data suspect back to last AMB check. AMS must follow up with an internal leak check. |
| QAS $PM_{2.5}$ Dust Check | AMS is informed of the results and follow up with their own check. |
| QAS $PM_{2.5}$ Speciation Leakage Test | Data suspect back to last AMB check. AMS must follow up with a leakage test. |
| Sampler run time | Data is invalid for any sample outside 1380 to 1500 minutes. However, when a sample period is less than 1,380 minutes, the measured concentration (as determined by the collected $PM_{2.5}$ mass divided by the actual sampled air volume), multiplied by the actual number of minutes in the sample period and divided by 1,440, may be used as if it were a valid concentration measurement for the specific purpose of determining a violation of the NAAQS. Data would then be valid but have a QA qualifier. |
| Sampler time | If the time is >5 minutes but within 60 minutes of the local standard time, a QA qualifier is applied to the data back to the last known accurate time check. If >60 minutes then a null data qualifier is used back to the last known accurate time check. |
| Sampler date | If the date is incorrect on the sampler, data is invalid back to the last known correct date. |
| PEP Audit | Data suspect back to last AMB check. AMS must follow up with a verification. QAS may provide assistance. |
| Sampler Collocation | Data suspect back to last known accurate concentration. AMS and ATS must follow up with a thorough review of all processes. QAS may provide assistance. |

**Table 21. Laboratory Measured Quality Objectives and Outcomes**

| Check | Outcome |
|---|---|
| Microbalance Calibration Frequency | If more than 13 months have passed, data will be assigned a QA qualifier "1" if other checks indicate accurate data. |
| Mass Reference Standards Calibration Frequency | If more than 13 months have passed, data will be assigned a QA qualifier "1" if other checks indicate accurate data. |
| Working vs. Primary mass reference standards fail check by ATS and QAS | Further evaluation will determine which weights are inaccurate. Those weights will be sent to the factory for a calibration. |
| Filters do not meet integrity check or are mishandled | Filters are thrown out and not used. |
| Pre-weighted filters >30 days | Filters are thrown out and not used. |
| Inaccurate or missing information on filter sheets | Further review will determine if a QA qualifier or a null data qualifier is needed. |
| $PM_{2.5}$ and $PM_{10}$ filter recovery delayed from sampler | A QA qualifier is applied to the data. Additional review of data may warrant a null data qualifier. |
| Clean room exceeds T limits | Filters are invalid if weighed under these conditions and data is assigned appropriate null code qualifier. |
| Clean room exceeds RH limits | Filters are assigned a QA qualifier of 1 if the mean %RH is >40.4% RH but <41.5% over last 24 hours, humidity control ±5.0% standard deviation over 24 hours, and pre and post weighing conditions within ±5% RH; If %RH is ≥41.5% RH over last 24 hours filters are invalid if weighed under these conditions and data is assigned appropriate null code qualifier. |
| Filters not received at clean room within 1 hour after being opened up to be logged | A QA qualifier 2 may be applied to the data pending data analysis and review of situation. |
| Exposed filters weighed >10 days after sampling | A QA qualifier 1 is applied to the data. Additional review of data may require a null data qualifier |
| Internal QC not performed | Further review will determine if a QA qualifier or a null data qualifier is needed. |
| Filter temperature >5 °C above ambient during sampling | A QA qualifier 1 is applied to the data. Additional review of data may require a null data qualifier. |
| T above 25.0 °C on post sample transport for $PM_{2.5}$ and $PM_{10}$ | Data is invalid and assigned null data qualifier EC. |
| Metals solution used for ATS analysis expired | Data will have a QA qualifier back to last use of valid solution. Further review of data may require a null data qualifier. |
| Speciation filters not conditioned to 4.0 °C or colder after received from sampler and stored at lab | A QA qualifier is applied to the data. Additional review of data may require a null data qualifier. |

| Check | Outcome |
|---|---|
| Speciation filters above 4.0 °C when received at contract laboratory | A QA qualifier is applied to the data. Additional review of data may require a null data qualifier. |
| QAS reweighs not matching ATS chemist values | Additional reweighs are performed until situation is resolved. |
| Analysis of QA Metals Strips by ATS is >10.0% | ATS investigates to determine the cause of the difference. Additional strips may be provided to help resolve the situation and as a post check. Field samples back to the last passing QA metals strip analysis may be re-analyzed, have a QA qualifier, or have a null data qualifier. |
| Clean room audit by QAS finds issues | ATS will resolve issues and if needed work with the AMS to resolve these. |
| IST/RH sensors in clean room fail QAS check | Data will be reviewed back to last passing QAS check to determine if a QA qualifier or a null data qualifier is needed. |
| PM filter cassette fails QAS leak check | QAS will have ATS analyze cassette for issues. ATS will provide QAS with a cassette until the leak check passes. |
| Min/Max thermometers for transport/storage of cooler fail QAS check | The min/max thermometer is not used. |

## Section 15: Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Samplers and any other items that are part of the data collection process must have checks and routine preventive maintenance performed to ensure proper operation. Most manufacturers supply a preventive maintenance checklist with the instruction manual. When new samplers arrive, it is checked prior to field use to ensure all diagnostics meet manufacturer specifications. The manufacturer normally provides its own form showing the QC checks it had performed prior to sending out the equipment. All checks and maintenance must be documented in the site logbook, LEADS, or any forms used as part of the check. The AMS parameter specialist is informed of any issues. Any impact to data will be determined on a case by case basis unless it is outlined in this QAPP or in the appropriate AMB TSOP. All procedures on how to do the diagnostic checks as well as identify any equipment deficiencies are outlined in the instruments manuals. In cases where equipment does not meet specifications, the AMB maintains enough spare units ready for use. Critical spare parts are also maintained to ensure data collection is able to continue. Critical spare parts may include items as part of routine checks, such as spare v-seals.

### 15.1 $PM_{1.0}/PM_{2.5}/PM_{10}$

1. Filter cassettes – The ATS inspects filter cassettes for contamination after every use. The ATS washes the cassettes then allows them to air dry before placing them into plastic bags. QAS does a monthly leak check on filter cassettes in the QA laboratory. ATS provides one filter cassette to QAS, who then does a leak check comparison against a

designated QAS filter cassette. Results of this test will help eliminate damaged parts that make up the cassette and ensure the ATS prepares the filter cassettes accurately, resulting in no leaks.

2. VSCC/SCC – The AMS clean or change the VSCC/SCC after every 30 days for continuous samplers, every 90 days for samplers that run every 3 days, and every 180 days for samplers running every 6 days. The AMS will perform maintenance in a separate controlled environment (laboratory, field office etc.) whenever possible. Refer to the Lab Cleaning of Field Items TSOP for detailed instructions on maintenance.
3. Internal leak check - Perform an internal leak check according to the AMB TSOP when external leak check fails or as indicated by sampler diagnostics.
4. External leak check - Perform an external leak check according to the AMB TSOP 2025 Sequential Air Sampler External Leak Check monthly or as indicated by sampler diagnostics.
5. 1st stage inlet - Monthly, the AMS disassembles the Partisol-Plus Air Sampler sample inlet and cleans it with a soft brush or cloth. Refer to the Lab Cleaning of Field Items AMB TSOP for detailed instructions on maintenance.
6. In-line filter - Annually the AMS replaces the in-line filter according to the Partisol-Plus Air Sampler operating manual or AMB TSOP "2025 A/B Sequential Air Sampler Calibration and Maintenance".
7. V seals – The AMS checks V seals once each year or if a leak check fails, and replaces it if necessary according to the Partisol-Plus Air Sampler operating manual or AMB TSOP "2025 A/B Sequential Air Sampler Calibration and Maintenance".
8. Air screens – The AMS cleans the sampler air screens (located under the sampler rain hoods) monthly according to the Partisol-Plus Air Sampler operating manual or AMB TSOP "2025 A/B Sequential Air Sampler Verification and Maintenance".
9. Battery voltage – The AMS checks the voltage of the batteries on the main computer board in the electronics compartment annually according to the Partisol-Plus Air Sampler operating manual or AMB TSOP "2025 A/B Sequential Air Sampler Calibration and Maintenance".
10. BAM background zero check – This test is performed a minimum of twice per year per manufacturer procedures and the AMB TSOP "Met One Instruments Beta Attenuation Monitor (BAM) 1020 Background Zero Check".

Routine preventive maintenance performed by the AMS helps prevent failures of the monitoring processes. The overall objective is to increase measurement reliability and prevent data loss. The manufacturer's recommended guidelines for routine maintenance procedures are understood and followed. Maintenance records are kept for each sampler or instrument. These records contain a history of the sampler, including all replacement parts, suppliers, costs, installation dates, etc. (see tables 22 and 23).

**Table 22. Recommended Maintenance and Frequencies**

| Maintenance | Frequency |
|---|---|
| Clean $PM_{10}$ or $PM_{2.5}$ inlet | Monthly |
| Large bypass in-line filter exchange | 6 months |
| Battery test | 6 months – change if necessary |
| Pump test | 6 months (or pump power >95% in SHARP) |
| Clean air inlet system | 1 year |
| Rebuild pump | 1 year – or as needed |

**As Needed Maintenance**

- Exchange fuses
- Clock adjustment
- Resetting system
- System software download

**Table 23. Inspection of Field Items**

| Item | Inspection Frequency | Inspection Parameter | Action if Item Fails Inspection | Documentation Requirement |
|---|---|---|---|---|
| Sample downtube | During monthly verification | Visible particulate | Clean with a clean dry cloth | Document in logbook and LEADS |
| VSCC | During monthly verification | Damaged | Replace | Document in logbook and LEADS |
| Rain collector | Every site visit | >1/3 full | Empty | Document in logbook and LEADS |
| Cassette V seals | As needed | Clean and smooth | Clean with a clean dry cloth, or replace as needed | Document in logbook and LEADS |
| In-line filter | Annually | Loaded particulate | Replace | Document in logbook, LEADS, and calibration form |
| Battery | Annually | Decrease in voltage | Replace | Document in logbook, LEADS, and on calibration form |

Sample recovery must be performed within 177 hours from the end of the sample period. Table 24 illustrates set-up, run, and recovery dates based on sample frequency requirements of a 1-in-3 day sampling frequency.

**Table 24. Sample Set-up, run, and Recovery Example Schedule***

| Sample Frequency | Sampler Type | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|---|
| 1 in 3 Week 1 | Multiple Day | Sample Day 1 | | | Sample Day 2 | Recovery & Set-up | | Sample Day 3 |
| 1 in 3 Week 2 | Multiple Day | | | Sample Day 4 | Recovery & Set-up | | Sample Day 5 | |
| 1 in 3 Week 3 | Multiple Day | | Sample Day 6 | Recovery & Set-up | | Sample Day 7 | | |
| 1 in 3 Week 4 | Multiple Day | Sample Day 8 | Recovery & Set-up | | Sample Day 9 | Recovery & Set-up | | Sample Day 10 |
| 1 in 3 Week 5 | Multiple Day | | | Sample Day 11 | Recovery & Set-up | | Sample Day 12 | |
| 1 in 3 Week 6 | Multiple Day | | Sample Day 13 | Recovery & Set-up | | Sample Day 14 | | |

**As found in the U.S. EPA SLAMS Quality Assurance Guidance Document EPA-454/R-98-005 Table 11-1 Monitoring*

### 15.2 Metals

Routine preventive maintenance helps prevent failures of the monitoring and analytical processes. The overall objective is to increase measurement reliability and prevent data loss. The guidelines below are intended to be general routine maintenance procedures. More detailed information can be found in the manufacturer's instruction manual for individual instruments as well as the following TSOPs; "Tisch Environmental Hi-Vol+ Calibration/Maintenance" and "Tisch Environmental Hi-Vol+ Verification/Maintenance". Maintenance records must be kept for each sampler or instrument. These records should contain a history of the sampler, including all replacement parts, suppliers, costs, installation dates, etc.

**Filter Cassette Maintenance**

1. The AMS cleans the filter cassette before any TSP filters are loaded into them.

**Six Month and One Year Maintenance**

1. The AMS replaces Motor Brushes every 6 months. The manufacturer's instructions for the replacement of motor brushes are understood and followed. Replacement frequencies will vary depending on total operating hours of each motor. A flow controller calibration must be performed by the AMS after any motor maintenance or motor replacement.
2. The AMS will clean the flow controller probe with alcohol and properly align the probe in the throat of the sampler's cone when needed.

**As Needed Maintenance**

1. The AMS checks the gaskets at each setup and replace them if they are worn, cracked, or excessively flat.
2. The AMS cleans the inside of the shelter when needed.

3. The AMS checks the motor armatures during brush change and replaces them when needed.

## 15.3 Intermittent $PM_{2.5}$ Speciation

### 15.3.1 Met One Instruments SASS/Super SASS

The Met One Instruments SASS/Super SASS requires very little maintenance other than the regular checks and calibration activities. Most maintenance involves inspection of various components for damage or wear. Additional information is available in the instrument manual and the AMB TSOPs "Met One Instruments Speciation Air Sampling System (SASS) Calibration/Maintenance" and "Met One Instruments Speciation Air Sampling System (SASS) Verification/Maintenance".

For example:

- The AMS checks the O-rings on a regular basis for signs of deterioration and replaces them when necessary. Failure to identify O-ring deterioration may result in leak check or audit flow rate failures.
- The AMS inspects the solar radiation shield after each sample run and cleans as necessary with a damp cloth or a dilute soap and water solution. Accumulation of dirt can reduce the effectiveness of the reflective surface and cause the temperature to rise inside the shield.
- The denuders should be replaced by the support laboratory approximately every three months.
- The AMS cleans the SCC's grit cap after each sample run and the entire SCC is cleaned or replaced with a clean SCC every 3 months if running every 3$^{rd}$ day or every 6 months if running every 6 days.

### 15.3.2 URG 3000N

As with the Met One Instruments SASS/Super SASS, the URG 3000N requires little in the matter of routine maintenance. Additional information is available in the instrument manual and the AMB TSOPs "URG 3000N Calibration/Maintenance" and "URG 3000N Verification/Maintenance".

- The AMS cleans the cyclone every 3 months if running every 3$^{rd}$ day or every 6 months if running every 6 days.
- The AMS checks the O-rings on a regular basis for signs of deterioration and lubricated with a light coat of vacuum grease if required or replaced as necessary.
- The AMS will clean the interior of the sample and control modules monthly to remove bugs, dirt and water deposits.
- The AMS will clean the sampler inlet surfaces.
- The AMS checks all Tygon tubing and vacuum lines and will replace as necessary.
- The AMS will inspect electrical connections.
- Annually, the AMS cleans the sample inlet tube by pushing a slightly moistened paper towel through the down tube using a wooden dowel rod.
- The AMS and QAS inspect filters used for monthly verifications and quarterly audits and will replace them as needed.

### 15.4 Continuous $PM_{2.5}$ Speciation

**Aethalometer**

Routine preventive maintenance helps prevent failures of the monitoring processes. The overall objective is to increase measurement reliability and prevent data loss. Follow the manufacturer's recommended guidelines for routine maintenance procedures. Additional information also available in the AMB TSOPs "Magee Scientific AE21 and AE22 Aethalometer Verification/Maintenance" and "TAPI 633 Aethalometer Verification/Maintenance".

Maintenance records must be kept for each sampler or instrument. These records should contain a history of the sampler, including all replacement parts, suppliers, costs, installation dates, etc. (see table 25).

**Table 25. Aethalometer Recommended Maintenance**

| Maintenance | Frequency |
|---|---|
| Optical Sampling and Analysis Cylinder cleaning | 1-2 Years as needed |
| Bypass Filter Cartridge Replacement | 1-2 Years as needed |
| Sample line | Replace on 1 to 4 year cycle |

**As Needed Maintenance**

- Exchange fuses
- Clock adjustment
- Resetting system
- System software download

## Section 16: Instrument Calibration and Frequency

All samplers in the air monitoring network adhere to the prescribed calibration schedules that are defined in the sampling methods of 40 CFR Parts 50, 53, and 58, as well as QA GD 2.12, Quality Assurance Handbook for Measurement Systems Vol. II, AMB TSOPs "Certification of Delta/Tetracal Using the Fluke molbox™/molbloc-s™ System", "Certification of Flow Devices Using the DH Instrument molbox™/molbloc-s™ System Procedures", and AMB TSOPs/SOPs listed in this QAPP. Transfer standards used for this work follow strict verification/audit/certification/calibration schedules, as required by the documents mentioned. Almost all transfer standards are verified/certified/calibrated against standards that are maintained at the QA laboratory. If the QAS cannot do the verification/certification/calibration, then the item is sent to a standards lab. On occasion some items are sent to a standards lab to cross check the transfer standards used in the QA laboratory. All equipment is verified/certified/calibrated prior to use. Table 26 lists the transfer standards used in the particulate program. Work performed with an expired transfer standard date is voided.

**Table 26. Calibration and Frequency**

| Item | Frequency (months) | Primary Standard | Limit |
|---|---|---|---|
| Temperature Probe | 12 | Isotech | $< \pm 0.51°C$ |

| Item | Frequency (months) | Primary Standard | Limit |
|---|---|---|---|
| Barometer | 12 | Mercury Barometer | < ± 2.26 mmHg |
| Chinook or Flow Device | 12 | Fluke Molbox or Hastings Bubble Meter | ≤ ± 1% |
| Orifice | 12 | Dresser Roots Meter | ≤ ± 1% |
| Electronic Manometer | 12 | Used with Chinook or flow device on Fluke Molbox or Hastings Bubble Meter | Determined certified if Chinook or flow device is ≤ ± 1% |
| S Weights | 12 | Standards Laboratory Primary Weights | See QA GD 2.12 |
| Pb, Mn, As Reference Standard Solution | 12 | Manufacturer atomic adsorption certified | ≤ ± 1% |

## Section 17: Inspection/Acceptance Requirements for Supplies and Consumables

Filter media is the main consumable for the particulate network. All of the $PM_{2.5}$ and $PM_{10}$ filters are acquired through the U.S. EPA based on a national contract. Filter lots are evaluated for stability when received.

All of the $PM_{2.5}$ speciation filters are acquired through the U.S. EPA based on a national contract. SASS canisters and URG cartridges with filters and denuders arrive via overland delivery to the AMS in Indianapolis and to regional offices throughout the state.

Sampler replacement parts, rebuild kits, and continuous particulate tape are obtained from the manufacturer or a distributor when the items are commonly available and needed by the AMB. The parameter specialist for the AMS and the ATS keeps track of their own supplies and will order items when needed. The QA laboratory manager makes sure the QA laboratory has enough supplies and QA field staff also keep track of when items are needed. A designated QA environmental manager will order supplies for the QAS when needed. Most consumables do not have an expiration date. If there is an expiration date the AMS and ATS parameters specialist and the QA laboratory manager will track and dispose of it when it expires.

## Section 18: Non-direct Measurements

Determining site location as well as data analysis may be performed utilizing meteorological data obtained from the National Weather Service as well as traffic counts obtained from the INDOT. The additional data used for site selection and data analysis is viewed as being accurate since this data falls under specific rules and guidelines.

## Section 19: Data Management

Minimizing data loss is of paramount importance to each monitoring program in order to meet and exceed the program's data completeness requirements. Data loss can result from missing or invalid data. Data records are generated through the use of GLIMS for intermittent $PM_{2.5}$, intermittent $PM_{10}$, and intermittent $PM_c$, LEADS for continuous $PM_1$, continuous $PM_{2.5}$,

continuous $PM_{10}$, continuous $PM_c$, and continuous $PM_{2.5}$ speciation, and Excel spreadsheet for intermittent TSP for metals. Data records for intermittent PM2.5 speciation are handled through a U.S. EPA contractor. It is the goal of IDEM to collect 100% of generated data and maintain a completeness rate of least 75% valid data. The U.S. EPA requires at least 75% of data to be valid to meet completeness requirements. The processes of determining valid data and the QC/QA of these processes is mentioned in this QAPP. The data process includes collecting, storing, transmitting, verifying, validating, and reporting to the U.S. EPA's AQS database.

The data process starting from the initial check of the filter media, to the field, to AQS submittal will depend on the parameter. Each type of particulate parameter is described below.

### 19.1 Intermittent $PM_{2.5}$, Intermittent $PM_{10}$, and Intermittent $PM_c$

1. Data collection is performed using an approved U.S. EPA reference sampler.
2. The sampler is calibrated prior to sample collection. This information is stored on an AMS calibration sheet and also logged in LEADS.
3. Monthly AMS verifications and quarterly QAS audits are performed. These results are loaded into the U.S. EPA transaction generator then uploaded to AQS.
4. Filters to be sampled on go through a candling process. Filters with holes or scratches are discarded. This process is documented in filter conditioning log, blanks log, and room maintenance binder.
5. Filters are conditioned for at least 24 hours. This process is described in the TSOP "Analysis of Both PM2.5 and PM10 Particulate Matter Using GLIMS Software". The date and time these filters could be weighed is recorded on a piece of tape on the tray where the filters were placed.
6. Filters are labeled. This process is described in the AMB TSOP mentioned in step 5.
7. The tare weight of the filter is measured. Record of this is in GLIMS.
8. The QAS also does a tare weight on at least seven percent of the batch of filters but no less than three. This QA audit is documented in an Excel spreadsheet, which is password protected.
9. Filters are packed in appropriate coolers. This process is documented in the AMB TSOP mentioned in step 5.
10. Samples are set up prior to the sample day. Information is documented on a data sheet, a site log book, and in LEADS.
11. Samples are picked up after sampling is completed. Information is documented on a data sheet, a site log book, and in LEADS.
12. Samples are brought back to the office and logged in. The min/max temperature is recorded. This information is recorded on the data sheet.
13. Samples are taken to the clean room and unpacked from the magazine by an ATS staff

member. Information is documented on the data sheet.

14. Samples are conditioned for at least 24 hours. This process is described in the AMB TSOP mentioned in step 5.
15. The gross weight is measured. Information is documented in the weighing conditions spreadsheet, the HOBO log which is the ATS temperature and relative humidity clean room data logger, and the clean room logbook.
16. Once all laboratory functions are complete for a filter, the samples are archived in cold storage for 12 months as stated in the AMB TSOP "Analysis of Both PM2.5 and PM10 Particulate Matter Using GLIMS Software". After 12 months filters are stored in the AMB warehouse for a minimum of five years.
17. Data is screened by AMS staff monthly per AMB TSOP "Filter Based Particulate Matter Data Validation". Data sheets are filed by the 15$^{th}$ of the following month and verification completed by the 30$^{th}$.
18. Data is sent to the QAS program coordinator to validate per AMB TSOP "$PM_{2.5/10}$ Intermittent Data Check Procedures". This information is documented on a data check sheet and stored on the AMB shared computer drive.
19. The AQS administrator in the AMS is informed by the QAS program coordinator that QA of the data is complete.
20. The AQS administrator in the AMS uploads data into AQS.
21. Once all data for a quarter has been verified and validated, a designated environmental manager in the QAS submits QA flow audits into AQS, and an environmental manager in the AMS submits monthly flow verifications into AQS.
22. Each quarter AMP reports are submitted by a QAS environmental manager to the QAS chief and these are reviewed for accuracy and any issues. Any indication of a problem will require further analysis by QAS and/or AMS of the reported data with the possibility of data resubmission.
23. Each year data from the previous year is certified as being true and accurate. The AMB chief, AMS (1 and 2) chiefs, ATS chief, QAS chief, and specific staff in the AMS (1 and 2) and QAS do a final check on this data package, which is then submitted to U.S. EPA.

### 19.2 Intermittent $PM_{2.5}$ Speciation

1. Data collection is performed using an approved U.S. EPA reference sampler.
2. The sampler is calibrated prior to sample collection. This information is stored on an AMS calibration sheet and also logged in LEADS.
3. Monthly AMS verifications and quarterly QAS audits are performed. These results are loaded into the U.S. EPA transaction generator then uploaded to AQS.
4. Samples are set up prior to the sample day. Information is documented on a data sheet, a

site log book, and in LEADS.

5. Samples are picked up after sampling is completed. Information is documented on a data sheet, a site log book, and in LEADS.
6. Samples are brought back to the office and stored in a refrigerator prior to shipping out based on the U.S. EPA shipping schedule.
7. Filters are shipped to the U.S. EPA contract laboratory as scheduled. Once analysis is performed, the AMS receives monthly batch data from the U.S. EPA contractor via Data Analysis Reporting Tool (DART). The data is analyzed by the AMS per the AMB TSOP "Intermittent Chemical Speciation Data Validation". Changes to the data can occur based on the AMS findings. The U.S. EPA contractor submits the data into AQS.
8. Once all data for a quarter has been verified and validated, a designated environmental manager in the QAS submits QA flow audits into AQS, and an environmental manager in the AMS submits monthly flow verifications into AQS.
9. Each quarter AMP reports are submitted by a QAS environmental manager to the QAS chief and these are reviewed for accuracy and any issues. Any indication of a problem will require further analysis by QAS and/or AMS of the reported data with the possibility of data resubmission.
10. Each year data from the previous year is certified as being true and accurate. The AMB chief, AMS (1 and 2) chiefs, ATS chief, QAS chief, and specific staff in the AMS (1 and 2) and QAS do a final check on this data package, which is then submitted to U.S. EPA.

**19.3 Intermittent TSP for Metals**

1. Data collection is performed using an approved U.S. EPA reference sampler.
2. The unit is calibrated prior to sample collection. This information is stored on an AMS calibration sheet and also logged in LEADS.
3. Monthly AMS verifications and quarterly QAS audits are performed. These results are loaded into the U.S. EPA transaction generator then uploaded to AQS.
4. Samples are set up prior to the sample day. Information is documented on a filter card and in LEADS.
5. Samples are picked up after sampling is completed. Information is documented on a filter card and in LEADS.
6. The filters are given to the AMS environmental manager, who records data from the filter card into an Excel spreadsheet. The AMS environmental manager also inspects the filter for damage and reviews all of the data to determine if the filter is valid.
7. The AMS environmental manager gives the filter to the QAS program coordinator, who does a QA check on the sample per the AMB TSOP "Particulate Filter Quality Assurance".
8. Once analysis is completed by the ATS, the data is added to an Excel spreadsheet.

9. The QAS program coordinator will review the data as per the AMB TSOP "TSP for Metals Intermittent Data Review Procedures".
10. Once all data for a quarter has been verified and validated, a designated environmental manager in the QAS submits QA flow audits into AQS, and an environmental manager in the AMS submits monthly flow verifications into AQS.
11. Each quarter AMP reports are submitted by a QAS environmental manager to the QAS chief and these are reviewed for accuracy and any issues. Any indication of a problem will require further analysis by QAS and/or AMS of the reported data with the possibility of data resubmission.
12. Each year data from the previous year is certified as being true and accurate. The AMB chief, AMS (1 and 2) chiefs, ATS chief, QAS chief, and specific staff in the AMS (1 and 2) and QAS do a final check on this data package, which is then submitted to U.S. EPA.

### 19.4 Continuous $PM_1$, Continuous $PM_{2.5}$, Continuous $PM_{10}$, and Continuous $PM_c$

1. Data collection is performed using an approved U.S. EPA reference analyzer.
2. The unit is calibrated prior to sample collection. This information is stored on an AMS calibration sheet and also logged in LEADS.
3. Monthly AMS verifications and quarterly QAS audits are performed. These results are loaded into the U.S. EPA transaction generator then uploaded to AQS.
4. Each site has a specific IP address and each parameter has its own internal IP address. Data is sent from the analyzer via digital output to a router with a Sutron Expert2 data logger hooked in-line. Although data collection is continuous, data is averaged in five minute or hourly intervals, depending on the type of the particulate sampler. The Sutron data logger is capable of storing up to approximately two weeks of data before it starts being overwritten. The Sutron data logger at the site requires a password to access it.
5. The LEADS Comms Front-End Processor (CFEP) at MeteoStar in Round Rock, Texas communicates with the data loggers and retrieves data from them every 10 minutes through the internet via cellular modem. The MeteoStar LEADS software collects data from the data logger using the Native Datalogger Computer-To-Computer language (CC-SAIL). Preliminary data checks are performed and then the data is forwarded to the LEADS server. The CFEP computers can store three months of data.
6. A LEADS server housed at MeteoStar in Round Rock, Texas polls data from the CFEP computers. The data is decoded, checked for errors, processed and stored in a database. The LEADS database uses a flat, packed binary structure and are physically segregated by date and monitoring site. Each binary data file contains all the measurements from a monitoring site for a specific day. The binary data files are kept indefinitely by MeteoStar.
7. Each business day, the AMS LEADS administrator will check the monitoring data database to ensure that all data were polled and transmitted successfully from each monitoring station and stored on LEADS. In case of missing data, a re-poll can be

initiated to backfill the data.

8. Approximately one to three weeks after the end of a month, AMS staff will initiate the data verification procedure. AMS staff log into the LEADS server and are able to review and flag raw data and document data verification by using a program within LEADS called ManVal. (Note: LEADS recognizes this process as "data validation" although it is the verification process). A log is made in ManVal which documents who verified the data, changes made, and a date/time when this occurred (see AMB TSOP "Gaseous Data Validation Using LEADS").
9. Once the data has been verified, AMS staff will inform the QAS program coordinator via e-mail that verified data is ready for validation.
10. The QAS program coordinator logs the date that the verified data has been sent to the QAS and then informs QAS environmental manager via e-mail that data is ready for validation. The QAS environmental manager has 15 business days to complete the validation process.
11. The QAS environmental manager logs into the LEADS server (read access only) and performs an audit on the data (validation process) using the various LEADS reports and the ManVal program (see TSOP "Leading Environmental and Analysis of Data System (LEADS) Validated Data Review Procedures"). The validation process is documented on a Validation Check form, which is stored on the Branch shared drive.
12. If data issues arise during the validation process, the issues are sent to the appropriate AMS staff member for correction or additional information.
13. Once the validation review is complete, the QAS environmental manager will initial and date the Validation Check form. The QAS environmental manager informs QAS program coordinator via e-mail that the data validation is complete.
14. The QAS program coordinator will log the data validation completion date and informs the AMS AQS administrator via email that the data review process is completed by the QAS.
15. The AMS AQS administrator submits the validated data to AQS.
16. Once all data for a quarter has been verified and validated, a designated environmental manager in the QAS submits one point quality control checks and QA PE audits into AQS.
17. Each quarter AMP reports are submitted by a QAS environmental manager to the QAS chief and these are reviewed for accuracy and any issues. Any indication of a problem will require further analysis by QAS and/or AMS of the reported data with the possibility of data resubmission.
18. Each year data from the previous year is certified as being true and accurate. The AMB chief, AMS (1 and 2) chiefs, ATS chief, QAS chief, and specific staff in the AMS (1 and

2) and QAS do a final check on this data package, which is then submitted to U.S. EPA.

**19.5 Continuous PM2.5 Speciation**

1. Data collection is performed using an Aethalometer.
2. The Aethalometer is calibrated prior to sample collection. This information is stored on an AMS calibration sheet and also logged in LEADS.
3. Monthly AMS verifications and quarterly QAS audits are performed. These results are loaded into the U.S. EPA transaction generator then uploaded to AQS.
4. Each site has a specific IP address and each parameter has its own internal IP address. Data is sent from the analyzer via digital output to a router with a Sutron Expert2 data logger hooked in-line. Although data collection is continuous, data is averaged in five minute intervals. The Sutron data logger is capable of storing up to approximately two weeks of data before it starts being overwritten. The Sutron data logger at the site requires a password to access it.
5. The LEADS Comms Front-End Processor (CFEP) at MeteoStar in Round Rock, Texas communicates with the data loggers and retrieves data from them every 10 minutes through the internet via cellular modem (manufacturer & model number). The MeteoStar LEADS software collects data from the data logger using the Native Datalogger Computer-To-Computer language (CC-SAIL). Preliminary data checks are performed and then the data is forwarded to the LEADS server. The CFEP computers can store three months of data.
6. A LEADS server housed at MeteoStar in Round Rock, Texas polls data from the CFEP computers. The data is decoded, checked for errors, processed and stored in a database. The LEADS database uses a flat, packed binary structure and are physically segregated by date and monitoring site. Each binary data file contains all the measurements from a monitoring site for a specific day. The binary data files are kept indefinitely by MeteoStar. All LEADS servers hosted by MeteoStar in Round Rock, Texas have mirrored Disaster Recovery Servers installed at MeteoStar's Denver, Colorado offices.
7. Each business day, the AMS LEADS administrator will check the monitoring data database to ensure that all data were polled and transmitted successfully from each monitoring station and stored on LEADS. In case of missing data, a re-poll can be initiated to backfill the data.
8. The data collected through the processes described in steps 1 to 5 above is overwritten at a later date with the data collected on a SD card located inside the Aethalometer. This SD card is collected monthly during AMS site visits. Further steps for this data process are available in the AMB TSOP "Aethalometer Data Validation".
9. Once the data has been verified, AMS staff will inform the QAS program coordinator via e-mail that verified data is ready for validation.
10. The QAS program coordinator logs the date that the verified data has been sent to the QAS and then informs QAS environmental manager via e-mail that data is ready for

validation. The QAS environmental manager has 15 business days to complete the validation process.

11. The QAS environmental manager takes the data, which is a txt file, and loads it into a macro Excel spreadsheet, which allows it to be viewed easier. Data is screened for high and low values, audits, verifications, and confirm existing null data codes. Also, the monthly logs in LEADS are checked to confirm work at the site. The validation process is documented on a Validation Check form, which is stored on the Branch shared drive.
12. If data issues arise during the validation process, the issues are sent to the appropriate AMS staff member for correction or additional information.
13. Once the validation review is complete, the QAS environmental manager will initial and date the Validation Check form. The QAS environmental manager sends the data to the AMS AQS administrator and cc's the QAS program coordinator that the data validation is complete.
14. The QAS program coordinator will log the data validation completion date.
15. The AMS AQS administrator submits the validated data to AQS.
16. Once all data for a quarter has been verified and validated, a designated environmental manager in the QAS submits one point quality control checks and QA PE audits into AQS.
17. Each quarter AMP reports are submitted by a QAS environmental manager to the QAS chief and these are reviewed for accuracy and any issues. Any indication of a problem will require further analysis by QAS and/or AMS of the reported data with the possibility of data resubmission.
18. Each year data from the previous year is certified as being true and accurate. The AMB chief, AMS (1 and 2) chiefs, ATS chief, QAS chief, and specific staff in the AMS (1 and 2) and QAS do a final check on this data package, which is then submitted to U.S. EPA.

Particulate data records are generated from a variety of sources in the process of sampling and analyzing of filters. Examples of paper forms are provided in AMB TSOPs/SOPs mentioned throughout this QAPP and these are stored on shared, secured AMB computer drives or in other secured network drives. It is the goal of AMB to maintain at least 75% valid data. The processes of determining valid data and the QC/QA of these processes is mentioned in Section 7 of this QAPP.

The U.S. EPA requires at least 75% of scheduled samples to be valid to meet completeness requirements. The data must be collected, verified, validated, and reported to the U.S. EPA's AQS database quarterly and certified yearly. Quarterly data is reported to the AQS within 90 days after the quarter is completed. Data consists of sample values, flow verifications, and flow audits. Continuous particulate data is made available to the IDEM website as it is being

collected; therefore the data has not initially had QC or QA checks performed. Continuous particulate data is also provided to AIRNOW as it is being collected.

The continuous particulate data is reported as hourly averages. The continuous speciation data collected with the Aethalometer provides data as it is being collected; however, the actual reported data is collected from the disk monthly and this data replaces the data that is collected from the instrument instantaneously.

The intermittent samples are collected either once or twice per week. This intermittent particulate data consists of 24 hour samples. Specific requirements on collecting and analyzing this data is provided in other sections of this QAPP. All of the analysis of the particulate samples is performed by ATS, except for the intermittent $PM_{2.5}$ speciation, which is performed by a U.S. EPA contract laboratory. The U.S. EPA contract laboratory has its own internal QC and QA checks.

All of the particulate data is reported in $\mu g/m^3$ at local conditions except for some of the continuous speciation, which is at standard conditions of 298 K and 1 atmosphere.

Data generated by the AMS during verifications and the QAS during audits is entered into an Excel file then the file is uploaded to a shared computer drive. In addition, this data is entered into the U.S. EPA transaction generator and a text file is created. This text file is then uploaded into AQS quarterly.

## Section 20: Assessments and Response Actions

IDEM utilizes several assessment procedures to ensure activities are being conducted as planned and data is acceptable. This also helps to identify and correct issues. These procedures may include formal or informal communication and response (see table 27).

**Table 27. Assessments and Response Actions**

| Assessment | Conducted By | Frequency | Goals |
|---|---|---|---|
| Monthly Verification | AMS Personnel | Monthly | QAPP Requirements |
| Semi-annual flow rate audit | QAS Personnel | Quarterly for each sampler | QAPP Requirements |
| Precision via permanently collocated sampler | AMS Personnel | Every 6 days | <10.1 %CV for total precision for PM; <20.1 %CV for total precision for Pb |
| Data Verification | AMS | Monthly | Screening of data, sample information, QC checks |
| Data Validation | QAS | Monthly | Screening of data, sample information, QC and QA checks |

| Assessment | Conducted By | Frequency | Goals |
|---|---|---|---|
| High Value Event | QAS | As needed | Screening of information, such as calibration, pickup date, analysis date, etc. which may impact high value |
| AMP Reports | QAS | Quarterly | Review data for statistical issues and completeness |
| QAPP | QAS | Annually | Determine if changes are needed which accurately describes the project |
| ANP | AMB | Annually | Determine if sites cover necessary air monitoring requirements |
| Annual Data Certification | AMB | Annual | Review data for issues |
| Siting | QAS | 3 years per site | QAPP Requirements |
| 5 Year Network Assessment | AMB | 5 years | Determine future monitoring goals and direction |
| PEP | U.S. EPA Regional Personnel/Contractor | See Section 7.2 of this QAPP | See Section 7.2 of this QAPP |
| Internal Clean Room Audit | QAS Personnel | Annually | See U.S. EPA QA GD 2.12 |
| Technical Systems Audit | U.S. EPA Regional Personnel | Once every 3 years | CFR Requirements |

In the event that an assessment identifies an area of concern, there are specific corrective actions which occur depending on what the finding shows. Below is listed the assessment and corrective action time frame for follow-up.

Monthly Verification – AMS addresses issue once they are aware. QAS environmental manager ensures action was taken and issues were resolved.

Semi-annual flow rate audit – QAS addresses issues either from the site or once back in the office. Consulting with AMS parameter specialist is performed to resolve issues.

Precision via permanently collocated sampler – QAS addresses issues once %CV is determined. AMS 1 Chief and ATS Chief is informed of potential issues. A QA qualifier or null data qualifier may be applied to data and procedures may need to be adjusted.

Data Verification Process – The AMS parameter specialist performs a verification of the ambient data within 1 to 3 weeks after the end of a month. Documentation of the process can be found in the LEADS validator notes.

Data Validation Process – A QAS staff member performs a validation review of the data within 15 days after the QA Program Coordinator is informed that a data package is available for review. Data validation is documented on the Data Check Sheet, which are stored on the AMB shared drive.

High Value Event – A QAS staff member performs additional reviews on any high values which meet or exceed the NAAQS for that parameter. This review is performed within 15 days after the data validation is completed for that specific site and month. The high value event is documented on a data sheet, which is stored on the AMB shared drive.

AMP Reports - Quarterly AMP Reports (AMP256, AMP430) are sent to the QAS chief after the flow verifications and PE audit results are submitted to AQS within 90 days after the end of the quarter. The QAS chief and an environmental manager may consult with AMS or ATS to resolve any issues once any are discovered. If practical, the issue should be resolved within two weeks after identification of the issue.

QAPP - QAS section chief ensures QAPP is being followed and makes necessary changes, with approval by AMB chief, AMS (1 and 2) chiefs, and ATS chief. An annual check is documented or when a change needs to be made.

ANP - The Annual Network Plan is due the EPA Regional Administrator by July 1st. The AMB tries to have a complete ANP available for public comment by mid-May to allow for the 30-day public comment period to be completed by mid-June. Corrective actions taken immediately (based on issue could be one day but prior to New Year) by AMB based on U.S. EPA feedback.

Annual Data Certification – The Annual Data Certification for ambient data from the previous year (January 1 – December 31) is due to the EPA Regional Administrator by May 1st of each year. The AMB reviews the annual data package and resolves any correctable issues, if practical, prior to submission of the certification package.

Siting – The QAS performs site evaluations on a 3-year cycle from the previous site evaluation. The AMS addresses issues based on QAS findings (usually within a work day if data is impacted

or some time frames may be extended based on the nature of the issue and if the site is on private property). QAS chief ensures corrective action is taken to resolve the issues.

5 Year Network Assessment - The 5-year Network Assessment is due at EPA by July 1st for years ending in zero or five. Corrective actions by AMB based on U.S. EPA feedback within the time frame allotted for the response.

PEP - QAS chief works with AMS to address PEP issues as soon as possible (usually within a week to resolve any issues).

Internal Clean Room Audit – QAS chief works with ATS to address issues as soon as possible.

Technical Systems Audit - Technical System Audits are scheduled by the EPA Regions on a 3-year frequency. The QAS works with AMS(s) and ATS to address any audit findings. All findings should be resolved within 1 year of the TSA report.

## Section 21: Reports to Management

Reports that are generated and utilized in the particulate program are listed in table 28.

**Table 28. Reports to Management**

| Report | Frequency | Responsible Party |
|---|---|---|
| $PM_{2.5}$ Exceedance Report | Monthly | AMS |
| Pb Design Value | Monthly | AMS |
| AMP Reports | Quarterly | QAS |
| Primary vs. Working Standard Weight Comparison | Quarterly | ATS |
| Chemist Weighing Comparisons | Annual | ATS |
| $PM_{2.5}$, $PM_{10}$, and Pb Exceedance Reports | As needed | QAS |
| $PM_{2.5}$ and Pb %CV Reports | Quarterly | QAS |
| Invalid Data Memos | As needed | AMB |
| Annual Network Plan | Annual | AMB |
| 5 Year Network Plan | 5 Years | AMB |

## Section 22: Data Validation and Usability

Many of the criteria used to review and validate data have been detailed in the previous sections of this QAPP. The AMB utilizes this established QAPP, TSOPs/SOPs, and U.S. EPA Validation Template found in the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program", to determine data validity.

## Section 23: Validation and Verification Methods

Data verification is the process of evaluating the completeness, correctness and conformance of a specific data set against the method, procedural or contractual requirements, as specified in both the SOPs and 40 CFR Part 58. Data validation is a process that extends the evaluation of data beyond method, procedural or contractual compliance (i.e. data verification) to ensure that reported values meet the quality goals of the environmental data operations and that the data can be used for its intended purpose.

The AMB uses the criteria particulate pollutant validation templates provided in Appendix D of the EPA QA Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program (EPA-454/B-17-001, January 2017) for the weight of evidence approach for validating criteria particulate data. The AMB follows the guidance in the QA Handbook regarding the use of these templates and handles the criteria as follows:

- Critical criteria are issues deemed critical to maintaining the integrity of the hourly ambient concentration measurement or a group of successive hourly ambient concentration measurements. Data reviewers should invalidate observations that do not meet each and every criterion in the critical criteria table unless there are compelling reasons and justification for not doing so. Basically, the hourly measurement or group of hourly measurements that do not meet one or more of these criteria is invalid unless proven otherwise. In most cases, the CFR dictates the requirement, the implementation frequency of the criteria and the acceptance criteria so these criteria are considered regulatory in nature.
- Operational criteria are situations where violations of a criterion or criteria may be cause for invalidation of the data. Data reviewers should consider other QC information that may or may not indicate the data are acceptable for the parameter they want to control. Therefore, ambient data, which do not meet one or more of these criteria, are suspect unless other QC information demonstrates otherwise and the reviewers have adequate documentation of that information. Data reviewers should investigate, mitigate or justify the reason for not meeting the criteria.
- Systematic criteria include those criteria, including the DQOs, which are important for the correct interpretation of the data, but do not usually impact the validity of the ambient data. If the data do not meet the DQOs, this does not invalidate any of the hourly measurements, but it may impact the confidence in the attainment/non-attainment decision.

The AMB brackets all particulate concentration data using the results of the monthly verifications, calibration, or performance evaluation audit to ensure the particulate samplers were in proper operating condition between the checks. When an intermittent sampler fails a check, data is suspect back to the last passing check until the causing failure is remedied. For some continuous samplers LEADS software automatically flags the data as LIM when the error occurs to time & date when the issue causing failure is remedied. The AMS parameter specialist will review the data, determine the cause for the failure and verify the extent of the data invalidation period. During the validation process, the QAS will review the invalid data period to ensure it is proper, accurate and documented.

### 23.1 AMS Verification for Intermittent $PM_{2.5}$, Intermittent $PM_{10}$, and Intermittent $PM_c$

The verification on intermittent filters begins when the ATS does its initial weighing and then again after the filters have sampled as per the AMB TSOP “Analysis of Both PM2.5 and PM10 Particulate Matter Using GLIMS Software”. Once the concentrations have been determined the AMS does its own data verification as per the AMB TSOP “Filter Based Particulate Matter Data

Validation". Data flags can be added during the sampling process, the weighing process, and after the concentrations have been determined and entered into GLIMS. Any flags to be added can be found at https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html.

### 23.2 AMS Verification for Intermittent $PM_{2.5}$ Speciation

The AMS environmental manager specialist receives monthly batch data from the U.S. EPA contract laboratory, via DART. This data has had QC checks performed on it by the U.S. EPA contract laboratory. The AMS environmental manager then performs data analysis per the AMS TSOP "Intermittent Chemical Speciation Data Validation". Any flags to be added can be found at https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html.

### 23.3 AMS Verification for Intermittent TSP for Metals

The verification on TSP for metals filters begins when the ATS does its initial candling and then again after the filters have sampled. The AMS also reviews data collected for the sample as well as scanning the filter for defects once the filter has been retrieved from the sampler and brought back to the office. Once the concentrations have been determined the ATS and the AMS both determine if the concentrations are accurate. Data flags can be added during the sampling process, the analysis process, and after the concentrations have been determined and entered into an Excel spreadsheet. Any flags to be added can be found at https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html.

### 23.4 AMS Verification for Continuous $PM_1$, Continuous $PM_{2.5}$, Continuous $PM_{10}$, and Continuous $PM_c$

The LEADS administrator reviews the LEADS reports every business day to check for anomalies and to repoll data loggers when missing data is notated. The LEADS administrator will review the hourly values for any NAAQS exceedances and notify the AMS parameter specialist and the QAS. After a month of data is collected, a monthly pollutant concentration report is generated by LEADS. The AMS verifies all data per the AMB TSOP "Continuous Particulate Data Validation" during the monthly data review. The monthly report is reviewed by the AMS parameter specialist for data values as well as any flags applied by LEADS. These are reviewed using the LEADS Operator to justify the application of the flag and to determine if they are accurately applied. The data trace is also evaluated. Any changes needed are applied by the AMS parameter specialist. Once this process is completed the AMS parameter specialist leaves a "Validator Note" in LEADS, which means the data has been verified. Once the verification process is completed by the AMS, the QAS program coordinator is informed by the AMS parameter specialist that the data is ready for QA.

The following null and data qualifiers are available in LEADS to flag data as appropriate:

| Flag Text | Description | EPA Qualifier | |
|---|---|---|---|
| | | Null Data | Data Qualifier |
| ZERO | Neg Value Detected - Zero Reported | | 9 |
| AMB-A | High Winds | | A |
| AMB-B | Stratospheric Ozone Intrusion | | B |
| AMB-C | Volcanic Eruption | | C |
| AMB-D | Sandblasting | | D |
| AMB-E | Forest Fire | | E |
| AMB-F | Structural Fire | | F |
| AMB-G | High Pollen Count | | G |
| AMB-H | Chemical Spill or Industrial Accident | | H |
| AMB-I | Unusual Traffic Congestion | | I |
| AMB-J | Construction/Demolition | | J |
| AMB-K | Agricultural Tilling | | K |
| AMB-L | Highway Construction | | L |
| AMB-M | Rerouting of Traffic | | M |
| AMB-N | Sanding/Salting of Streets | | N |
| AMB-O | Infrequent Large Gatherings | | O |
| AMB-P | Roofing Operations | | P |
| AMB-R | Cleanup After Major Disaster | | R |
| n | Not used | AA | |
| TEMP | Shelter Temperature Outside Limits - 9971 - AE | AE | |
| FEW | Insufficient Data - 9975 - AI | AI | |
| VOID | Voided by Operator - 9978 - AL | AL | |
| NEG | Failed NEG Test - 9979 - AM | AM | |
| MUL | Failed MUL Test - 9979 - AM | AM | |
| BLAN | Blank Sample | AM | |
| AUDI | Audit Sample | AM | |
| 5PPB | 5 ppb-V Unblended Standard Check | AM | |
| EXP | Experimental or Bad Sample | AM | |
| RT S | Standard Sample | AM | |
| ARC | GC Acetylene Response Check | AM | |
| CACS | GC Compress Air Comp Sample | AM | |

| | | | |
|---|---|---|---|
| DCSD | GC Daily Cal Check Stand Dup | AM | |
| DLA | GC Detection Limit Analysis | AM | |
| RAS | GC Radian Audit Sample | AM | |
| UNK | GC Unknown Flag in File | AM | |
| NOD | Not Detected | AM | |
| LIM | Failed Limit Check - 9980 - AN | AN | |
| MAL | Machine Malfunction - 9980 - AN | AN | |
| ICE | Bad Weather - 9981 - AO | AO | |
| LOST | Lost - 9983 - AQ | AQ | |
| POOR | Poor Quality Assurance Results - 9985 - AS | AS | |
| ADJ | Instrument Adjustment - Cal - Background Zero - 9986- AT | AT | |
| NOL | Not On Line - 9987 - AU | AU | |
| POW | Power Failure - 9988 - AV | AV | |
| SPZ | Span-Zero Check - 9991 - AY | AY | |
| VER | QC Verification - 9992 - AZ | AZ | |
| PM | Preventive Maintenance - 9993 - BA | BA | |
| CAL | Multi-Point Calibration - 9995 - BC | BC | |
| SPN | Span Check - 9998 - BF | BF | |
| OPE | Operator Error - 9963 - BJ | BJ | |
| DAS | Data Logger not communicating with instrument - 9962 - BK | BK | |
| QAS | QA Audit in Progress - 9961 - BL | BL | |
| BAL | Negative values under AQS Acceptable Limits - BR | BR | |
| ALNR | Above Linear Range - EH | | EH |
| AMB-IF | Fire - Canadian Informational - IF | | IF |
| AMB-IH | Fireworks Informational - IH | | IH |
| AMB-IM | Prescribed Burning - IM | | IM |
| AMB-IT | Wildfires - US | | IT |
| BDL | Below Detection Limit | | MD |
| AMB-RH | Fireworks RH | | RH |

Additional flags are available to be applied as well. These can be found at https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html.

### 23.5 AMS Verification for Continuous $PM_{2.5}$ Speciation

Although Aethalometer data is used from the SD card located inside the unit, the LEADS administrator still reviews the LEADS reports every business day to check for anomalies and to repoll data loggers when missing data is notated. Each month the data from the SD card is

dumped in an AMB shared drive. The AMS verifies all data per the AMB TSOP "Aethalometer Data Validation Procedures" during the monthly data review. The monthly report is reviewed by the AMS parameter specialist for data values as well as any flags applied by the masher program. Once the verification process is completed by the AMS, the QAS program coordinator is informed by the AMS parameter specialist that the data is ready for QA.

### 23.6 QAS Validation

The QAS validates the continuous particulate data per the AMB TSOP "Leading Environmental and Analysis of Data System (LEADS) Validated Data Review Procedures" and the intermittent particulate data per the TSOP "Particulate Filter Quality Assurance". The QAS program coordinator sends an e-mail to the QAS staff member who is responsible for performing the validation on that specific data. A standard form is used by QAS, which includes analysis of concentrations as well as a review of QC and QA processes and to document the review.

When high concentrations are identified, whether by email or memo by the AMS or ATS, the QAS is notified of the site and date/time when the exceedance occurred. In some instances a high concentration could be discovered during the data audit process. In either situation, the QAS will initiate a NAAQS exceedance memoranda. A standard form is used to identify if the data exceeding the NAAQS is of a valid nature. The exceedance verification form identifies results of specific checks preceding and subsequent to the exceedance event. If a check on both sides of the NAAQS exceedance are considered valid, then that data is considered valid provided that no intervening null codes between the checks invalidates the data. If any checks indicate an issue, the data may be suspect. The checks may be quarterly QAS PE audits, AMS monthly verification checks, and ATS reweighs. In some situations, this may entail a special QA audit after the exceedance to verify analyzer performance and data validity. Any invalid or missing data may be documented in the comments portion of the exceedance form.

The QAS chief and one QAS environmental manager reviews various AMP reports, such as AMP251, AMP256, and AMP350 that are generated quarterly from AQS and reviewed for any data that requires further analysis. The QAS has the authority to have data rechecked and if needed, invalidate additional data.

## Section 24: Reconciliation with Data Quality Objectives

The data quality objectives and intended uses for the particulate pollutant data are discussed in Section 7 of this QAPP. The main purpose of this data is to show compliance with the U.S. EPA NAAQS and to measure air pollutant concentrations that may be of concern for public health concerns and public welfare considerations. Section 7 of this QAPP also lists the measurement quality objectives, which were established to provide the expected data quality that users need.

It is the role of the QAPP to establish procedures to control measurement uncertainty to an appropriate level in order to achieve the objectives for which monitoring data are collected. As long as guidelines and any TSOPs/SOPs governing the measurement process are followed and all measurement quality objectives listed in this QAPP are met, it will be recognized that the DQOs can be achieved. However, there is always a chance that exceptional field events may negatively affect the performance of the monitoring station. Therefore, it is important to

reconcile the monitoring data with the DQOs to evaluate whether the data set is adequate for its intended use. This involves reviewing routine data, such as the monthly verification and validation reviews described in section 23 of this QAPP, and the results of monthly verification checks.

On a quarterly basis, the performance of the monitoring network will be evaluated by reviewing the data quality statistics (precision, bias and completeness) of the QA/QC data set and comparing the results to the monitoring project goals. Data quality assessment statistics are taken from the AQS AMP450 Report, Quick-look Report, the AQS AMP430 Report, Data Completeness, and the AQS AMP256 Report, QA Data Quality Indicator Report. The AMP450 Report provides summary statistics on the criteria pollutant data collected. The AMP430 Report provides a status of the quantity of criteria pollutant collected. The AMP256 Report provides a status of the QA/QC activities. Unacceptable performance for any of the DQO goals does not automatically indicate that the data set cannot be used for its intended purpose, i.e. the support of the decision process for a NAAQS. However, the impact on the confidence with which the data set can be used for its intended purpose in the decision process will have to be reviewed and communicated. This is done in the quarterly reports generated by the QAS environmental manager and QAS chief. Any anomalies are reported to the AMS(s) and ATS section chiefs and the AMB chief. The reports will identify the point(s) the data failed to meet DQOs and at what point in time, after corrective action, the data again meets DQOs. The corresponding data will be flagged and commented, and all supporting documentation will be included in the report.

The performance of the monitoring network for the previous year's data (January 1 to December 31) is evaluated for the annual Data Certification Package, which is due to the EPA by May 1$^{st}$. The AQS AMP600 Report, Certification Report, is used to evaluate the performance of the network as to its attaining the Data Quality Objectives. The AMP600 report provides summary statistics on QA/QC activities and on collected data from each monitor. This report also provides a summary evaluation of monitoring network performance by flagging data collection and QA/QC activities as acceptable/green, warning/yellow or recommend N/red. Normally by this time any issues or concerns have already been dealt with and sufficient documentation is available. The annual certification letter will provide a short summary to document data collection or QA/QC activities flagged as warning (yellow) or red (recommend N).