QUALITY ASSURANCE PROJECT PLAN

In Use By

Polk County Air Quality
Ambient Air Monitoring Personnel

For Calendar Year 2023

Revised: February 22, 2023

Revision: 21

QUALITY ASSURANCE PROJECT PLAN (QAPP)
for
POLK COUNTY AMBIENT AIR MONITORING PROGRAM
5885 NE 14th Street
DES MOINES, IA, 50313

Foreword

This document represents the Quality Assurance Project Plan (QAPP) for the field operations associated with the Polk County Public Works (PCPW) Air Quality Division Ambient Air Monitoring Network.

This QAPP was developed using the Environmental Protection Agency (EPA) QA regulations and guidance outlined in EPA QA/R-5, EPA *Requirements for Quality Assurance Project Plans* as well as the Quality Assurance (*QA) Handbook for Air Pollution Measurement Systems, Volume II, January 2017.* To the best of our agency's ability all pertinent elements of the regulations and guidance are addressed in this QAPP

EPA Policy requires that all projects involving the generation, acquisition, and use of environmental data be planned and documented and have an agency-approved QAPP prior to the start of data collection.

The QAPP provides an overview of the project, describes the need for the measurements, and defines the quality assurance/quality control (QA/QC) activities to be applied to the project within PCPW Ambient Air Monitoring Program.

The attached Quality Assurance Plan is hereby recommended for approval and commits Polk County Public Works Air Quality Division to follow the elements prescribed within.

1.0 Signatures/Approvals

Robert Rice 3-3-2023

Robert Rice,
Polk County Public Works Director ***Date***

3/2/2023

Jeremy Becker,
Polk County Air Quality Manager ***Date***

Jennifer M Bradley 3/6/2023

Jennifer Bradley,
Polk County Air Quality Assurance Manager ***Date***

2.0 Table of Contents

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3.0 Distribution List

A hardcopy or an electronic copy of this QAPP will be distributed to the individuals in Table 3-1. The QAPP will be distributed to other personnel and operators beyond this list, in accordance with the organizational charts presented in Section 4. An official version of this QAPP is also available on the Polk Co. website at the following hyperlink: https://www.polkcountyiowa.gov/public-works/air-quality/air-quality-monitoring/current-qapp-qmp-sop-s/

Table 3-1 Distribution List

Name	Position	Primary Function	Division/Branch
Polk County Air Quality			
Robert Rice	Director	Administration	Polk County Public Works
Jeremy Becker	Air Quality Manager	Program Manager/Oversight	Polk County Air Quality
Jennifer Bradley	Air Permit Engineer	Quality Assurance Manager	Polk County Air Quality
Chad Hines	Air Quality Specialist	Quality Assurance Officer	Polk County Air Quality
Jim Voigt	Air Quality Specialist	Technical Air Monitoring	Polk County Air Quality
Jessica Moeller	Air Quality Specialist	Technical Air Monitoring	Polk County Air Quality
David Tisl	Air Quality Compliance Technician	Technical Air Monitoring	Polk County Air Quality
Iowa Department Of Natural Resources			
John Gering	Environmental Specialist Senior	Ambient Air Monitoring	Iowa Department of Natural Resources
Jasmine Bootman	Environmental Specialist	Ambient Air Monitoring	Iowa Department of Natural Resources
EPA Region 7			
Mike F. Davis	Chemist	Science and Technology Center	Air/Air Quality Monitoring EPA Region 7
Diane Harris		Regional QA Manager	Grants Administration Office EPA Region 7

4.0 Project/Task Organization

The intent of this section is to discusses the roles and responsibilities of the key players. Figure 4-1 illustrates the chain-of-command and lines of communication within this project.

4.1 Office of Air Quality Planning and Standards (OAQPS)

OAQPS is the organization charged under the authority of the CAA to protect and enhance the quality of the nation's air resources. OAQPS sets standards, also known as National Ambient Air Quality Standards (NAAQS), for pollutants considered harmful to public health or welfare and, in cooperation with EPA's Regional Offices and the States, enforces compliance with the standards through state implementation plans (SIPs) and regulations controlling emissions from stationary sources. The office evaluates the need to regulate potential air pollutants and develops national standards; works with state and local agencies to develop plans for meeting these standards; monitors national air quality trends and maintains a database of information on air pollution and controls; provides technical guidance and training on air pollution control strategies; and monitors compliance with air pollution standards.

Within the OAQPS, the Ambient Air Monitoring Program or Ambient Air Monitoring Group (AAMG) is responsible for the oversight of the Ambient Air Quality Monitoring Network. OAQPS has the following responsibilities:

- X ensure that the methods and procedures used in making air pollution measurements are adequate to meet the programs objectives and that the resulting data are of satisfactory quality.
- X manages the National Performance Evaluation Program (NPEP) which includes PM2.5 and Lead Performance Evaluation Program (PEP) and the National Performance Audit Program (NPAP).
- X evaluate the performance of organizations making air pollution measurements of importance to the regulatory process.
- X implement satisfactory quality assurance programs over EPA's Ambient Air Quality Monitoring Network.
- X ensure that guidance pertaining to the quality assurance aspects of the Ambient Air Program is written and revised as necessary.
- X render technical assistance to the EPA Regional Offices and air pollution monitoring community.

4.2 EPA Regional Offices

EPA Regional Offices have been developed to address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs.

The major quality assurance responsibilities of EPA's Regional Offices regarding the Ambient Air Quality Program are the coordination of quality assurance matters between the various EPA offices and the State and local agencies. This is accomplished by the designation of EPA Regional Project Officers who are responsible for the technical aspects of the program including the review of QAPPs, and Regional QA Officers who are delegated the authority by the Regional Administrator to review and approve QAPPs for the Agency. The region acts as a liaison by making available the technical and quality assurance information developed by EPA headquarters to the State and local agencies and making EPA headquarters aware of the unmet quality assurance needs of the State and local agencies. The Regional Office also evaluates the capabilities of State and local agency laboratories to measure the

criteria air pollutants. These reviews are accomplished through network reviews and technical systems audits whose frequency is addressed in the Code of Federal Regulations. To be effective in these roles, the Regional Offices must maintain their technical capabilities with respect to air pollution monitoring. 40 CFR Part 58 defines the Local Agency as "any local government agency, other than the state agency, which is charged with the responsibility for carrying out a portion of the plan (SIP).

4.3 Iowa Department of Natural Resources (DNR)

Iowa DNR Air Quality Bureau is the organization charged under the authority of the CAA primarily responsible for the development and implementation of the State Implementation Plan (SIP). The main responsibility of the DNR is the implementation of a satisfactory monitoring program throughout, and the implementation of a satisfactory QA program. Iowa DNR develop and writes Annual Network Plans and 5-year Network Assessments for the entire state. Examples of the DNR recent annual Network Plan and 5-year Network Assessment are available at this hyper link of the IDNR Air Quality web page: https://www.iowadnr.gov/Environmental-Protection/Air-Quality/Monitoring-Ambient-Air

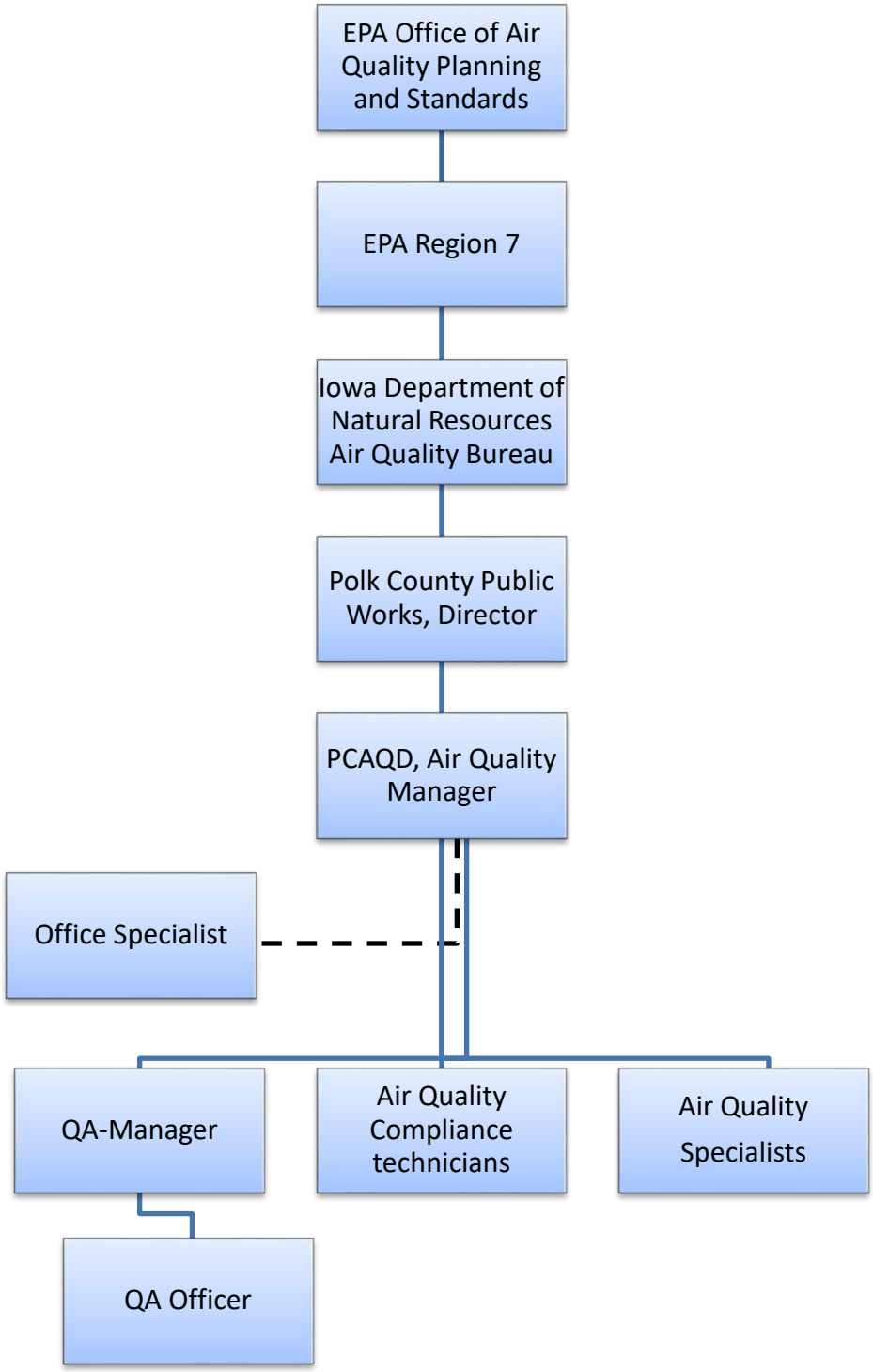
Polk County works with the IDNR if network site changes are needed. The Iowa DNR also conducts annual Technical System Audits (TSAs) of the Polk County Air Quality Division (PCAQD). Iowa DNR and EPA reviews and approves the Polk County Air Quality Division QMP. Polk County Air Quality Division has the ability to approve its own QAPP internally. The contract between the DNR and PCAQD reflects the Annual Network Plan and specifies the current monitoring network and sampling frequencies, as well as any modifications that are to be implemented during the contract period. Upon request of DNR, PCAQD shall make unscheduled network modifications (i.e. add or remove monitoring sites). Changes shall be negotiated and agreed upon in writing between DNR's monitoring contact and PCAQD.

4.4 Polk County Air Quality Division

4.4.1 Organization

Figure 4.1 represents the organizational structure for the Polk County Air Quality Division responsible for the activities of the Ambient Air Quality Monitoring Program. The following information lists the specific responsibilities of each individual and is grouped by functions of the Air Quality Manager, and the divisions related to Quality Assurance and Program Support.

Figure 4-1 Organizational Structure of the Polk County Air Quality Monitoring Project Chart



4.4.2 Mission Statement

The mission of the Polk County Air Quality Division is to protect the public from the harmful effects of air pollution, and conserve natural resources by preventing damage to the environment from releases of air contaminants. The Polk County Air Quality Division has been established to assist in fulfilling this mission.

4.4.3 Goals and Objectives

As authorized by 455B Code of Iowa, Polk County maintains an ambient air quality monitoring network.

Information gathered through this network provides a scientific and technical basis for regulatory and administrative decisions made by the Polk County Air Quality Division. Continued maintenance of this program is a major priority for Polk County.

4.4.4 Responsibilities

The major responsibility of the Polk County Air Quality Ambient Air Monitoring program is the implementation of a satisfactory monitoring program, which would naturally include the implementation of an appropriate quality assurance program. It is also the responsibility of the Polk County Air Quality Ambient Air Monitoring program to implement quality assurance programs in all phases of the data collection process, including the field, laboratories, and in any consulting and contractor laboratories which they may use to obtain or analyze data.

4.4.4.1 Polk County Board of Supervisors

The Polk County Board of Supervisors has the ultimate responsibility for the day-to-day operations of all divisions of Polk County government.

4.4.4.2 Director of Polk County Public Works

The Director of Polk County Public Works Department is the delegated manager of the ambient air monitoring program that includes the QA/QC activities that are implemented as part of normal data collection activities. Responsibilities of the Director include:

- X administrative oversight of the ambient air monitoring program
- X approving the budget and planning processes
- X assuring that the ambient air monitoring program develops and maintains a current and germane quality assurance/quality control system

The Director of Polk County Public Works Department delegates the responsibility for the development and implementation of individual monitoring programs, in accordance with Polk County policy, to the Air Quality Manager.

4.4.4.3 Air Quality Manager (AQM)

The Air Quality Manager has overall responsibility for establishing departmental policy and managing the Polk County Air Quality Ambient Air Monitoring program. The direct responsibility for assuring data quality rests with line personnel. Ultimately, the Air Quality Manager is responsible for establishing QA

policy and for resolving QA issues identified through the QA program. Major QA related responsibilities of the Air Quality Manager include:

- X approve the budget and planning processes
- X assure that the ambient air monitoring program develops and maintains a current and germane quality assurance/quality control system
- X assure that the ambient air monitoring program develops and maintains a current air monitoring QAPP and ensures adherence to the document by staff and, where appropriate, other extramural cooperators
- X establish policies to ensure that QA requirements are incorporated in all environmental data collection activities
- X maintain an active line of communication with the QAM, QAO and ambient air quality specialists/compliance technicians and provide dispute resolution
- X negotiate and approve any proposed acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements)
- X develop an annual work plan (e.g., contract between DNR and PCAQD) for the Air Quality Division
- X approve QA budgets proposed by the QAM
- X ensure that all personnel involved in environmental data collection have access to any training or QA information needed to be knowledgeable in QA requirements, protocols, and technology
- X ensure that a management system review occurs every 2 years
- X Oversees Training for ambient air monitoring program

The Air Quality Manager delegates the responsibility of QA implementation in accordance with the Ambient Air Monitoring Policy to the Quality Assurance Manager Oversight of the QA program is delegated to the QA manager.

4.4.4.4 Quality Assurance Manager (QAM)

The QA Manager is the delegated manager of the Polk County Air Quality Ambient Air Monitoring QA program. They have direct access to the Air Quality Manager on all matters pertaining to Quality Assurance. The main responsibility of the QAM is QA oversight; ensuring that all personnel understand the programs QA policy and all pertinent EPA QA policies and regulations specific to the Ambient Air Quality Monitoring Program. The QAM provides technical support and reviews, and approves QA products. Responsibilities include:

- X develop and interpret ambient air monitoring programs' QA policy, revising it as necessary
- X develop an Annual Quality Assurance Report and Annual Network Review for the Air Quality Manager
- X assist with the development of the annual work plan (e.g., contract between DNR and PCAQD)
- X review acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements) to determine the necessary QA requirements
- X assist the Air Quality Manager in developing QA budgets
- X assist staff in developing QA documentation and in providing answers to technical questions
- X ensure that environmental data collection activities are covered by appropriate QA planning documentation (e.g., QA project plans and data quality objectives)
- X track the QA/QC status of all ambient monitoring programs
- X serve as the program's QA liaison with EPA Regional QA Managers or QA Officers and the Regional Project Officer

- X remain current on PCAQD QA policy and general and specific EPA QA policies and regulations as it relates to the Ambient Air Quality Monitoring Program
- X review and approve the QAPP for the Ambient Air Quality Monitoring Program
- X review and approve all SOPs and revisions to SOPs annually as part of the Network Review
- X schedule and implement technical systems audits
- X perform data quality assessments
- X review precision and bias data
- X ensure timely delivery of all required data to the AQS system and ensure the development of data base guides (data base structures, user guidance documents)
- X ensure that technical systems audits occur within the appropriate schedules
- X review and approve QAPP
- X ensure that a QAPP is in place for all environmental data collection activities associated with the Ambient Air Quality Monitoring Program and that it is up-to-date
- X verify that all required QA activities were performed and that measurement quality standards were met as required in the QAPP
- X develop data quality requirements with the appropriate QAO
- X ensure that technical personnel follow the QAPP
- X participate in training and certification activities

The QAM has the authority to carry out these responsibilities and to bring to the attention of the Air Quality Manager any issues associated with these responsibilities. The QAM delegates the responsibility of QA development and implementation in accordance with the Ambient Air Monitoring Programs' policy to the Quality Assurance Officer.

4.4.4.5 Quality Assurance Officer (QAO)

The QAO assists the QAM. The QAO shall be provided with the needed assessment tools/documents and training opportunities to fulfill the needs of this position. The main responsibility of the QAO is to monitor the effectiveness of QA/QC programs in relation to the data collected as part of the daily field operations. The QAO Responsibilities include:

- X track the QA/QC status of all programs
- X review precision and bias data
- X give input to the Annual Quality Assurance Report, Annual Network Review and annual work plan (e.g., contract between DNR and PCAQD)
- X quarterly auditing of the monitoring system as required by the 40 CFR 58 Appendix A
- X auditing of record books associated with each site
- X review all monthly, quarterly, and annual reports prepared by the Air Quality Specialists
- X performs regular system audits of the ambient air monitoring network
- X responsible for developing the QAPP
- X ensure that technical personnel follow the QAPP
- X ensure that technical personnel follow the appropriate SOP
- X participate in training and certification activities

The AQM will provide support to the QAO to correct problems addressed in the QA report. Implementation of the QA program as it relates to daily field operations of the Ambient Air Monitoring Program is assigned to the Air Quality Specialist/Compliance Technician.

4.4.4.6 Air Quality Specialist/Compliance Technician

The Air Quality Specialists/Compliance Technicians are responsible for overseeing the routine field/lab monitoring and QA activities of the Ambient Air Quality Monitoring Program. In portions of this document the Air Quality Specialist/Compliance Technician is referred to as field personnel or field operator. The Air Quality Specialist/Compliance Technician responsibilities include:

- X give input to the Annual Quality Assurance Report, Annual Network Review and annual work plan (e.g., contract between DNR and PCAQD)
- X assist in solving QA-related problems at the lowest possible organizational level
- X ensure timely follow-up and corrective actions resulting from auditing and evaluation activities.
- X facilitate management systems reviews implemented by the QAM
- X participate in the development and implementation of the Ambient Air Quality Monitoring Program QAPP.
- X participate in training and certification activities
- X develop data quality requirements with the QAM and QAO
- X write and modify standard operating procedures (SOPs)
- X tracks the certification of standards that are NIST traceable and expiration dates
- X follow all manufacturer's specifications
- X perform and document preventative maintenance
- X QC checks and instrument verifications
- X document deviations from established procedures and method.
- X report all problems and corrective actions to the QAM
- X assess, verify and report data quality
- X retrieve the data from the instruments and subsequent upload of the electronic data to the EPA AQS database
- X maintain COC forms, as well as sample retrieval and transportation to IDNR contracted laboratory
- X tracks copies of all field sheets used to manually record data of ambient air tests
- X prepare and deliver reports to the QAM and/or QAO
- X flag suspect data
- X prepare and deliver data for further review by the QAM and/or QAO
- X develop local data management standard operating procedures
- X ensure that information management activities are developed within reasonable time frames for review and approval
- X follow good automated data processes for monitoring activities and sample collection
- X ensure the development of data standards for data structure, entry, transfer, and archive
- X ensure access to data for timely reporting and interpretation process
- X ensure the development of data base guides (data base structures, user guidance documents)

4.4.4.7 Multi Service Clerk

The Multi Service Clerk has been designated to provide support for all shipping/receiving of all equipment and consumable supplies as well as document duplication for the Ambient Air Monitoring Program. Responsibilities include:

- X assist in the development of standard operating procedures for shipping/receiving and following the procedures

X inform appropriate field /lab staff of arrival of consumables and equipment
X document, track, and archive shipping/receiving records

4.5 Quality Assurance Policies

It is Polk County's policy that there shall be sufficient QA/QC activities to ensure that all data generated are as accurate as possible and of acceptable completeness, comparability, and representativeness to support regulatory decisions based upon those data.

Completeness of data is an indicator of the quantity of valid data obtained from a measurement system compared to the quantity expected to be obtained under normal conditions. Completeness is related to the number of samples taken, and also to the care of instruments through calibration, maintenance or replacement and related activities.

Comparability expresses the confidence with which one data set can be compared to another. This encompasses data generated through measurements taken at various locations being reported in consistent units and collected and analyzed by consistent methods to allow direct comparisons of measurement results.

Representativeness expresses the degree to which data represent reality. It is related to the nature of the condition being measured and includes consideration of probe siting criteria, spatial scales, monitoring objectives, and timing of sampling to represent peak pollutant levels.

Precision checks and performance audits are conducted on a regular basis in order to provide QC data for evaluation of monitoring data. Precision checks yield information on data precision and a measure of mutual agreement among individual measurements of the same type, usually collected under similar conditions. Performance audits yield data indicative of accuracy, which refers to the degree of agreement between a measurement and an accepted reference value.

In keeping with the above-stated policy, all data produced and utilized shall be of known quality. All air monitoring shall be done in accordance with the guidelines set forth in this program QA management plan utilizing reference or equivalent methodology (REM), provided that designated REMs exist for the analytical parameters of interest. Standard operating procedures shall be developed and followed for all activities. Quality Assurance Project Plans shall be prepared for special projects of limited scope or duration.

4.6 Ambient Air Monitoring QA Program

4.6.1 Planning

Planning activities include:

Quality Management Plan (QMP) - This is a Polk County Public Works Ambient Air Program document that describes management practices, including Quality Assurance/Quality Control (QA/QC) activities, to ensure that the results of all technical work associated with the ambient air program are of the type and quality needed for their intended use.

Data Quality Objectives (DQOs) - DQOs are qualitative and quantitative statements derived from the outputs of the DQO Process that:

1. Clarify the study objective.
2. Define the most appropriate type of data to collect.
3. Determine the most appropriate conditions from which to collect the data.
4. Specify tolerable limits on decision errors which will be used as the basis for establishing the quantity and quality of data needed to support the decision. This process is discussed in Section 7.

Methods- Reference methods and standard operating procedures have been written for each pollutant monitor and meteorological instrument in use in the network.

Training - Training activities are discussed in Section 8.

Guidance - The State of Iowa Department of Natural Resources in accordance with EPA Region 7 offices shall provide guidance in the development of quality assurance/quality control procedures for the Polk County Ambient Air Quality Monitoring Program. Also, refer to section 9.3.1 regarding QAPPs

4.6.2 Implementation

Implementation activities include:

Precision and Accuracy (P & A) Checks - These checks are described in the Code of Federal Regulations as well as in each monitoring method specific SOP. These checks can be used to provide an overall assessment of measurement uncertainty.

Internal Audits - These performance audits are used to provide an independent assessment on the measurement operations of each instrument by comparing performance samples of "known" concentrations or values to the values measured by the instrument.

EPA External Audits - These audits are conducted by EPA Regional personnel. Performance Evaluation Program (PEP) is a program implemented by EPA that audits filter samplers which includes the PM2.5 PEP and Lead PEP audits. National Performance Audit Program (NPAP) is a program implemented by EPA that audits gas analyzers and includes Through the Probe (TTP) audits.

Annual Certifications - A certification is the process which ensures the traceability and viability of various QC standards. Standard traceability is the process of transferring the accuracy or authority of a primary standard to a field-usable standard. Traceability protocols are available for certifying a working standard by direct comparison to a NIST-Standard Reference Material (SRM). Certification requirements are included in the individual monitoring SOPs.

Calibrations - Calibrations should be carried out at the field monitoring site by allowing the analyzer to sample test atmospheres containing known pollutant concentrations. Calibrations are discussed in Section 14.

4.6.3 Assessment

Scientific and statistical evaluations of data are conducted to determine if the data obtained from environmental data operations are of the right type, quality and quantity for their intended use. Assessments for the Ambient Air Quality Monitoring Program include:

P & A Reports - These reports are generated annually and evaluate the precision and accuracy data against the acceptance criteria.

QA Reports - A QA report provides an evaluation of QA/QC data for a given time period to determine whether the data quality objectives were met. Discussions of QA reports can be found in Section 21.

Network Reviews - The annual network review is used to determine how well the Air Monitoring Network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. Network reviews are discussed in Sections 20.4 and 21.1.2.

5.0 Problem Definition / Background

The purpose of this document is to define and outline quality assurance management policies at the Division level as a part of an effort by the Polk County Air Quality Division to consolidate QAPPs and Standard Operating Procedures. This QAPP is intended to enhance the efforts of the Polk County Air Quality Division and assist the PCAQD in achieving its mission.

This document presents the quality assurance (QA) project plan for the Polk County, Iowa ambient air quality monitoring program. The purpose of the plan is to define and document the quality assurance (QA) and quality control (QC) activities of the program and ensure the validity of all data produced in the course of operations. Standard operating procedures (SOPs) and equipment associated with the operation and maintenance of field facilities. For a list of current SOP's covered by the QAPP see Appendix A of this document.

The provisions of this plan apply to ambient air monitoring conducted by Polk County at State and Local Air Monitoring Stations (SLAMS) and any other monitoring performed by the Polk County Air Quality Division.

Polk County Air Quality Division Monitors for the ambient air in Polk County for Particulates (PM10 & PM2.5), Air Toxics (TO-11), Nitrogen Dioxide (NO_2), and Ozone (O_3).

5.1 Background

Between the years 1900 and 1970, the emission of six principal pollutants increased significantly. The principal pollutants, also called criteria pollutants are: particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. In 1970 the Clean Air Act (CAA) was signed into law. The CAA and its amendments provide the framework for pertinent organizations to protect air quality. On May 10, 1979, EPA promulgated regulations in 40 CFR 58 that specified monitoring requirements for State Implementation Plans (SIPs outline the policies and procedures used by the State to assure CAA compliance with the National Ambient Air Quality Standards (NAAQS)).

These regulations also set forth requirements made in response to Section 319 of the Clean Air Act Amendments of 1977, which required EPA to establish monitoring criteria to be applied uniformly across the nation, and to establish a national monitoring network. One requirement of the regulations is that organizations responsible for ambient air pollution monitoring must establish and maintain a viable QA/QC program. Appendix A of 40 CFR 58 describes such requirements for organizations responsible for SLAMS. Appendix B of 40 CFR 58 describes requirements for organizations responsible for prevention of significant deterioration (PSD) air monitoring. These requirements include development and implementation of policies, procedures, specifications, standards, and documentation necessary to both provide data of adequate quality to meet monitoring objectives and to minimize loss of data due to malfunctions or out-of-control conditions.

The Polk County Air Quality Division QAPP has been developed from existing information and documentation present in budget narratives, internal policy memos, and other publications. The information and policies contained in this plan were previously available, but were not contained in a single document.

The Polk County Air Quality Division was initially authorized for implementation with the enactment of 455B.144 Code of Iowa, by the 1973 Iowa Legislature. The major provisions of this enabling statute were adopted to simultaneously comply with the requirements of the Federal Clean Air Act (42 U.S.C. 1857), which has been amended in 1967, 1970, 1977, and 1990. This Federal law establishes

requirements for states to implement approved air pollution control programs within their respective jurisdictions. The initial series of air pollution control regulations were promulgated and codified in 567 Iowa Administrative Code and in Chapter V, Polk County Board of Health Rules and Regulations, Air Pollution. These original regulations have been amended and expanded since that time in order to comply with relevant modifications to the federal requirements and to respond to changing needs. The Polk County Air Quality Division has been assigned the responsibility for implementation of the air quality program within Polk County in the State of Iowa.

Polk County has maintained an ambient air quality-monitoring program with an approved quality assurance plan and associated standard operating procedures in accordance with 40 CFR 58 since July 1, 1980.

Air quality samples are generally collected for one or more of the following objectives:

< judge compliance with and/or progress toward meeting ambient air quality standards.
< activate emergency control procedures that prevent or alleviate air pollution episodes as well as develop long term control strategies.
< observe pollution trends throughout the state, including non-urban areas.
< provide a database for research and evaluation of effects.

With the end use of the air quality samples as a prime consideration, the network should be designed to determine:

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

The Polk County Ambient Air Quality Monitoring Program consists of two major categories of monitoring stations or networks that measures pollutants. These stations are described below.

State and Local Air Monitoring Stations (SLAMS)

The SLAMS consist of a network of monitoring stations. The SIP provides for the implementation, maintenance, and enforcement of the national ambient air quality standards (NAAQS) in each air quality control region within the State.

Special Purpose Monitoring Stations (SPMS)

Special Purpose Monitoring Stations provide for special studies needed by the State to support SIPs and other air program activities. The SPMS are not permanently established and, thus, can be adjusted with relative ease to accommodate changing needs and priorities. The SPMS are used to supplement the fixed monitoring network as circumstances require and resources permit. If the data from SPMS are used for SIP purposes, they must meet all QA and methodology requirements for SLAMS monitoring.

5.2 Plan Objectives

The primary objective of the QAPP is to ensure, to the greatest extent possible, that all data obtained by scientific measurement provide accurate, valid information for interpretation and use within the scope of the Polk County Ambient Air Quality Division's program. This is to be achieved through monitoring and assessment of precision and accuracy of measurement devices and systems, together with efforts to verify and maintain the integrity of archived data. These efforts require that all personnel involved in any function impacting upon data quality must have sufficient training in their appointed jobs to contribute to the reporting of complete data of high quality.

A major priority is effective management of a comprehensive air pollution control program, as authorized by Code of Iowa enabling legislation. Information gathered through ambient air monitoring provides a scientific and technical basis for many of the regulatory and administrative decisions made by Polk County. Maintenance of an ambient air monitoring program capable of providing accurate, valid data for measured pollutants is essential to achieving this goal.

The objectives of special and/or additional monitoring projects shall be determined prior to initiation of data collection activities. This determination shall be accomplished during the planning phase of each project to ensure inclusion of appropriate procedures for collection of relevant data. Quality Assurance Project Plans (QAPP) shall be developed for such projects. These QAPPs shall include descriptions of how project activities will achieve stated objectives.

6.0 Project/Task Description

6.1 Description of Work to be Performed

In general, the measurement goal of the Polk County's Ambient Air Quality Monitoring Program is to estimate the concentrations of the certain primary pollutants described in 40 CFR Part 50. For the Polk County SLAMS/ SPMS network, which is what this QAPP describes, the primary goal is to compare the concentrations of Ozone, NO_2, Particulate Matter <10 micrometers (PM10) and Particulate Matter <2.5 micrometers (PM2.5) to the National Ambient Air Quality Standard (NAAQS). The national primary and secondary ambient air quality standards for pollutants which Polk County Air Quality monitor are described in Table 6-1 below.

Table 6-1 National Ambient Air Quality Standards*

Pollutant	Primary Stds.	Averaging Times	Secondary Stds.
Carbon Monoxide	9 ppm	8-hour(1)	None
	35 ppm	1-hour(1)	None
Lead	0.15 µg/m^3	Rolling 3 month average	Same as Primary
Nitrogen Dioxide	100 ppb	1-hour(2)	None
	53 ppb	Annual Mean	Same as Primary
Particulate Matter (PM_{10})	150 µg/m^3	24-hour(3)	Same as Primary
Particulate Matter ($PM_{2.5}$)	12.0 µg/m^3	Annual Mean(4)	15.0 µg/m^3
	35 µg/m^3	24-hour(7)	Same as Primary
Ozone	0.070 ppm	8-hour(5)	Same as Primary
Sulfur Dioxide	75 ppb	1-hour(6)	0.5ppm (3hrs)[1]

* This is based on EPA NAAQS table, most current table is located at the hyperlink:

https://www.epa.gov/criteria-air-pollutants/naaqs-table

(1) Not to be exceeded more than once per year.

(2) 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years

(3) Not to be exceeded more than once per year on average over 3 years.

(4) Annual mean, averaged over 3 years

(5) Annual fourth highest daily maximum 8-hour concentration averaged over 3 years

(6) 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

(7) 98th percentile, averaged over 3-years

The following sections will describe the measurements required for the routine field and laboratory activities for the network. In addition to these measurements, an initial set of measurements will be required to fulfill the requirements of the AQS database. These measurements are included in Section 18.

6.1.1 Field Activities

The performance requirements of the air samplers used by Polk County Air Quality is specified in 40 CFR Part 50 and the Federal Register Notice. Each corresponding appendix is shown below in Table 6-2. Each appendix of 40 CFR and the Federal Register summarizes some of the more critical performance requirements.

Table 6-2 References for Performance Requirements

Pollutant	Reference
Ozone (O3)	40 CFR Part 50, Appendix D
Nitrogen Dioxide (NO_2)	40 CFR Part 50, Appendix F
Particulate Matter <10 micrometers (PM10)	40 CFR Part 50, Appendix J
Particulate Matter <2.5 micrometers (PM2.5)	40 CFR Part 50, Appendix L.

6.1.2 Field Measurements

When operating any analyzer, certain diagnostic and conditional measurements must be recorded. Table 6-3 provides references for each pollutant that Polk County Air Quality monitors. References indicate what field measurements must be collected and are indicated in each pollutant's SOP. Measurements are made by the analyzer and are stored in the instrument for downloading/recording by the field operator during routine visits. Also, see Section 19 regarding data management.

Table 6-3 Field Measurement Requirements References

Pollutant	Reference
Ozone (O3)	40 CFR Part 50, Appendix D
Nitrogen Dioxide (NO2)	40 CFR Part 50, Appendix F
Particulate Matter <10 micrometers (PM10)	40 CFR Part 50, Appendix J
Particulate Matter <2.5 micrometers (PM2.5)	40 CFR Part 50, Appendix L Jan. 2016 EPA QA Guidance Document 2.12

6.1.3 Laboratory Activities

Laboratory activities for the Polk County Air Quality Monitoring Program are included in the SOP of each pertinent pollutant and fall within the guidelines set forth in 40 CFR. The following activities are examples of general laboratory activities associated with the Polk County Air Quality Monitoring Program. Polk County Air Quality utilizes the State Hygienic Laboratory (SHL) at the University of Iowa for analyses services. These services include analysis of discrete particulate network and the toxics network.

Activities associated with the Polk County Air Quality Monitoring Program are listed below:

Shipping/Receiving

- Receiving filters ($PM_{2.5}$ and PM_{10})
- Carrying filters to the field (if required)
- Receiving filters from the field and logging these in
- Storing filters
- Shipping $PM_{2.5}$ and PM_{10} filters to the State Hygienic Laboratory
- Receiving Carbonyl sampling cartridges
- Storing Carbonyl Cartridges

- Carrying Carbonyl sampling cartridges to the field
- Shipping Carbonyl sampling cartridges to the State Hygienic Laboratory
- Associated QA/QC activities

Post Sample Period

- Data downloads from field data loggers
- Data entry/upload to AQS
- Associated QA/QC activities

6.2 Project Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance. Sections 20 and 21 will discuss the details of the PCAQD assessments. Table 6-4 will provide information on the parties implementing the assessment and their frequency.

Table 6-4 Assessment Schedule

Assessment Type	Assessment Agency	Frequency
Technical Systems Audit	EPA Regional Office	As Scheduled by EPA Region VII
Network Review	Iowa DNR	Yearly
FRM Performance Audit (PM2.5)	EPA Regional Office	25% of sites/year/4 times per year.
Quarterly Performance Audits	PCAQD	Quarterly

6.3 Project Records

The Polk County Air Quality division will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision and maintenance of documents and records. Table 6-5 represents the categories and types of records and documents.

Table 6-5 Critical Documents and Records

Categories	**Record/Document Types**
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and training Training Certification Quality management plan Document control plan EPA Directives Grant allocations Support Contract
Site Information	Network description Site characterization file Site maps Site Pictures
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory notebooks Sample handling/custody records Inspection/Maintenance records
Raw Data	Any original data (routine and QC data) including data entry forms
Data Reporting	Air quality index report Annual SLAMS air quality information Data/summary reports Journal articles/papers/presentations
Data Management	Data algorithms Data management plans/flowcharts PM2.5 Data Data Management Systems
Quality Assurance	Good Laboratory Practice Network reviews Data quality assessments QA reports System audits Response/Corrective action reports Site Audits

7.0 Quality Objectives and Criteria for Measurement Data

Data collected for the Polk County Ambient Air Quality Monitoring Program is used to make specific decisions that can have an economic impact on the area represented by the data. EPA OAQPS will be responsible for defining the Data Quality Objectives (DQO) for criteria pollutants as they apply to the end-users or decision makers. DQOs are a qualitative and quantitative statements used to design and/or define an environmental data collection activity (EDCA) including a specification of the level of uncertainty that a decision maker (data user) is willing to accept in the data to which the decision will apply. See Appendix B of this document for DQO's. Throughout this section, the term "decision maker" is used. This term represents individuals that are the ultimate users of ambient air data and therefore may be responsible for: setting the NAAQS, developing a quality system, evaluating the data, or declaring an area non-attainment. Decision makers need to feel confident that the data used to make environmental decisions are of adequate quality. The data used in these decisions are never error free and always contain some level of uncertainty. Because of these uncertainties or errors, there is a possibility that decision makers may declare an area "non-attainment" when the area is actually in "attainment" (false positive error) or "attainment" when actually the area is in "non-attainment" (false negative error). There are serious political, economic, and health consequences of making such decision errors. Therefore, decision makers need to understand and set limits on the probabilities of making incorrect decisions with the data. In order to set probability limits on decision errors, one needs to understand and control uncertainty. Uncertainty is used as a generic term to describe the sum of all sources of error associated with an EDCA.

The estimate of overall uncertainty is an important component in the DQO process. Both population and measurement uncertainties must be understood. Population uncertainties can be controlled by developing a proper statistical sampling design. Likewise, measurement uncertainties can be evaluated and controlled through appropriate quality assurance and quality control techniques (QA/QC).

Population uncertainties are the spatial and temporal components of error. These uncertainties can be controlled by selecting appropriate boundary conditions (the area and the time period) to which the decision will apply, and by developing a proper statistical sampling design. The key to controlling population uncertainties, and the most important attribute of any Ambient Air Monitoring Network, is representativeness. Representativeness refers to the degree in which data accurately and precisely represents a characteristic of a population, parameter variation at a sampling point, a process condition, or an environmental condition. It does not matter how precise or unbiased the measurement values are if a site is unrepresentative of the population it is presumed to represent. Assuring the collection of a representative air quality sample depends on the following factors:

- Selecting a network size that is consistent with the monitoring objectives and locating representative sampling sites.
- Determining and documenting restraints on the sampling sites that are imposed by meteorology, local topography, emission sources, and the physical constraints.
- Planning sampling schedules that are consistent with the monitoring objectives.

Measurement uncertainties are the errors associated with the EDCA, including errors associated with the measurement phases of field, preparation, and laboratory activities. At each measurement phase of this process, errors can occur that, in most cases, are additive. The goal of a QA program is to control measurement uncertainty to an acceptable level through the use of various quality control and evaluation techniques. In a resource constrained environment, it is most important to be able to calculate/evaluate the total measurement system uncertainty and compare this to the DQO. If resources are available, it may be possible to evaluate various phases of the measurement system. The data quality indicators of precision, bias, and detectability, as described in section 7.2, are important in determining total measurement uncertainty.

The DQO process is used to facilitate the planning of data collection activities. It asks the data user to focus their EDCA efforts by specifying the use of data (the decision), decision criteria, and the probability they can accept of making an incorrect decision based on the data. The DQO process contains the following steps:

1. Identify the problem to be resolved
2. Decision/Goals
3. Inputs to the decision
4. Boundaries of the study
5. Decision rule/analytic approach
6. Limits of uncertainty (performance or acceptance criteria)
7. Study design optimization/plan for obtaining data

For further information, this formal 7-step process is described in the EPA document *Guidance on Systematic Planning Using the DQO Process* (EPA QA/G-4, February 2006).

7.1 Ambient Air Quality DQOs

As indicated above, the first step in the DQO process is to identify the problems that need to be resolved. The objectives of the Polk County Ambient Air Quality Monitoring Program as previously mentioned are:

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

Site-specific data quality objectives (DQOs) are defined for each monitoring station in operation in Polk County consistent with any one or more of the aforementioned monitoring objectives.

7.2 Measurement Quality Objectives

Once a DQO is established, the quality of the data needs to evaluated and controlled in order to ensure that it remains within the accepted range. Measurement quality objectives (MQOs) are designed to control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the ranges prescribed by the DQOs. MQOs can be defined in terms of the following measurement quality attributes:

Bias - the systematic or persistent distortion of a measurement process which causes error in one direction. Bias will be determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

Precision -A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar condition.

Accuracy - Degree of agreement between a measurement (or an average of measurements of the same thing), and the amount actually present.

Representativeness - a measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition, assuring the collection of a representative air quality sample depends on the following factors:

1. Selecting a network size consistent with the monitoring objectives and properly locating the sampling site.
2. Determining restraints on the sampling sites that are imposed by meteorology, local topography, emission sources, and physical constraints.
3. Planning sampling schedules consistent with the monitoring objectives.

Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR Part 50).

Comparability - a measure of confidence with which one data set can be compared to another. Established by uniform application of siting criteria objectives for pollutant specific spatial scales of representativeness (see Section 10 Sampling Process Design).

Detectability - The determination of the low range critical value of a characteristic that a method specific procedure can reliably discern. It is identified on a pollutant monitoring method specific basis as established by the appropriate SOP. Factory specifications for the ozone and nitrogen dioxide analyzers operated by the PCAQD meet or exceed the lower detectable limit criteria outlined in the Measurement Quality Objective tables of the Quality Assurance Handbook for Air Pollution Measurement Systems Volume II.

The Polk County Air Quality Division operates air monitoring equipment within a set of MQOs designed to maintain high data quality and exceed DQOs required for the monitoring program. A summary of the of these MQOs is included in Appendix B of this QAPP. Complete and unedited MQO Tables can be found in Polk County Air Quality SOPs for criteria pollutants.

8.0 Special Training Requirements / Certifications

8.1 Personnel Qualifications

Personnel assigned to ambient air monitoring activities are expected to have met the educational, work experience, responsibility, personal attributes, and training requirements for their positions. In some cases, certain positions may require certification and/or recertification. These requirements are outlined in the air monitoring staff personnel position descriptions. Records on personnel qualifications and training are maintained with the Polk County Air Quality Manager and shall be accessible for review during audit activities. These records should be retained as described in Section 9.

8.2 Training

Adequate education and training are integral to the Polk County Ambient Air Quality Monitoring Program. Training is aimed at increasing the effectiveness of employees and their organization. Appropriate training shall be available to all employees supporting the Polk County Ambient Air Quality Monitoring Program, commensurate with their duties. Such training may consist of classroom lectures, workshops, teleconferences, and on-the-job training.

New employees of the Polk County Ambient Air Monitoring Program receive a thorough indoctrination into the quality assurance and quality control policies and procedures of ambient air quality monitoring. This document and its associated SOPs are required reading for all new employees. All employees participating in ambient air quality monitoring activities are involved in review and revision of these documents annually. All new employees participate in orientation seminars offered by the Polk County Manager's Office. New supervisory staff is also expected to complete introductory management courses offered by the Polk County Manager's Office. New employees shall go into the field with the current site operator and job shadow for an amount if time till he or she has covered all aspects of the monitoring program.

The Polk County Air Quality Division maintains a library of educational materials and has access to a satellite television receiver system, which may be utilized, for training and/or continuing educational purposes. Workshops, symposia, or continuing education courses offered by firms, colleges, or various government agencies are available to staff. In order for an employee to participate, the subject matter must be applicable to a program or project, funding must be available, and supervisory and administrative approval must be secured in advance. Yearly reviews are conducted by the Air Quality Manager for each employee. These are used to demonstrate competency of each project staff.

8.2.1 Suggested Training

Over the years, a number of courses have been developed for personnel involved with ambient air monitoring and quality assurance aspects. Formal QA/QC training is offered through the following organizations:

- σ Air Pollution Training Institute (APTI)[1]
- σ Air & Waste Management Association (AWMA)
- σ American Society for Quality, formerly the American Society for Quality Control (ASQC)
- σ Office of Air and Radiation
- σ EPA Quality Program
  https://www.epa.gov/quality/training-courses-quality-assurance-and-quality-control-activities

[1] EPA is in the process of replacing APTI with AirKnowledge Learning Management System (LMS); course names listed in Table 8-1 may change.

σ EPA Regional Offices

Table 8-1 provides a suggested sequence of core QA-related ambient air monitoring courses for ambient air monitoring staff, and QA Managers (marked by asterisk). The suggested course sequences assume little or no experience in QA/QC or air monitoring. Persons having experience in the subject matter described in the courses would select courses according to their appropriate experience level. Courses not included in the core sequence would be selected according to individual responsibilities, preferences, and available resources.

Table 8-1 Suggested Sequence of Core QA-related Ambient Air Training Courses for OAQPS QA or Ambient Air Monitoring Contacts and QA Managers

Sequence	Course Title (SI = Self Instructional)	Source
1*	Air Pollution Control Orientation Course (Revised), SI:422	APTI
2*	Principles and Practices of Air Pollution Control, 452	APTI
3*	Orientation to Quality Assurance Management	EPA Quality Program
4*	Introduction to Ambient Air Monitoring (Under Revision), SI:434	APTI
5*	General Quality Assurance Considerations for Ambient Air Monitoring (Under Revision), SI:471	APTI
6*	Quality Assurance for Air Pollution Measurement Systems (Under Revision), 470	APTI
7*	Data Quality Objectives Workshop	EPA Quality Program
8*	Quality Assurance Project Plan	EPA Quality Program
9	Atmospheric Sampling (Under Revision), 435	APTI
10	Analytical Methods for Air Quality Standards, 464	APTI
11	Chain-of-Custody Procedures for Samples and Data, SI:443	APTI
*	Data Quality Assessment	EPA Quality Program
*	Management Systems Review	EPA Quality Program
*	Beginning Environmental Statistical Techniques (Revised), SI:473A	APTI
*	Introduction to Environmental Statistics, SI:473B	APTI
*	Quality Audits for Improved Performance	AWMA
*	Statistics for Effective Decision Making	ASQC

* Courses recommended for QA Managers

9.0 Documentation and Records

For the Polk County Air Quality monitoring program, there are a number of documents and records that need to be retained. A document, from a record management perspective, is a volume that contains information that describes, defines, specifies, reports, certifies, or provides data or results pertaining to environmental programs. As defined in the Federal Records Act of 1950 and the Paperwork Reduction Act of 1995 (now 44 U.S.C. 3101-3107), records are: "...books, papers, maps, photographs, machine readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the United States Government under Federal Law or in connection with the transaction of public business and preserved or appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the Government or because of the informational value of data in them...." This section will provide guidance of documentation and records for the Polk County Ambient Air Quality Monitoring Program.

Table 9-1 Types of information that should be retained through document control

Categories	Record/Document Types
Management and Organization	State Implementation Plan Reporting agency information Organizational structure of monitoring program Personnel qualifications and training Quality management plan Document control plan Network reviews
Site Information	Network description Site characterization file Site maps Site audits
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory notebooks Sample handling/custody records Critical Monitoring Emails
Raw Data	Any original data
Data Reporting	Air quality index report Annual SLAMS air quality information Data/summary reports Journal articles/papers/presentations
Data Management	Data algorithms Data management plans/flowcharts
Quality Assurance	Data quality assessments QA reports System audits Control Charts

Table 9-1 represents the categories and types of records and documents which are applicable to document control. Information on key documents in each category follow. It should be noted that the list contains documents that may not be applicable to particular organizations and therefore is not meant to be a list of required documentation. This list should also not be construed as the definitive list of record and document types.

Statute of Limitations - As stated in 40 CFR 31.42, in general, all information considered as documentation and records should be retained for 3 years from the date the grantee submits its final expenditure report unless otherwise noted in the funding agreement. However, if any litigation, claim,

negotiation, audit or other action involving the records has been started before the expiration of the 3-year period, the records must be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular 3-year period, whichever is later.

Polk County Air Quality keeps computer files and hard copies of all documents on site for a minimum of five years. Hard copies are then moved to Polk County Archives and stored for an additional ten years prior to being destroyed. Table 19-2 provides more detail on PCAQD archive policies. Also, the QMP describes retention times for records described as 'miscellaneous' such as site selection studies.

9.1 Management and Organization

Documentation for many of the document types listed in Table 9-1 for this category can be found in the Polk County Air Quality Management Plan.

9.2 Site Information

The Polk County Ambient Air Monitoring Network is composed of State and Local Air Monitoring Stations (SLAMS). This Network is provided for in the Iowa State Implementation Plan (SIP) as required by 40 CFR 58.20.

DQO requirements for such stations are outlined in the technical appendices to 40 CFR 58, as follows:

1. 40 CFR 58, Appendix A contains QA criteria (DQOs) for the operation of SLAMS and other monitor types whose data are intended to be used to determine compliance with the NAAQS;
2. 40 CFR 58, Appendix B contains QA criteria (DQOs) for Prevention of Significant Deterioration (PSD) Air Monitoring;
3. 40 CFR 58, Appendix C contains criteria for the selection of monitoring methods and instruments for SLAMS and Particulate Matter Episode Monitoring;
4. 40 CFR 58, Appendix D contains criteria for SLAMS network design; and
5. 40 CFR 58, Appendix E contains criteria for siting of instruments and/or instrument probes.

The Iowa Ambient air Monitoring Network is described in the State of Iowa Implementation Plan for the Attainment and Maintenance of National Air Quality Standards. All monitoring stations are assigned a specific identification number for the EPA Air Quality System (AQS) according to the format, SS-CCC-NNNN, where SS represents a two digit state code (19 for Iowa), CCC represents a three digit county code (153 for Polk County), and NNNN represents a specific site identifier. A current list of monitoring stations is provided in Table 9-2 of this plan; map of site locations and site pictures are provided online on PCAQD website, hyperlink: https://www.polkcountyiowa.gov/public-works/air-quality/air-quality-monitoring/monitoring-sites/

SPECIAL PURPOSE MONITORING/REGULATED ENTITIES

Special Purpose Monitors (SPMs) may be operated. Although Special Purpose Monitors are not SLAMS, they are subject to specific requirements in 40 CFR 58.14.

Regulated entities conducting their own ambient monitoring shall utilize reference or equivalent methods (as defined in 40 CFR 50.1), and conduct monitoring according to PSD monitoring requirements (contained in 40 CFR 58, Appendix B). Each regulated entity conducting such monitoring shall develop a monitoring plan that must include a QA plan.

Below is provided monitoring site characteristics for each PCACD monitoring station. This information will assist in providing objective inputs into the evaluation of data gathered at that site. See the QMP for record retention of site selection information. The monitoring site files are covered under Miscellaneous record in the PCAQD QMP.

Table 9-2 Monitoring stations

Carpenter-BAM $PM_{2.5}$

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	88101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	SLAMS
Sample Frequency:	Continuous
Analyzer:	Met One Instruments, Model 1022
Probe height:	30 feet
Distance from road:	>30 meters
Comments:	Located on top of building

Carpenter-BAM $PM_{2.5}$

Address:	1907 Carpenter Ave.
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	88101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	Continuous
Analyzer:	Met One Instruments, Model 1022
Probe height:	30 feet
Distance from road:	> 30 meters
Comments:	Located on top of Building

Carpenter-O_3

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	44201
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	SLAMS
Sample Frequency:	Continuous
Analyzer:	Thermo Scientific 49*i*, 49*iQ*
Probe height:	30 feet
Distance from road:	>30 meters
Comments:	Located in building

Carpenter-NO/NO_2/NOx

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	42601, 42602, 42603
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	Continuous
Analyzer:	Thermo Scientific TL-42*i*, TL-42*iQ*
Probe height:	30 feet
Distance from road:	>30 meters
Comments:	Located in building

Carpenter-Carbonyl

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	Several
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	1 in 12 days
Analyzer:	ATEC 2200
Probe height:	30 feet
Distance from road:	> 30 meters
Comments:	Located in building

Carpenter- Met Station

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	61103, 61104, 62201, 62101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	Continuous
Analyzer:	Met-One 597; RM Young 86000
Probe height:	30 feet
Distance from road:	> 30 feet
Comments:	Located on top of building

Carpenter – FRM $PM_{2.5}$

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	0030
Parameter:	88101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	SLAMS
Sample Frequency:	Daily
Analyzer:	Thermo Scientific 2025*i*
Probe height:	30 feet
Distance from road:	> 30 feet
Comments:	Located on top of building

Carpenter – FRM PM_{10}

Address:	1907 Carpenter Ave
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	81102
Parameter:	Several
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	SLAMS
Sample Frequency:	1 in 3 days
Analyzer:	Thermo Scientific 2025*i*
Probe height:	30 feet
Distance from road:	> 30 meters
Comments:	Located on top of building

Sheldahl- Met Station

Address:	15795 NW 58th St
City:	Polk City
State:	Iowa-19
County:	Polk-153
Site #:	1579
Parameter:	61103, 61104
Spatial Scale:	Regional
Monitor Objective:	Background
Monitor Type:	Special Purpose
Sample Frequency:	Continuous
Analyzer:	RM Young 86000
Probe height:	16 feet
Distance from road:	46 feet
Comments:	Located on county property

Sheldahl- Ozone

Address:	15795 NW 58th St
City:	Polk City
State:	Iowa-19
County:	Polk-153
Site #:	1579
Parameter:	44201
Spatial Scale:	Regional
Monitor Objective:	Downwind Exposure
Monitor Type:	SLAMS
Sample Frequency:	Continuous
Analyzer:	Thermo Scientific 49*i*, *49iQ*
Probe height:	16 feet
Distance from road:	46 feet
Comments:	Located on county property

Polk County Public Works FRM $PM_{2.5}$

Address:	5885 NE 14th Street
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	5885
Parameter:	88101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	1 in 3
Analyzer:	Thermo Scientific 2025*i*
Probe height:	15 feet
Distance from road:	200 feet
Comments:	Located on County property

Polk County Public Works BAM $PM_{2.5}$

Address:	5885 NE 14th Street
City:	Des Moines
State:	Iowa-19
County:	Polk-153
Site #:	N/A
Parameter:	88101
Spatial Scale:	Neighborhood
Monitor Objective:	Population Exposure
Monitor Type:	Special Purpose
Sample Frequency:	Continuous
Analyzer:	Met One Instruments, Model 1022
Probe height:	15 feet
Distance from road:	200 feet
Comments:	Located on County property

9.3 Environmental Data Operations

A quality assurance program associated with the collection of ambient air monitoring data must include an effective procedure for preserving the integrity of the data. Ambient air test results and, in certain types of tests, the sample itself may be essential elements in proving the compliance status of a facility; that is, it may be necessary to introduce the sample or the test results as evidence in an enforcement proceeding. Therefore, each step in the testing and analysis procedure must be carefully monitored and documented. There are basically four elements in the evidentiary phase of an overall Quality Assurance Program:

1. Data collection - includes testing, preparation and identification of the sample or other data.
2. Sample handling - includes protection from contamination and tampering during transfer between individuals and from the sampling site to the evidence locker.
3. Analysis - includes storage of samples prior to and after analysis as well as data interpretation.
4. Preparation and filing of test report - includes evidentiary requirements and retention of records.

Failure to include any one of these elements in the collection and analysis of ambient air monitoring data may render the results of the program inadmissible as evidence, or may seriously undermine the credibility of any report based on these data.

Environmental data operations include all the operations required to successfully measure and report a value within the data quality objectives. Documentation for environmental data operations would include:

- σ *QA Project Plans* - Documents how environmental data operations are planned, implemented, and assessed during the life cycle of a program, project, or task. See below.
- σ *Standard operating procedures(SOPs)* -Written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. See below.
- σ *Field and laboratory notebooks* - Any documentation that may provide additional information about the environmental data operation (i.e. calibration notebooks, temperature records, site notes, maintenance records, NIST Traceability documentation etc.). See below.
- σ *Sample handling/custody records* - Records tracing sample handling from the site through analysis, including transportation to facilities, sample storage, and handling between individuals within facilities. Section 13 provides more information on this activity.

9.3.1 Quality Assurance Project Plans

As mentioned in the assistance agreement sections of 40 CFR parts 30.54 (Non-State and Local Gov.) and 31.45 (State and Local Gov.) quality assurance programs must be established. In addition to the grant requirements, 40 CFR Part 58 Appendix A states that each quality assurance program must be described in detail in accordance with the *EPA Requirements for Quality assurance Project plans for Environmental Data Operations EPA QA/R-5*. PCQAD QMP also discusses the preparation, review, and retention of QAPPs.

9.3.2 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) are written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. It is officially approved as the method for all routine activities, especially those that are involved in the environmental data operations, which generally involve repetitious operations performed in a consistent manner. SOPs should be written by individuals performing the procedures that are being standardized. Individuals, with appropriate training and experience with the process, review the SOPs. SOPs must be approved by the supervisor of the

personnel responsible for writing the document. For documentation purposes, the approving official should sign and date the title page of the SOP.

SOPs currently in use shall be electronically stored in pdf format on the agencies shared drive in the folder entitled "Current SOPs". These SOPs shall be used in field operations until a revised SOP receives review and approval from QAM/QAO and AQM. SOPs shall be maintained for historical purposes in the agencies shared drive in the folder entitled "Archived SOPs". Archived SOPs shall be stored in a file named with the year that the SOP was in use. As stated in the PCAQD QMP, outdated or invalid documents shall be filed and noted as such in the project file directory and kept for a minimum of 5 years from date of replacement.

SOPs should ensure consistent conformance with organizational practices, serve as training aids, provide ready reference and documentation of proper procedures, reduce work effort, reduce error occurrences in data, and improve data comparability, credibility, and defensibility. They should be sufficiently clear and written in a step-by-step format to be readily understood by a person knowledgeable in the general concept of the procedure. Elements to include in SOP:

1. Scope and Applicability
2. Summary of Method
3. Cautions Indicating activities that would result in equipment damage, degradation of sample or possible invalidation of results
4. Interference
5. Apparatus and Materials (list or specify; note also designated locations where found)
6. Instrument or Method Calibration
7. Sample Collection
8. Handling and Preservation Sample Preparation and Analysis
9. Troubleshooting
10. Data Acquisition, Calculations & Data Reduction

9.3.3 Field and Laboratory Notebooks

Manual recording of data is sometimes required for ambient air tests. Standardized forms will be utilized to ensure that all necessary information is obtained. These forms (such as field data sheets and chain of custody forms) are designed to clearly identify the process being tested, the date and time, location of test site, and operating personnel. These forms may determine the credibility of the data and should not be erased or altered. Any errors should be crossed out with a single line, and the correct value recorded above the crossed-out number.

Site notebooks are located at each site, as are copies of any manually recorded test done at that site. These notebooks shall not be removed unless they are used completely and replaced with a new notebook of similar style. Copies of all field sheets used to manually record data of ambient air tests are also kept by the Polk County Air Quality Specialist/Compliance Technician and are available upon request.

Do not discard original field records; copies are not normally admissible as evidence. For neatness, the field data may be transcribed or copied for incorporation in a final report, but the originals should be kept on file. Since these records may be subpoenaed, it is important that all field notes be legible.

9.3.4 Sample Handling

Sample handling is covered in greater detail in Section 12.

9.3.5 Raw Data

Raw data includes any original factual information from a measurement activity or study recorded in laboratory work sheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. For automated information systems, raw data is considered the original observations recorded by the information system that are needed to verify, calculate, or derive data that are or may be reported.

9.3.6 Data Reporting

In addition to samples and field records, the report of the analysis itself serves as material evidence. Just as the procedures and data leading up to the final report are subject to the rules of evidence, so is the report itself.

To ensure compliance with legal rules, all test reports are filed by Polk County Air Quality Specialist or Compliance Technician at the main office. Although the field notes and calculations are not generally included in the summary report, these materials may be required at a future date to bolster the acceptability and credibility of the report as evidence in an enforcement proceeding. Therefore, the full report including all original notes and calculation sheets should be kept in the file. Signed receipts for all samples or other data, are also filed. See table 19-2 for retention time of these reports.

9.3.7 Data Management

Virtually all of the data collected for the Polk County Ambient Air Quality Monitoring Program will be collected through the use of automated systems. These systems are effectively managed and documented by using a set of guidelines and principles by which adherence will ensure data integrity. This can be found in Section 19, the discussion of data management activities and the requirements for documentation.

9.3.8 Quality Assurance

Quality assurance information is necessary to document the quality of data. This information should be retained in a manner that it can be associated with the routine data that it represents. QA Information include:

1. *Control charts* - Used to visualize the QC results of a particular monitor. Polk County Air Quality uses a server based central data collection system as well Excel spreadsheets for creating and viewing control charts.
2. *Data quality assessments (DQAs)* - These assessments are a statistical and scientific evaluation of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use.
3. *QA Reports* - Reports pertaining to the quality of data usually related to some aggregate (quarterly, yearly etc) and discuss the measurement quality attributes and data quality objectives are discussed in Section 21.
4. *System Audits* - Assessments of various phases of the environmental data operation are discussed in Section 20.

10.0 Sampling Process Design

The purpose of this section is to describe all of the relevant components of the monitoring network to be operated by Polk County Air Quality Division, including the network design for evaluating the quality of data. This entails developing and understanding the monitoring objectives and appropriate data quality objectives; identifying the spatial scale most appropriate for the monitoring objective of the site; identifying the general locations where the monitoring site should be placed; and identifying specific monitoring sites. The network design components comply with the regulations set forth in 40 CFR Part 58 Section 58.13, Appendix A, Appendix D, and Appendix E.

Air quality samples are generally collected for one or more of the following purposes:

1. to judge compliance with and/or progress made towards meeting ambient air quality standards
2. to activate emergency control procedures that prevent or alleviate air pollution episodes
3. to observe pollution trends throughout the region, including nonurban areas
4. to provide a data base for research evaluation of effects: urban, land-use, and transportation planning; and development and validation of diffusion models

10.1 Monitoring Purposes

10.1.1 Compliance Monitoring

The information required for selecting the number of samplers and the sampler locations include isopleth maps, population density maps, source locations, and availability of appropriate location space. The following are suggested guidelines:

- the priority area is the zone of highest pollution concentration within Polk County; one or more stations should be located in this area
- close attention should be given to densely populated areas within Polk County
- the quality of air entering Polk County's region is to be assessed by stations situated on the periphery of the region (i.e. upwind and downwind locations)
- some information of air quality should be available to represent all portions of the region
- a major objective of surveillance is evaluation of progress made in attaining the desired air quality; for this purpose, sampling stations should be strategically situated to facilitate evaluation of the implemented control tactics

10.1.2 Emergency Episode Monitoring

In making determinations for the declaration of an air pollution episode condition, Polk County Air Quality will notify the Iowa Department of Resources immediately when any of the following levels is reached:

Fine particulate matter (PM10) – 150 micrograms per cubic meter for a 24-hour average
Fine particulate matter (PM2.5) – 35 micrograms per cubic meter for a 24-hour average
Ozone (O_3) – 0.070 ppm for an 8-hour average
Nitrogen dioxide (NO_2) – 100 ppb for a 1-hour average

The Iowa Department of Natural Resources will have ultimate authority for determination of an air pollution alert. In the event that the Iowa Department of Natural Resources issues an air pollution alert,

Polk County Air Quality will act as described in the *Polk County Board of Health Chapter V, Article XV. Emergency Air Pollution Episodes.*

10.2 Rationale for the Design

10.2.1 Primary Samplers

The primary purpose of the ambient air monitoring program operated by Polk County Air Quality is to measure compliance with national standards for ozone, nitrogen dioxide and particulate matter less than or equal to 10 or 2.5 micrometers. These standards are detailed in 40 CFR Part 50 and are summarized as:

Table 10-1 National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary Stds.	Averaging Times	Secondary Stds.
Carbon Monoxide	9 ppm	8-hour(1)	None
	35 ppm	1-hour(1)	None
Lead	0.15 µg/m^3	Rolling 3 month average	Same as Primary
Nitrogen Dioxide	100 ppb	1-hour(2)	None
	53 ppb	Annual Mean	Same as Primary
Particulate Matter (PM_{10})	150 µg/m^3	24-hour(3)	Same as Primary
Particulate Matter ($PM_{2.5}$)	12.0 µg/m^3	Annual Mean(4)	15.0 µg/m^3
	35 µg/m^3	24-hour(5)	Same as Primary
Ozone	0.070 ppm	8-hour(6)	Same as Primary
Sulfur Dioxide	75 ppb	1-hour(7)	0.5ppm, averaging time 3 hours(1)

(1) Not to be exceeded more than once per year.

(2) 98th percentile of 1-hr daily maximum concentrations, averaged over 3 years

(3) Not to be exceeded more than once per year on average over 3 years.

(4) Annual mean, averaged over 3 years

(5) 98th percentile, averaged over 3 years

(6) Annual fourth highest daily maximum 8-hour concentration averaged over 3 years

(7) 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

To determine whether these characteristics are quantified with sufficient confidence, Polk County Air Quality must address sampler type, sampling frequency, and sampler siting. By employing FRM/FEM samplers, Polk County Air Quality is assured to be measuring the pollutant concentrations as well as possible with regard to evaluating compliance with the NAAQS. By complying with the sampling frequency requirements of 40 CFR Part 58 Section 58.13, Polk County Air Quality assumes that the sampling frequency is sufficient to attain the desired confidence in the annual 98th percentile and annual mean of concentrations in the vicinity of each monitor.

10.2.2 QA Samplers

The purpose of collocated samplers and the FRM/FEM performance evaluation is to estimate the precision and bias of the various samplers. Bias and precision goals, as presented in the MQO tables (Appendix B), must be accomplished to ensure that decisions concerning attainment and/or non-attainment of the NAAQS can be made with sufficient confidence. To estimate the level of bias and precision being achieved in the field, 25% of all pollutant sites will operate a collocated sampler and the remaining will be audited with an audit device. If a sampler is operating within the required bias and precision levels, then the decision maker can proceed knowing that the decisions will be supported by unambiguous data. If however, a sampler exceeds the bias limits, the precision limits, or both, then the decision maker cannot use the data to make decisions at the desired level of confidence and corrective action must be implemented to ensure that future data collected by the sampler does meet the bias and precision limits. Thus the key characteristics being measured with the QA samplers are bias and precision.

To determine whether these characteristics are measured with sufficient confidence, Polk County Air Quality must address sampler type, sampling frequency, and sampler siting for the QA network. As with the primary monitoring network, by using FRM/FEM samplers, maintaining the sampling frequency specified in 40 CFR Part 58 Appendix A, Appendix E, and collocating the number of samplers as specified in 40 CFR Part 58 Appendix A, Polk County Air Quality assumes its QA network will measure bias and precision with sufficient confidence.

10.3 Design Assumptions

The sampling design is based on the assumption that following the rules and guidance provided in the CFR and *Guidance for Network Design and Optimum Site Exposure for PM*2.5 *and PM*10 will result in data that can be used to measure compliance with the national standards. The only issue at Polk County Air Quality's discretion is the sampler siting, and to a degree, sampling frequency.

10.4 Procedures for Locating and Selecting Environmental Samples

10.4.1 Primary Samplers

The design of the SLAMS/SPMS network must achieve one of six basic monitoring objectives, as described in 40 CFR Part 58, Appendix D. They are:

1. To determine the highest concentrations expected to occur in the area covered by the network.
2. To determine representative concentrations in areas of high population density.
3. To determine the impact on ambient pollution levels of significant sources or source categories.
4. To determine general background concentration levels.
5. To determine the extent of regional pollution transport among populated areas.
6. In support of secondary standards, to determine the welfare-related impacts in more rural and remote areas.

The procedure for siting samplers to achieve the six basic objectives is based on judgmental sampling, as is the case for most ambient air monitoring networks. Judgmental sampling uses data from existing monitoring networks, knowledge of source emissions and population distribution, and inference from analyses of meteorology to select optimal sampler locations.

Table 10-2 Polk County Air Quality Monitoring Network

Pollutant	Monitor Type	AQS ID	City	Location	Address	Operating Schedule	Monitoring Objective	Spatial Scale
PM2.5 FRM	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Daily	Population Exposure	Neighborhood
PM2.5 FRM	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	1 in 6	Precision	Neighborhood
PM2.5 BAM	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Neighborhood
PM2.5 BAM	SPM	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Neighborhood
PM2.5 FRM	SPM	19-153-5885	Des Moines	Polk County Public Works	5885 NE 14th Street	1 in 3	Population Exposure	Neighborhood
PM2.5 BAM	SPM	19-153-5885	Des Moines	Polk County Public Works	5885 NE 14th Street	Continuous	Population Exposure	Neighborhood
PM10 FRM	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	1 in 3	Population Exposure	Neighborhood
PM10 FRM	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter.	1 in 6	Precision	Neighborhood
Ozone	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Urban
Ozone	SLAMS	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Urban
TL-NO_2	Special Purpose	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Neighborhood
Ozone	SLAMS	19-153-1579	Polk City	Sheldahl	15795 NW 58th Street	Continuous	Max Ozone Concentration	Urban
Ozone	SLAMS	19-153-1579	Polk City	Sheldahl	15795 NW 58th Street	Continuous	Max Ozone Concentration	Urban
Carbonyl	SPM	19-153-0030	Des Moines	Carpenter	1907 Carpenter	1 in 12	Population Exposure	Neighborhood
Air Toxics-Aldehydes	SPM	19-153-0030	Des Moines	Carpenter	1907 Carpenter	1 in 12	Population Exposure	Neighborhood
Met Station	SPM	19-153-0030	Des Moines	Carpenter	1907 Carpenter	Continuous	Population Exposure	Neighborhood
Met Station	SPM	19-153-1579	Polk City	Sheldahl	15795 NW 58th Street	Continuous	Downwind Background	Urban

10.4.2 Primary Samplers – Defining Maps

At this time, no monitoring planning areas (MPAs) are defined. As data is gathered, MPAs may be defined.

10.4.3 Primary Samplers – Defining CMZs

Polk County Air Quality is defining no Community Monitoring Zones (CMZs) and no spatial averaging will be done.

10.4.4 Primary Samplers – Sampling Frequency

The sampling frequency is shown in Table 10.2 above.

10.4.5 Primary Samplers – Types of Samplers

All SLAMS/SPMS samplers will be FRM/FEM monitors.

10.4.6 QA Samplers

The collocated monitor will be the same type as the core sampler, with the exception of the PM2.5 Beta Attenuation Mass (BAM) monitors. The Primary PM 2.5 BAMs is a SLAMS monitor, but the collocated PM2.5 BAM is a SPM. The collocated sampler will run in accordance to Table 10.1 above, which will coincide with the sampling day of the core sampler at that site. According to 40 CFR Part 58, Appendix A, Section 3.5.2, for each method designation, at least 25% (minimum of one) of the samplers must be collocated. Polk County Air Quality has met this requirement by collocating the core sampler at the Carpenter and Sheldahl monitoring sites with a sampler of the same type and model.

A complementary method for estimating bias and precision for PM2.5 is the FRM Performance Evaluation. Even though U.S. EPA will be performing these evaluations, it is important to recognize that these evaluations be performed. First, Polk County Air Quality will provide access to the sites and offer other needed support after the EPA Region 7 QA Coordinator contacts Polk County. Secondly, the performance evaluation data will be reviewed by Polk County Air Quality. According to 40 CFR Part 58, Appendix A, Section 3.5.3, each method designation and at least 25% of each method designation with a reporting organization must be audited each year.

10.5 Classifications of Measurements as Critical/Noncritical

10.5.1 Primary Samplers

The critical criteria information specified in the QA Handbook Volume II, Appendix D, Measurement Quality Objective (MQO) and Validation Templates (See Polk County Air Quality SOPs) determines what data will be provided to AQS. Also critical is the site information. This data is critical because they are necessary for determining compliance with the NAAQS standards. All SLAMS/SPMs monitoring data will be used in comparison with the NAAQS.

10.5.2 QA Samplers

The critical information collected at collocated samplers is the same as that presented in the MQO Tables. All of the measurements in the MQO Tables are considered critical because they form the basis for estimating bias and precision which are critical for evaluating the ability of the decision makers to make decisions at desired levels of confidence. The measurements described in the MQO Tables will also be collected for the collocated samplers.

11.0 Sampling Methods Requirements

11.1 Purpose/Background

Ambient air sampling performed by Polk County Air Quality is primarily concerned with atmospheric concentrations of particulates ($PM_{10/2.5}$), Ozone (O_3), and hazardous air pollutants (HAPs). To establish validity of ambient air monitoring data it must be shown that the proposed sampling method complies with any and all appropriate testing regulations as well as the equipment is accurately sited, was accurately calibrated using correct calibration methods, and the organization implementing the data collection operation is qualified to do so. For criteria pollutants only equipment designated as reference methods (FRM) or equivalent methods (FEM) in accordance with 40 CFR Part 53 may be used if data are to be utilized for attainment designation purposes whether the primary and secondary national ambient air quality standards for monitored pollutants are met.

11.2 Sample Collection and Preparation

FRM and FEM samplers will be used as the monitor for collection of concentrations/samples for comparison to the NAAQS. It is planned that sequential samplers will be used at all PM2.5 FRM and PM10 FRM sites including collocated samplers. Continuous samplers will be used at all ozone and NO_2, sites. Continuous BAM-1022 will also be used at the Carpenter site as SLAMS monitors for PM 2.5. Air Toxics Carbonyl cartridges will be used at the Carpenter site as a special purpose monitor. Each model sampler shall be installed with adherence to procedures, guidance, and requirements detailed in 40 CFR Parts 50, 53 and 58: Section 2:12 of the QA Hand Book: the sampler manufacturer's operation manual; Polk County's Air Quality SOP's (Appendix A), and the EPA's Quality Assurance Guidance Documents.

11.2.1 Particulate Monitors

Polk County Air Quality utilizes two separate types of particulate monitors. 24-hour filter based samplers and continuous Particulate monitors.

11.2.1.1 PM_{10} Particulate Monitors Thermo Scientific Partisol 2025*i*

Polk County utilizes Thermo Fisher Scientific Partisol 2025*i* all with PM_{10} inlet specified in 40 CFR 50 Appendix L, Figures L-2 through L-19, and configured as a PM_{10} reference method and operated for 24-hour continuous sample periods with a flow rate of 16.7 L/min. Partisol 2025*i* is to be operated with firmware version 2.0 or greater, with modified filter shuttle mechanism, in accordance to the Partisol 2025*i* instruction manual, as appropriate and with the requirements specified in 40 CFR Part 50 Appendix J. Manual Reference Method RFPS-1298-127 with an AQS method code of 127.

11.2.1.2 $PM_{2.5}$ Particulate Monitors Thermo Scientific Partisol 2025*i*

Polk County utilizes Thermo Fisher Scientific Partisol 2025*i* all with a Very Sharp Cut Cyclone (VSCC) particle size separator with PM_{10} inlet specified in 40 CFR 50 Appendix L, Figures L-2 through L-19 and operated for 24-hour continuous sample periods with a flow rate of 16.7 L/min. Partisol 2025*i* is to be operated with firmware version 2.0 or greater, with modified filter shuttle mechanism, in accordance to the Partisol 2025*i* instruction manual, as appropriate, with the VSCC supplemental manual and with the requirements specified in 40 CFR Part 50 Appendix L. Manual Equivalent Method EQPM-0202-145 with an AQS method code of 145.

11.2.1.3 $PM_{2.5}$ Particulate Monitors BAM 1022

Polk County Utilizes the Met One BAM 1022 Continuous particulate monitor as a $PM_{2.5}$, sampling ambient air at 16.7 L/min on a continuous basis with a VSCC particle size separator. This monitor is considered a FEM (Federal Equivalent Method) EQPM-1013-209 as described in 40 CFR Part 50, Appendix L and can be considered either a SLAMS or SPM with an AQS method code of 209.

11.2.2 Continuous Gaseous Monitors

The continuous monitors sample ambient air through a sample probe on a 24-hour basis every day, except for times of instrument maintenance and calibrations. The flow rate of the air is indicated in the applicable SOP manuals for each monitor and follow the guidelines laid out by 40 CFR Part 53.

11.2.2.1 Ozone Monitors

Ozone (O_3) monitors are Thermo Environmental Instruments 49*i* and 49*iQ* type analyzers and are designated under equivalent method EQOA-0880-047 and operated under the guidelines in 40 CFR Parts 53 and 58 with an AQS method code of 047.

49*i* monitors operated with a sample flow rate of 1 to 3 LPM on any measurement range between 0-0.051 to 1.0 ppm, with any time average setting between 10 and 300 seconds, operated at temperatures between 5°C to 40°C with the temperature and/or pressure compensation on or off, with or without any of the following options: Teflon particulate filter, Internal Zero Air Scrubber, Internal Ozonator with remote activation, rack mounts, or I/O expansion board.

49*iQ* monitors operated with a sample flow rate of 1 to 3 LPM on any measurement range between 0 and 1000 ppb, with any time average setting between 10 and 300 seconds, operated at temperatures between 0°C to 45°C with the temperature and pressure compensation, with or without the following options: Teflon particulate filter, 19 inch rack mount, internal zero air scrubber, internal ozonator with remote activation, internal zero/span valves with remote activation, internal zero air package, analog I/O expansion board, digital I/O expansion board, communications board, dynamic filtering. Operated with the appropriate instrument manual

Ozone Calibration Units are Thermo Environmental Instruments 49*i*. These are utilized as transfer standards (TS) for field calibrations and routine site QC and audit checks. The Primary Ozone analyzer(s) are certified annually against the Region 7 EPA SRM. The Primary Ozone analyzers are Thermo Environmental Instruments 49*i*PS and 49*iQ*PS. The TS units utilized for calibrating the Ozone field analyzers are referenced to the certified Primary standard prior to and during the Ozone season.

11.2.2.2 Nitrogen Dioxide Monitors

Nitrogen Dioxide (NO_2) monitors are Thermo Environmental Instruments 42*i*-TL analyzers and are designated under reference method RFNA-1289-074 and operated under the guidelines in 40 CFR Parts 53 and 58 with an AQS method code of 574.

42*i*-TL monitors operated between 0-10 ppb and 0-1000 ppb with averaging times from 10 to 300 seconds, operate at temperatures between 15°C and 35°C, and with or without the following options: rack mounts, Teflon® Particle Filter, or I/O Expansion Board.

42*iQ*-TL Trace Level NO/NO2/NOx Analyzer operated between 0-10 ppb and 0-1000 ppb with averaging times from 10 to 300 seconds or with dynamic filtering, operated at temperatures between 0^{O}C and 35^{O}C with temperature and pressure compensation, at line voltages of 100 to 240 VAC @ 50/60 Hz, with or without the following options: Teflon particulate filter, ozone particulate filter, ozone permeation dryer, 19 inch rack mount, internal zero/span valves with remote activation, internal zero air package, analog I/O expansion board, digital I/O expansion board, communication board, and dynamic filtering. Operated with the appropriate instrument manual.

All of the site monitors are to be operated under specific operational conditions listed in the appropriate instrument operational manual and individual SOP in order to be classified as an equivalent or reference method. The instrument operational manuals and SOPs are located at each site for reference to all specifications.

11.2.3 Air Toxics Monitor

Air Toxics are sampled by an ATEC 2200 instrument on an intermittent basis for a 24-hour period through a stainless steel sample port at a flow rate determined by the target pollutant. Currently Polk County is using the sampler as a special purpose monitor (SPM) for Compendium Method TO-11. This method includes the ambient air collection (for which Polk County is responsible) as well as the analysis of the sample collection by the IDNR contracted laboratory.

11.3 Environmental Controls

A proper sampling environment demands control of all physical parameters external to the samples that might affect sample stability and reactivity within the sampler. Some of the parameters to be controlled are:

Instrument vibration: Design of instrument housing and benches should be according to the manufacturer recommendations.

Light: Shield all chemicals or instruments that can be affected by natural or artificial light. Applicable Polk County Air Quality monitors, such as the gaseous and toxic, are placed out of direct sunlight.

Electrical voltage: Use constant voltage transformers or regulators, separate power lines from other electrical uses. Polk County Air Quality uses surge protectors on all instrumentation. In trailer sites, the instrument power is on a separate circuit from lighting and heating/cooling systems. Monitors at the Public Health site are protected from excessive data loss due to power outages by a backup diesel generator.

Temperature: Use an electrical heating and cooling system only to maintain needed temperature range for the monitor in use at the site based on their operational ranges stated in the SOP and appropriate operational manuals. For ozone and NO_2 monitors, the attached MQO tables specify a shelter temperature of 20.0 to 30.0 ºC (hourly average) or per manufactures specifications if designated to a wider temperature range. Most continuous analyzers have been tested and qualified over a temperature range of 5C to 40C by the manufacturer. The acceptable manufacturer operating temperatures and the range of temperature change which the analyzer can accommodate without excessive drift needs to be adhered to, to be considered an equivalent or reference method. A thermometer attached to the site data logger is used at each location to monitor this temperature. Maintaining temperatures above the atmospheric dew point will prevent moisture issues in the manifold or sample lines. If the temperature is outside of the instrument acceptable operational range, the QAM/QAO will evaluate data for the period back to the last

acceptable temperature record. Corrective action should be taken to help maintain the target temperature range.

Humidity: PCAQD uses an air conditioning system to control humidity. If air conditioning system fails, the field operator shall note the temperature and also indicate a humidity reading in field logbook. Operator shall refer to the QAM/QAO for data reporting validation requirements.

Outdoor deployment: Some particulate samplers are designed to be deployed outdoors and are able to perform in a variety of local temperature ranges. Use of internal cooling fans and electronic heaters are incorporated into the samplers to maintain functionality in all extremes. Regular cleaning of cooling fan inlet/outlets is needed to provide adequate circulation in the electronics compartments of the samplers.

11.4 Sampling Probes and Manifolds

Placement of probes and manifolds must be placed to avoid introducing bias to the sample. Important considerations are probe height, probe length, physical influences near probe, material of manifold or probe and residence time of pollutants within the sampling manifold to monitor are important. Probes should not be placed next to air outlets such as exhaust fans. Horizontal probes must extend beyond building overhangs. Probes should not be near physical obstructions, which can affect the airflow. Height of probe over ground depends on the pollutant being monitored and is listed in Appendix E, 40 CFR 58 (except PM2.5) for SLAMS sites. Probe and manifold information is included in the Polk County Air Quality Division annual Network Review report completed during the 1st quarter of each calendar year.

For PM2.5 monitoring the initial goal of the project is to select a site where the PM2.5 measurements will be representative of the monitoring area. Spatial and temporal (annual, 24-hr. or both concentrations) scale must be considered in site selection. The below items should be observed no matter what scale is chosen:

The PM2.5 sampler should have unobstructed airflow for a minimum of 2 meters in all directions and the sampler inlet should be placed at a height of 2 to 15 meters above ground level. If the PM2.5 FRM sampler is collocated with any other particulate sampler the spacing between sampler inlets must be at least 1 meter but no more than 4 meters and the heights of their inlets within 1 meter measured vertically.

In the event that calibration gases are vented out the sample lines of gas analyzers, their inlets above the roof for different pollutants must be adequately separated; so that excess check gases from one pollutant to not produce anomalies in routine sample values from another pollutant.

Residence time of pollutants within the sampling probe/manifold is critical. Total residence time should be less than 10 seconds and is required to be less than 20 seconds for reactive gas monitoring. Each site has a residence time calculated and is noted in the site information file. If any changes in the probe manifold are made the residence time must be re-calculated. The site field operator (AIR QUALITY SPECILAIST/COMPLIANCE TECHNICIAN) or the QAM/QAO shall make this calculation at time of site setup. If the volume of the manifold does not allow an acceptable residence time to occur then use of a blower motor or vacuum pump can be used to reduce this residence time. A residence time determination worksheet is available on the EPA AMTIC website.

If a manifold system is used, maintain a flow rate in a manifold system that is 3 to 5 times the total sampling requirements. This rate will help reduce the sample residence time in the manifold and ensure adequate gas flow to the monitor. Polk County Air Quality currently does not utilize any manifold systems in its monitoring network.

Manifolds and probes should be made of materials such as Pyrex glass, Teflon or Stainless Steel since these materials are inert. For all continuous gaseous pollutants, Polk County Air Quality uses PTFE Teflon for all sample lines to the instruments. Stainless Steel sample lines are used at all Air Toxics sites.

A regular cleaning schedule should be maintained to help maintain constant sampling conditions. For Polk County Air Quality the rain caps and probe lines are to be inspected at least quarterly. Rain caps are cleaned or replaced as needed while all probe lines are replaced as needed or at a minimum every two years. The site operator is responsible for the monitoring site while the AQM is responsible for monitoring site support. If a problem arises at a site, the corrective action taken is noted in the site field logbook for review and approval by the AQM or QAM.

Other information to consider in designing a sampling manifold is the positioning of the air conditioning flow, which should be away from the sample line to prevent condensation of water vapor. This is especially important during high dew point periods. This can cause problems because moisture can absorb gases as well other possible issues if it is introduced into the instrument. It is usually useful to wrap the sample line to the instrument with an insulator to minimize issues during high dew point periods. Another means of protection is the use of a water resistant particulate filter in-line with the instrument. Additionally, nafion tubes to prevent condensation interference in ozone analyzers are a corrective action option and if used, will be added to the appropriate SOP or a separate SOP developed.

11.5 Preventative Maintenance Description and Schedule

Preventative maintenance is important to the operational process of all monitors. Regular maintenance of the instruments (e.g. cleaning probes, changing inlet filters) ensures monitor interferences are being preemptively dealt with. The maintenance is reflected in the completeness reports of each monitor. Calibration information is used to determine potential instrumentation problems. The guidelines for maintenance are described in the operational manuals for the monitors and noted in their respective SOPs.

Recommended spare parts and expendables shall be purchased so as to minimize the down time of any monitor in the network. The field personnel are trained to perform maintenance and performance checks on the instrumentation. If the problem still exists after troubleshooting and consultation with the manufacturer, the monitor will be shipped to the manufacturer for repair. If funding is available, maintaining backup monitors is recommended. The use of a backup instrument may be used if the instrument is of the same USEPA designation as a reference or equivalent method as the primary monitor. Any maintenance shall be noted in the instrument site logbook.

11.6 Support Facilities for Sampling Methods

Polk County Air Quality has a laboratory which is an environmental and clinical laboratory and has all the reagents, refrigerators and other auxiliary equipment and supplies required to support the monitoring activities. This includes all needed reagent waters (Type 1) and various standards for use in all calibrations of instrumentation. Polk County Air Quality has a designated area for ambient air monitoring maintenance, assessment and training.

Purity specifications for all calibration gases from various manufacturers are reviewed and compared before purchasing. The certificates and purity ratings for these gases are located in the Polk County Air Quality standards certification file.

11.7 Sampling/Measurement System Corrective Action

Sample corrective actions shall be noted in the site and instrument specific logbook. The Quality assurance manager shall review all corrective actions on a monthly basis and assess the corrective action for approval. When method changes or corrections arise, these changes are made in AQS with Iowa DNR's guidance.

12.0 Handling & Custody Requirements for PM2.5 FRM, PM10 FRM and Carbonyls

12.1 Sample Handling and Custody

The data generated by all ambient air monitors must be handled in such a way as to ensure that the data are of the highest quality to be used for its intended purpose. Some of the items included are data retrieval from monitors, data retrieval system checks, field personnel handling of data, data processing for transfer, data storage methods and final QC procedures of all data prior to being sent to the AQS database. The guidelines for handling, reduction and validation of all data from the ambient air monitors are contained in Section 11 this QAPP, and the Polk County Air Quality SOP 15 Data Retrieval and submission SOP. The monitor SOP's, as identified in Appendix A of this QAPP, detail pre- and post-sample custody requirements and procedures.

The continuous monitors are connected to ESC 8832 data loggers for the digital and analog collection of ambient data, instrumentation operational diagnostics and all calibration data. Data retrieval from the sites is via a hosted SQL server by Agilaire. Polk County utilizes wireless modems for the transmission of data from the site data loggers to the hosted server utilizing Agilaire AirVision software. AirVision allows users to view, analyze, report and distribute air quality data and information products across the full range of media.

The central system capabilities include:

- X Local and wide area networking support
- X Collection of data from remote stations at scheduled times or upon request
- X Electronic site and calibration summary reports and operational alarm notifications
- X Polling of a large variety of data logging systems
- X Dynamic displays
- X Automatic data backups
- X FTP file transfer to Air Now Tech
- X AQS file formatting for data transfer needs to EPA database (XML Reporter)
- X Data analysis, data editing (and the required edit tracking) and data reporting

The field personnel review the hourly data retrieved from the continuous monitors either electronically or via printed matrix reports and provide any comments to the QAM/QAO during the normal monthly data review process. The data are then quality controlled and quality assured by the QAM/QAO with any needed edits completed prior to transfer to the EPA AQS database system.

The $PM_{2.5}$ and PM_{10} FRM samples are delivered to the contracted laboratory by Polk County Air Quality staff in a temperature controlled environment for conditioning and weighing. The chain of custody (COC) sheets and monitor data from the runs are also sent with the filters for determination of ambient concentration. The results are then sent back to Polk County Air Quality for QA/QC before being loaded into the EPA AQS database. The transport and handling details for FRM $PM_{2.5}$ and PM_{10} filters are described in Polk County Air Quality SOP 19 COC and Transport of Filters.

Air Toxics collection cartridges are also transported by a Polk County Air Quality employee to/from the contracted laboratory facility. The handling of these samples is noted in the SOP 8 for Air Toxics. The field sheets are used for chain of custody purposes.

12.2 Sample Labeling and Identification

Care must be taken to properly mark all samples and monitoring device readings to ensure positive identification throughout sample collection and analysis. If ink is used for marking, it must be indelible and unaffected by the gases or temperatures. Ink is used on all field sheets and logbooks used in ambient monitoring. Any changes to records must use the strike out, date and initial method.

Filters from all monitors have numbers imprinted on the filter. For $PM_{2.5}$ and PM_{10} FRM, the filter housings also have a number imprinted on them. See the respective SOPs for the $PM_{2.5}$ and PM_{10} FRM samples.

Air Toxics cartridge pouches are labeled in the field when they are being set up. The labeling is also located on all field sheets for reference and comparison.

Electronic data are marked with a file name, which usually includes the pollutant, date/period and abbreviated site name. This electronic stamp is used to also identify the time of last update/viewing of the data file. All data and samples from the operations are stored on the password protected Polk County network or in the Air Quality Branch area, which is an accessed controlled building.

12.3 Sample Collection

Collected intermittent type samples and data are brought to the PCAQD facility on the same day of retrieval. All PM filter samples are collected, stored, and transported in the same cartridges as used for the collection.

12.4 Transportation

In transporting samples and other monitoring data, it is important to take precautions to eliminate the possibility of tampering, accidental destruction or physical/chemical action on the sample. Physical handling and temperature extremes can affect the integrity of the samples. The sample recovery time (from the end of the sample run to pick-up at the sampling site) for both $PM_{2.5}$ FRM, and low volume discrete PM_{10} samples, is 7 days and 9 hours; as specified in the attached MQO tables. The sample recovery time (from the end of the sample run to pick up at the sampling site) for air toxics is <72hours. The maximum allowable interval between the end of sampling and laboratory weighing or analysis is addressed in the SHL SOPs for the $PM_{2.5}$ Weigh Lab and Method TO-11.

Polk County Air Quality has an advantage of being within close proximity of our monitoring network sites. This reduces the risk of problems with transportation of samples. Toxic cartridges are stored in the Air Toxics lab refrigerator which will be kept at <4°C until they can be transferred to SHL for analysis. The PM FRM filters are placed in the facility filter storage refrigerator at 4ºC or less for holding until shipping/transport to the contracted laboratory. This refrigerator is manually recorded every week using a traceable thermometer. A Min/Max thermometer is used to monitor filter temperature during transport to the contracted laboratory and recorded on the custody sheets/field sheets associated with the filters. The vehicle used in the transport of all data and samples shall be locked whenever the field personnel are not in the vehicle.

12.5 Chain-Of-Custody

If results of a sampling program are to be used as evidence, a written record must be available listing the location of the data at all times. This chain of custody record is necessary in showing the representativeness of the sampling data. Without it, one cannot be sure the sampling data analyzed was the same as the data reported to have been collected. Only personnel associated with the test program should handle the sample/data. Each person handling the samples or data must be able to state from which it was received.

All non-continuous (intermittent) samples are hand delivered to the contracted laboratory by Polk County Air Quality personnel. For $PM_{2.5}$, PM_{10} and Air Toxics, PCAQD uses a COC form provided by the contracted laboratory. These forms include all of the required critical information such as sample dates/times, specimen ID's and personnel handling to assure traceability of the sample. Generally, Polk County Air Quality delivers the $PM_{2.5}$ FRM, PM_{10} FRM and Air Toxics samples to the contracted lab once a week. Make-up runs are completed for PM and toxics samples. To schedule a make-up, the site operator work directly with SHL.

For electronic sample data, the only personnel handling this type of data are the field personnel who retrieve the data from the instruments and does the validation/verification and subsequent upload of the electronic data to the EPA AQS database. Field staff maintain COC forms, as well as sample retrieval and transportation to SHL. COCs are scanned and copied for Polk County Air Quality record storage.

12.6 Personnel Responsibility

The site operators are primarily responsible for maintaining the integrity of the field sample data. In the absence of the site operators, the Air Quality Manager is responsible for sample handling procedures. All personnel involved have easy access to the SOP manuals located either in paper format at each monitoring site or in electronic format on the Polk County Air Quality network drive.

12.7 Storage

The storage of all data shall be held for a minimum of three (3) calendar years from the time of annual certification by the Polk County Air Quality reporting agency (designated in AQS as reporting organization, RO# 0874). The field data sheets shall be filed in the Polk County Air Quality data storage area. These include all particulate and toxics field sheets and calibration sheets. All logbooks for each site shall be held on site until full, then they will be stored in the Polk County Air Quality Division storage area for a minimum of five (5) years.

The electronic data collected from the monitors via the 8832 data logger is transferred to the hosted server system on an hourly basis using the Agilaire AirVision software. The Hosted server is backed up on a daily basis. Other electronic data such as FRM downloads are transferred to the Polk County network system on a weekly and/or monthly basis. The Polk County network is automatically backed up on a daily basis.

On an annual basis, Polk County conducts a Computer Security Audit that is provided in a report format to the Iowa DNR Air Quality Bureau for added data assurance in regards to the Polk County network, storage and security processes.

Discrete PM filter archiving is discussed in SHL SOP 312-02 “Long Term Storage and Archiving Procedures for PM-2.5” since the storage location is the SHL lab near Iowa City. After sampling filters are weighed and stored for at least 5 years. For the first year they are stored at 0-4 degrees C. Filters that exceed the NAAQS standard are stored under refrigeration for a minimum of seven years.

13.0 Analytical Methods

13.1 Guidelines

In order to perform sampling and analysis operations consistently, SOPs must be written as part of the QAPP. An SOP is a written document that details the method of operation, analysis and techniques in the monitoring of ambient air for criteria pollutants. SOPs are protocols for all routine activities, which generally involve repetitious operations performed in a consistent manner. SOPs should ensure consistent practices, serve as training aids, provide documentation of proper procedure, reduce error occurrences in data and improve data comparability and credibility. The SOP should be written in a clear step by step format and be understood by a person knowledgeable in the general concept of the procedure. Generally, individuals performing the procedures should write the SOP.

Equipment vendor operational manuals should also be utilized in conjunction with the instrumentation SOPs. These operational manuals are valuable in trouble shooting flow charts, procedures and in identifying needed replacement parts. An operational manual for each type of monitor is located at each Polk County Air Quality monitoring site.

13.2 Equipment

PCAQD shall monitor the ambient air through the use of reference methods or equivalent methods for all criteria pollutants following the guidelines for the selection of monitors set forth in 40 CFR 58 Appendix C. Designation as a reference method or equivalent method provides no guarantee that a particular analyzer will always operate properly. Therefore, ongoing QA is necessary and required for designated methods under 40 CFR Part 58 Appendix A.

The field personnel should follow the operating procedures outlined in the manufacturer's operational manuals for each monitor and must function within the limits of performance specifications listed in the manual for EPA designated reference method or equivalent method. The field personnel shall also follow all calibration, precision and audit check guidelines outlined in the air monitoring SOP manuals for both continuous and intermittent monitors. All criteria ambient air monitoring instrumentation used by PCAQD shall participate in the USEPA National Performance Audit Program (NPAP).

13.3 Monitors in Use

Refer to sections 9.2 and 10.4 for details of the sampling methods requirements for monitors utilized in the Polk County ambient air monitoring network. The gaseous pollutant analyzer monitoring methods (with the exception of air toxics) are "self-contained" within the apparatus (analyzer) utilized and no additional analyses at a laboratory is required.

13.4 DNR Contracted Laboratory

PCAQD uses the laboratory contracted to the DNR. Currently, the DNR contracts with SHL as their laboratory of choice. SHL provides the analysis of $PM_{2.5}$, PM_{10}, and TO-11 filters and cartridges which are submitted to SHL under chain of custody (COC). SHL performs the gravimetric analyses of PM filters and analyses of air toxics samples. SHL direct bills the IDNR. Refer to the SHL QAPP for laboratory analytical methods and procedures. A copy of the current SHL QAPP, that includes SOPs regarding laboratory work, can be made available upon request. Current contact information can be found under the SHL's Environmental Health Division, Air Quality contact listing at the referenced hyper link: http://shl.uiowa.edu/contact/.

13.5 Corrective Action

The site operator (AIR QUALITY SPECILAIST/COMPLIANCE TECHNICIAN) shall be responsible for corrective actions pertaining to equipment involved in the retrieval of ambient air data. These actions are noted in each field logbook at the monitoring sites. Final corrective action approval is done by the QAM/QAO on a monthly basis upon review of each field logbook, which the site operator collects and delivers. Any approval or disapproval is noted in the logbook at the time of this monthly review. Follow up discussion with the site operator in regards to any disapproved corrective actions is documented to complete the corrective action process. The Polk County Air Quality Manager, as to its acceptability according to 40 CFR 58 Appendix C, must approve any changes in the analytical method used in the monitoring prior to implementation. For toxics, prior to sending cartridges to SHL for analysis, Polk County personnel will verify that each of the validation criteria listed in the SOP 8 for Air Toxics has been met, and after data received from the laboratory, Polk County will verify that the appropriate flags or void codes have been entered for any questionable or voided samples. See Sections 4 and 6 for additional information on Polk County Air Quality's QC checks on laboratory samples.

14.0 Quality Control Requirements

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. One function is the control of the measurement process through broad quality assurance activities, such as establishing policies and procedures, developing data quality objectives, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. The other function is the control of the measurement process through the implementation of specific quality control procedures, such as audits, calibrations, checks, replicates, routine self-assessments, etc. In general, the greater the control of a given monitoring system, the better will be the resulting quality of the monitoring data.

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. In the case of the Polk County Air Quality Monitoring Network, QC activities are used to ensure that measurement uncertainty is maintained within acceptance criteria for the attainment of the DQO.

14.1 QC Procedures

Day-to-day quality control is implemented through the use of various check samples or instruments that are used for comparison. The Measurement Quality Objective Tables (MQOs) contains a complete listing of these QC samples as well as other requirements for the Polk County Air Monitoring Program (see Appendix B). The procedures for implementing the QC samples are included in each SOP.

In regard to field quality control activities, Polk County Air Quality will follow 40 CFR Part 50, 40 CFR Part 58, U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air quality Monitoring Program, Appendix D, and applicable Polk County Air Quality's SOPs.

For formulas used to calculate statistics and acceptance criteria related to 1-point QC (precision checks) and audits for gaseous pollutants, flow checks and audits on PM samplers, and collocated PM filters see: "*Guideline on the Meaning and the Use of Precision and Bias Data Required by 40 CFR Part 58 Appendix A*", Version 1.1; EPA-454/B-07-001; October, 2007; by Louise Camalier et. al. for additional details. The formulas given in this guidance document are implemented in an Excel file called the "Data Assessment Statistical Calculator" available at the link below:
https://www.epa.gov/amtic/ambient-air-monitoring-quality-assurance#reports

14.1.1 Calibrations

Calibration is the comparison of a measurement standard or instrument with another standard or instrument to report, or eliminate by adjustment, any variation (deviation) in the accuracy of the item being compared[1]. The purpose of calibration is to minimize bias.

Calibration activities follow a two-step process:

1. Certifying the calibration standard and/or transfer standard against an authoritative standard, and
2. Comparing the calibration standard and or transfer standard against the routine sampling/analytical instruments.

In regard to field calibration activities, Polk County Air Quality will follow 40 CFR Part 50, *U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems,* Volume II: Ambient Air quality Monitoring Program, Appendix D, and Polk County Air Quality's SOPs. All results shall be documented in accordance with the appropriate Polk County Air Quality SOP.

The calibration procedures and the frequency for the intermittent particulate monitors $PM_{2.5}$ FRM and PM_{10} FRM's are in their respective SOP's. Calibration verifications are conducted on an annual basis or whenever routine QC checks indicate a need. For intermittent flow samplers, items such as ambient temperature and ambient barometric pressure also require calibration to be able to accurately calibrate flow sensor and/or mass flow controllers (MFCs) of the instrumentation. All calibration data and information, which includes such items as analyzer identification number, date and person conducting the calibration shall be maintained in a site log book as well as on standardized calibration forms for review by the QAM/QAO.

The QAM/QAO receives and reviews all of the field logbooks for acceptance according to the MQOs and DQOs on a monthly basis. All particulate monitoring field logbooks are kept at the monitoring site until full and then they are stored in the Polk County Air Quality division for the required retention period (see Table 19-2).

The calibration procedures and frequency for continuous monitors are indicated in each of their respective monitoring SOP's and according to the target pollutant MQO table. All calibration data and information, which includes such items as analyzer identification number, date, person conducting the calibration, and concentrations shall be maintained in a site log book as well as on standardized calibration forms or calibration spreadsheets for review by the QAM/QAO.

All documents pertaining to the calibrations, QC checks and standard certification of the analyzers are to be maintained in paper or electronic format in the Polk County Air Quality Division. Polk County Air Quality uses spreadsheets for analyzing all calibration data, as well as all QC checks. The QAM/QAO reviews all calibration data and QC checks for each site and its respective monitoring instrumentation on a monthly basis.

Gaseous Continuous Monitors are calibrated using a multi-point calibration. These consist of four test concentrations plus zero and up to 80% to 90% of the calibration scale for the pollutant at that location. According to the 2017 Quality Assurance Handbook for Air Pollution Measurement Systems Volume II, an acceptable approach to establishing a calibration scale is 1.1 to 1.5 times the NAAQS or 1.5 times the highest hourly value over the previous 3-years, whichever is higher. Multi-point calibrations are used to establish or verify the linearity of analyzers upon initial setup and after major repair. Most modern analyzers have a linear or near linear response with concentrations. Multi-point calibrations are more accurate than two-point calibrations because of the averaging effect of the multiple points. The analyzer readings are plotted against the respective test concentrations and the best linear curve to fit the points is determined. Ideally, least squares regression analysis should be used to determine the slope and intercept for the best fit calibration line of the form, $y= mx + a$, where y represents the analyzer response, x represents the pollutant concentration, m is the slope and a is the x-axis intercept of the best fit calibration line. The calibration slope and intercept acceptability is checked against the pollutants current MQO.

Gas dilution systems used in NO_2 calibrations and routine checks should be checked on a quarterly basis. A certified flow-measuring device is used to verify the mass flow controllers in the gas dilution system over the operational range allowed by the SOP. If the dilution system MFC calibration verification fails to meet the percent difference criteria specified in the SOP, it should first be rechecked to make sure the result was accurate. If the recheck confirms that it is still outside the desired range, a re-calibration will be

performed. If still outside acceptance levels, contact the manufacturer for troubleshooting or service needs. Generation of a calibration curve slope of the MFC from the data can be applied to the gas concentration output to improve performance.

Ozone Standard Establishment. Ozone Level 2 and Level 3 transfer standards (TS) are utilized for the ozone network to establish traceability to a NIST standard Ozone source.

A Level 2 transfer standard is certified on an annual basis to a NIST SRM traceable Ozone Standard Reference Photometer (SRP), in establishing the calibration certificate and acceptability of this primary standard. This level 2 transfer standard can then be utilized by the monitoring agency for all calibrations associated with the Level 3 TS and subsequent field monitors.

The calibration and associated 6 by 6 certificate of the Level 3 TS shall be verified by inter-comparison between the Level 3 TS and Level 2 TS pre-season, every 3 months and post season. This process transfers traceability from the NIST SRM Ozone standard to the field units used to determine compliance to the EPA ambient standards. Refer to the PCAQD current Ozone SOP for details into this certification process.

The 6 by 6 certification, as well as subsequent re-certification shall follow the EPA technical assistance document (TAD) EPA-454/B-13-004, October 2013, “Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone” or most recent EPA TAD.

Field operators shall establish a certification calibration curve versus a primary standard consisting of six (6) calibration points of Zero, 50, 90, 200, 350 and 450 ppb over six (6) different days for any newly purchased transfer standard or after major maintenance or when any subsequent quarterly re-certification fails the requirements of the above EPA TAD.

Once a 6 by 6 certificate is established for a TS, a single six (6) point calibration curve is needed on a quarterly basis, which is then added to the previous five (5) certification calibration curves in establishing the field utilized slope and intercept values of the TS for calibration and QC checks of the ambient ozone monitors at the field sites.

If the comparison of the quarterly certification check to the previous certification curves indicates a fail rating according to the EPA TAD, the instrument will require maintenance and establishment of a new 6 by 6 certificate before the TS can be allowed for field analyzer work.

After any calibration checks of the TS versus the primary standard the results must be approved by the QAM/QAO or AQM prior to being utilized in the field site work procedures.

14.1.2 Precision Checks

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the data quality objectives for precision, the Polk County Air Quality Division must ensure the entire measurement process is within statistical control. Two types of precision measurements will be made in the monitoring program: collocated monitoring and filter duplicates. In addition to precision measurements, QC checks are performed. Below is a list of applicable precision checks performed in the PCAQD program.

- Collocated monitoring
- Field Blanks
- Filter duplicates

< Zero, Precision, and Span checks

Collocated Monitoring - In order to evaluate total measurement precision, collocated monitoring will be implemented, as referenced in 40 CFR Part 58. Therefore, method designations, as required, will:

1. Have 25% of the monitors collocated (values of 0.5 and greater round up).
2. Have at least 1 collocated monitor (if total number is less than 4). The first collocated monitor must be the FRM.
3. Have 50% of the collocated monitors must be FRM monitors and 50% must be the same method designation. If there is an odd number of collocated monitors required, bias in favor of the FRM.

Evaluation of Collocated Data- Collocated measurement pairs are selected for use in the precision calculations only when both meet the criteria described in 40 CFR Part 50, U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air quality Monitoring Program, Appendix D. However, all collocated data will be reported to AQS.

Zero, Precision and Span Checks-This is a three-point analyzer QC check for gaseous ozone and nitrogen dioxide analyzers. When no adjustments are made to the analyzer (as-is) this is called a Zero/Precision/Span (ZPS) check. These checks are performed on the schedule outlined in the MQO tables in Appendix B. The unadjusted zero, span, and precision readings provide valuable information for:

< Confirming the validity of the measurements obtained immediately preceding the calibration
< Monitoring the analyzers calibration zero and span drift
< Determining the frequency of re-calibration

The precision point is also known as the one-point QC check. The one-point QC check is made by challenging the monitor with a QC check gas of known concentration (effective concentration for open path monitors) between the prescribed range of 0.005 and 0.08 parts per million (ppm) for O_3 and NO_2. The QC check gas concentration selected within the prescribed range should be related to the monitoring objectives for the monitor. If monitoring at an NCore site or for trace-level monitoring, the QC check concentration should be selected to represent the mean or median concentrations at the site. If the mean or median concentrations at trace gas sites are below the MDL of the instrument the agency can select the lowest concentration in the prescribed range that can be practically achieved. The QC check gas concentration should be set a little above the low end of the range to allow for slight variations in the calibrators ability to generate the target concentration. If the mean or median concentrations at trace gas sites are above the prescribed range the agency can select the highest concentration in the prescribed range.

An additional QC check point is encouraged for those organizations that may have occasional high values or would like to confirm the monitors' linearity at the higher end of the operational range or around NAAQS concentrations. If monitoring for NAAQS decisions, the QC concentration can be selected at a higher concentration within the prescribed range but should also consider precision points around mean or median monitor concentrations.

Frequency of QC checks are specified in the respective SOPs for each pollutant and the MQO tables. The acceptance criteria for QC checks are specified in the SOPs for each pollutant.

The algorithms included in 40 CFR Part 58 Appendix A will be used to evaluate collocated data. Also see Section 14.1 for accepted QC procedures.

14.1.3 Accuracy or Bias Checks

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value and includes a combination of random error (precision) and systematic error (bias). These accuracy checks are used in the Polk County Air Quality monitoring program:

< Flow rate audits for $PM_{2.5}$ FRM and PM_{10} FRM
< Collocated monitors
< FRM performance evaluations by EPA
< Audits of Gaseous Analyzers

Flow Rate Audits for $PM_{2.5}$ FRM and PM_{10} FRM- Polk County Air Quality will perform a flow rate audit every quarter. The audit is done by measuring the analyzer's normal operating flow rate using a certified flow rate transfer standard. The flow rate standard used for auditing will not be the same flow rate standard used to calibrate the analyzer. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Report the audit (actual) flow rate and the corresponding flow rate indicated or assumed by the sampler.

Quarterly Audits of gaseous analyzers- Polk County Air Quality will perform an audit every quarter. The audit is done by measuring the analyzer's normal response to a known concentration generated by an audit gas dilution system and an audit gas stock cylinder that are not used by the routine operator. The mass flow controllers on the audit gas dilution system are calibrated using a NIST traceable flow meter. However, both the calibration standard used by the routine operator and the audit standard may be referenced to the same primary flow rate or volume standard. Report the audit (actual) gas dilution and the corresponding indicated or assumed by the sampler. Polk County Air Quality SOP's have specific procedures for audits and the audit levels for continuous gas analyzers. 40 CFR Part 58, Appendix A, Section 3.1.2.1 specifies audit levels for gaseous criteria pollutants and was revised on 3/27/2016. The following EPA documents are available at the link below and provide technical guidance on selecting audit levels.

- Technical Note- Guidance on Identifying Annual PE Audit Levels Using Method Detection Limits and the 99th Percentile (05/03/2016)

- Use of Expanded List of Audit Levels for Annual Performance Evaluation for NO_2 and O_3 as Described in 40 CFR Part 58 Appendix A Section 3.2.2 (11/1/2010)

https://www3.epa.gov/ttn/amtic/cpreldoc.html

Specific audit levels are enumerated in the SOPs.

Collocated Monitors - Although the collocated monitors are primarily used for evaluating and controlling precision, they can be used to determine accuracy or bias. By determining percent difference, one can track trends or bias between the two instruments without knowing which instrument is producing the "true" value. Use of the FRM performance evaluation information (discussed below) in conjunction with collocation data should help improve the data quality.

FRM Performance Evaluation for PM2.5 and PM10– The Federal Reference Method (FRM) Performance Evaluation is a quality assurance activity, which will be used to evaluate measurement system bias of the $PM_{2.5}$ and PM_{10} monitoring networks. The pertinent regulations for this performance evaluation are found in 40 CFR Part 58, Appendix A, Section 3.2.4. The strategy is to collocate a

portable $PM_{2.5}$ FRM or PM_{10} air sampling instrument with an established routine air monitoring site, operate both monitors in exactly the same manner and then compare the results of this instrument against the routine sampler at the site. The EPA will be implementing this program and will inform Polk County Air Quality when an evaluation will be conducted. The evaluation will be conducted on a regularly scheduled sampling day and the filters from the evaluation instrument will be sent to a national laboratory for measurement. The comparison of data will be accomplished by EPA personnel using the Air Quality System (AQS) database. Note that the performance evaluation is an estimate of the uncertainty of the measurement system and not necessarily of the instrument. Therefore, biases may be attributed to sample handling, transportation and laboratory activities as well as to the instrument.

Corrective Action – The U.S. EPA will notify Polk County Air Quality of the evaluation results within 10 days of sampling. The bias acceptance criteria for the data comparison is ±10%[4]. If a bias is apparent, corrective action will be initiated. The process will include an attempt to determine at what data collection phase(s) the majority of the measurement errors are occurring. This may require EPA to conduct additional performance evaluations to troubleshoot the process.

14.2 Meteorological Instruments

Calibration and verification procedures for the meteorological instrument, which includes wind speed, wind direction, humidity and temperature, are provided in the SOP for Meteorological Stations.

References

1. Taylor, J.K. 1987 Quality Assurance of Chemical Measurements. Lewis Publishers, Chelsea, Michigan. 328pp.

2. U.S. EPA (1997b) Revised Requirements for Designation of Reference and Equivalent Methods for PM2.5 and Ambient Air Quality Surveillance for Particulate Matter-Final Rule. 40 CFR Parts 53 and 58. *Federal Register*, **62**(138):38763-38854. July 18, 1997. https://www.epa.gov/amtic/monitoring-regulations.

3. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Monitoring Program, Appendix D. Revision 1, March, 2017.

4. 2016-Jan, EPA, Quality Assurance Guidance Document 2.12, Monitoring PM2.5 in Ambient Air Using Designated Reference or Class I Equivalent Methods.

15.0 Instrument/Equipment Testing, Inspection and Maintenance Requirements

15.1 Purpose

The purpose of this section is to discuss the procedures used to verify that all instruments and equipment are maintained in sound operating condition and are capable of operating at acceptable performance levels. All instrument inspection and maintenance activities are documented.

15.2 New Instruments and equipment

Instruments used for SLAMS monitoring must be FRM/FEM, and with the purchase of an FRM/FEM, the make/model of the instrument has passed 40 CFR Part 53 acceptance testing requirements. Additional testing and verifications are required on new equipment to verify the individual instrument is fully functional and meets performance criteria. Testing will include basic operational functionality (such as display, software, menus, function keys, pump function, flow, temperature/pressure) and leak checks.

All new intermittent particulate monitors should have a multi-point flow and temperature calibration verification prior to the start of sampling. The calibration procedures for the intermittent particulate monitors PM2.5 FRM and PM10 FRM's are in their respective SOP Manuals. The initial calibration verification should be noted in the logbook and the results documented in the calibration spreadsheet.

A multi-point calibration verification shall be performed on all new continuous gaseous instruments prior to data collection. The calibration verification needs to meet all criteria in the pollutants current MQO. The Ozone SOP Manual lists any other additional criteria that must be met in order to begin valid data collection. The initial calibration verification should be noted in the instrument site logbook and the results documented in the calibration spreadsheet.

If a new instrument does not pass in house acceptance testing, it should be returned to the vendor for repair or replacement while under warranty.

15.3 Preventative Maintenance and Inspections

Preventative maintenance and inspections are important to the operational process of all monitors. The guidelines for maintenance are described in the vendor operational manuals for the monitors and noted in their respective SOPs. All periodic maintenance and inspections should be documented in the instrument site logbook. Refer to Section 20 on site reviews which includes shelter and probe height inspections.

Recommended spare parts and expendables shall be purchased so as to minimize the down time of any monitor in the network. The field personnel are trained to perform maintenance and performance checks on the instrumentation. If a problem still exists after troubleshooting and consultation with the manufacturer, the monitor will be shipped to the manufacturer for repair. PCAQD endeavors to have back-up monitors for all instruments within their network though it is noted that funding can affect the number and age of the backup monitors for each primary and collocated instrument. The use of a backup instrument will be used if the instrument is of the same USEPA designation as a reference or equivalent method as the primary monitor. Any maintenance shall be noted in the instrument site logbook or if an instrument is swapped out with a back-up instrument.

16.0 Instrument Calibration and Frequency

16.1 Calibration

The calibration procedures and frequency for continuous monitors are indicated in each of their respective monitoring SOP manuals and according to the target pollutant MQO table. See Section 14 of this QAPP for additional information.

During calibration, all analyzers/instruments should be operating in their normal sampling mode through all filters, scrubbers, conditioners and other components used during the normal operation of analyzer.

16.2 Traceability of Standards

All utilized calibration equipment and gaseous tank concentrations must be local or working standards that are certified traceable to an NIST primary standard. Traceable is defined in 40 CFR Parts 50 and 58. Either the supplier or the user of the standard may establish certification of the working standard. For Ozone the test concentrations must be traceable to a primary standard UV photometer (SRP) as described in Appendix D of 40 CFR Part 50. Test concentrations at zero concentration are considered valid standards. Zero standards are not required to be traceable to a primary standard.

The frequency of certification for standards are listed in each pollutants MQO. Annual certification is typically required for flow, temperature, relative humidity, and barometric pressure standards. The field operators should keep track of upcoming certification dates and should note the expiration dates when utilizing the standards for routine verifications. Field Operators and QAM/QAO are responsible for acquiring return authorizations and maintaining the documentation of certifications. Flow standards are sent to Mesa Labs for certification. Barometers are sent to Cole Palmer for certification. Hygrometers are sent to Chinook Engineering for certification. Thermometers are sent to EPA Regional staff for certification.

Ozone Level 2 and Level 3 transfer standards (TS) are utilized for the Ozone network to establish traceability to a NIST standard Ozone source. A Level 2 transfer standard is certified on an annual basis to a NIST SRM traceable Ozone SRP standard in establishing the calibration certificate and acceptability of this primary standard. This level 2 transfer standard can then be utilized by the monitoring agency for all calibrations associated with the Level 3 TS and subsequent field monitors. See Section 14 of this QAPP and the Ozone SOP for more information.

For the calibration and auditing of Trace Nitrogen Dioxide, NIST certified gas cylinders must be used. The duration of the gas cylinders certification varies based on the concentration. For our agency, gas cylinders are typically certified and supplied by AirGas, although other vendors are acceptable as long as they provide EPA Protocol NIST certification.

It is important to utilize different standards for audits than is used for calibrations and routine verifications. Standards utilized during an audit may be of “like kind” but must be a different serial number than the standard that is used for calibrations and routine verifications.

17.0 Inspection/Acceptance Requirements for Supplies and Consumables

Polk County Air Quality and its' staff shall accept full responsibility for any supplies or consumables they receive and deem necessary for operation of the Polk County Air Quality monitoring network. When newly ordered or repaired sampling, analytical or computational equipment is delivered to the program office, the Air Quality Manager or designated personnel compares the item to that requested on the original order, then inspects the equipment to ensure no breakage has occurred in transit and all components function properly. Once this inspection is completed, the Air Quality Manager either accepts or rejects the shipment. Office and laboratory supplies receive a comparable level of scrutiny. Reference standard and equipment must be accompanied by a certificate from the vendor or manufacturer verifying the quality of these products. Note, new instruments are acceptance tested as indicated in Section 15. Specific requirements and procedures for inspecting ambient air monitors are found in the relevant SOP's.

Nitrogen Dioxide gas cylinders used for calibration and audits must be EPA Protocol certified cylinders. To detect possible errors in the concentrations assigned by the vendor to new certified gas cylinders that are used for quality control checks on the trace NO_2, a quality check will be performed comparing the certified gas cylinder in service and the new certified gas cylinder that will be used as a replacement. Further details of this process and the limits for acceptance can be found in the NO_2 SOP. The results of the quality check should be recorded in the site logbook for the pollutant.

The field operators are responsible for keeping track of supplies and consumables and the ordering of supplies and consumables. Supplies and consumables are tracked by the field operators and ordered on an as needed basis.

18.0 Non Direct Measurements

18.1 Acquisition of Non-Direct Measurement Data

This section addresses data not obtained by direct measurement from the Polk County Air Quality Ambient Air Monitoring Program. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the Program in a variety of ways. Use of information that fails to meet the necessary DQOs for the Polk County Air Quality Ambient Air Monitoring Program can lead to erroneous trend reports and regulatory decision errors. The policies and procedures in this section apply to information previously acquired and/or acquired from outside sources.

Geographic Area Information: Census data, or population data, is needed to determine size of network. Geographic locations and elevations will be determined by GPS measurements.

Chemical and Physical Properties Data - Physical and chemical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources. The following sources may be used in the Ambient Air Quality Monitoring Program.

- National Institute of Standards and Technology (NIST)
- International Organization for Standardization (ISO), International Union of Pure and Applied Chemistry (IUPAC), American National Standards Institute (ANSI)and other widely recognized national and international standards organizations
- U.S. EPA
- *Handbook of Chemistry and Physics*
- *Lange's Handbook of Chemistry*

Sampler Operation and Manufacturers' Literature - Another important source of information needed for sampler operation is manufacturers' literature. Operations manuals and users' manuals frequently provide numerical information and equations pertaining to specific equipment.

Historical Monitoring Information - Polk County Air Quality has operated a network of ambient air monitoring stations since July 1, 1980. Historical data obtained from this network in conjunction with current monitoring results can be used to identify trends or relationships between different pollutant concentrations.

External Monitoring Data Bases - Polk County Air Quality will not use available air monitoring data from other organizations without first determining with utmost confidence that it is of high quality. Any data obtained from the EPA AQS database will be scrutinized just as if it were obtained from another organization. Errors do, and have occurred when viewing, uploading or downloading files from the AQS database. Flagged data will not be used unless it is proven that it has met all QA/QC requirements. The Polk County Air Quality QA officer shall determine if any outside data can or will be used by Polk County.

National Oceanic and Atmospheric Administration Data - Meteorological information is gathered by the US National Weather Service, Des Moines office and supplied to Polk County Air Quality. Caution must be used when any of this data is used to determine pollutant concentrations. The Polk County Air Quality QAO shall determine if any National Weather Service data can or will be used by Polk County.

19.0 Data Management

19.1 Background and Overview

Success of the Polk County Ambient Air Monitoring Program relies on the data and its interpretation. It is critical that these data are reliable, of known quality, easily accessible to a variety of users, and aggregated in a manner consistent with its primary use.

In order to accomplish this activity, information must be collected and managed in a manner that protects and ensures its integrity. Most of the raw ambient concentration and automated QC data collected from the Polk County Air monitoring network will be collected through automated computer software and data acquisition software (DAS) at the various monitoring sites. An exception will be the intermittent PM2.5, PM10, and Air Toxic monitoring network, which utilizes standardized COC forms for tracking of the collected samples. Appendix C includes three flowcharts which depict the complete flow path for these pollutants.

As stated in 40 CFR Section No.31.42, in general, all information considered as documentation and records should be retained for 3 years from the date the grantee submits its final report noted in the funding agreement.

19.2 Personnel

Each organization responsible for data on automated systems should identify a person within the organization responsible for this information management system. Data should be made available to the system in a timely manner. The Air Quality Specialist/Compliance Technician is responsible for the information management activities and the AQM does the management system review.

The QAM/QAO is primarily responsible for data inspection, audit, and review activities under the QA objectives to ensure the information management system is operating correctly.

19.3 Data Acquisition Systems

The use of a DAS device to automate data handling from a continuous sampler is not a strict guarantee against errors. Internal validity checks are necessary to avoid data recording errors. The transfer is usually from an analog or digital format to a digital medium. Polk County Air Quality uses Environmental Systems Corporation (ESC) Model 8832 data loggers throughout the monitoring network to collect required concentrations, operational, and status data from the continuous analyzers in the network. From instantaneous values, the site data logger collects and stores raw instrument ambient data in one (1) minute, five (5) minute and one (1) hour average increments for the targeted pollutant. The DAS may also be setup based on the specific pollutant and operational needs to collect instrument diagnostics, instrument digital statuses, as well as auto-calibration results. The site operator during any onsite QC checks introduces the target QC concentration of pollutant into the monitor, and after a period of stabilization, validates and records the imprinted concentration from the site DAS 5-minute values and notes the result in the site and monitor logbook. This 5-minute data are then routinely polled and stored on the central polling server. Continuous data is polled from the sites hourly.

For the $PM_{2.5}$ and PM_{10} particulate monitors, each monitor has an internal circular buffer for data storage. The buffer has a finite capacity noted in the respective monitoring SOP. This buffer is downloaded on a regular basis according to the SOP using either on site with a handheld or laptop computer, or USB jump

drive or remotely with a desktop computer. Additional details are available in the Polk SOPs titled "Data Retrieval and Submission" and "AirVision SOP".

Data trail audits are performed to ensure the data is being transferred to the DAS from the instrument, from the DAS to the central server, and then from the central server to AQS with no errors. The procedure that is followed is one similar to the procedure presented in section 14.1.3 of the EPA 2017, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II.

- A data value(s) is collected from the monitor (usually an hourly value or another aggregated value reported to AQS) and is then compared to the data stored in the DAS for the same time period.
- If using a strip chart recorder, a random number of hourly values are compared to the data collected by the DAS.
- From the central computer, the auditor checks to see if this hourly value is the same.

This audit is completed on a regular defined frequency and for every pollutant where data is acquired digitally or by a DAS. A person other than the normal station operator performs this duty.

On a quarterly basis, the QA Officer performs a "data trail audit" regarding the flow checks, and collocated concentrations, from PM samplers; and manual bi-weekly checks on gas analyzers. Data from a source prior to the AQS upload, is compared to the results in the AMP 251. PCAQD also utilizes TEI software on a laptop that enables them to read values directly from Thermo gas analyzers. Spot checks are conducted to ensure that hourly averages collected by the TEI software match those in EPA's national database.

19.4 Data Validation

Data validation is a combination of checking that the data processing operations have been carried out correctly and to monitor the quality of field operations. Data validation can identify problems in either of these cases. If problems are identified, the data can then be validated or invalidated and corrective actions then taken.

The following validation checks will be performed:

- **Range Checks** (40 CFR, Part 58, Appendix A);
- **Completeness Checks** – Certain completeness checks must be met, i.e. start times, end times, average flow rate, dates weighed, operator/technician names, acceptable shelter parameters.
- **Internal Consistency and Other Reasonableness Checks** – The end time of a filter must be greater than the start time. Computer filter volume (integrated flow) must be approximately equal to the exposure time multiplied by the nominal flow.
- **Data Retention** – Copies of raw data sheets are retained on file at Polk County Air Quality offices for a period of five years and are available upon request. Originals for $PM_{2.5}$ FRM, PM_{10} FRM and Air Toxics will be sent to Iowa DNR's contracted laboratory. Any data (hardcopy or software), other than original field data forms as they pertain to $PM_{2.5}$ FRM, PM_{10} FRM sample filters and Carbonyl sample cartridges, shall be archived on Polk County property after this time period.
- **Statistical Data Checks** – Any statistical outliers shall be considered suspect and an investigation into its validity will be performed.

Two key operational criteria for pollutant sampling are bias and precision. As defined in 40 CFR Part 58, Appendix A, these are based on differences between collocated sampler results and the primary sampler

performance. Polk County Air Quality will inspect the results of collocated sampling. Acceptance criteria for collocated sampling can be found in the appropriate Polk County Air Quality SOP.

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Air monitoring regulations require certain summary data be computed and reported regularly to EPA. Example of data summaries include:

* Average concentration for a station or set of stations for a specific time period
* Accuracy, bias and precision statistics based on accumulated FRM/FEM data
* Data completeness reports based on number of valid samples collected during a specific period

The Audit Trail is another important concept associated with data transformations and reductions. An audit trail is a data structure that provides documentation for changes made to a data set during processing. Typical reasons for data changes that would be recorded include the following:

* Corrections of data input due to human error
* Application of revised calibration factors
* Addition of new or supplementary data

Upon completion of the monitor monthly raw data collected by the DAS system, the site/monitor field operators perform a final review of the data. The QAO makes or approves any necessary final editing in the AirVision server database and reviews the data edited by the technical field operators. The AirVision software is designed to track what data, who, why and when the data was edited. The final edited reports are electronically filed in the designated pollutant folder in the Air Quality network folder. This process allows for all edits to be documented back to the original raw data collected from each of the sites/monitors.

19.5 Data Transmittal

Data transmittal occurs when data is transferred from one person or location to another, or when data is copied from one form to another. Table 19-1 summarizes data transfer operations that will occur at Polk County Air Quality.

Table 19-1 Data Transfer Operations

Description of Data Transfer	Originator	Recipient	QA Measures Applied
Electronic data transfer	Between sampler and Data-logger	SQL Database with AirVision	Parity checking: transmission protocols
Calibration, FRM/ FEM and audit data	Auditor or Field Operator	database computer	Spot checked by Polk County Air Quality QA Officer
Field data transfer	Polk County Air Quality Field Operator	Iowa DNR contract laboratory	Chain-of custody protocol
Electronic data (strings) and paper lab reports	Iowa DNR contracted laboratory	Polk County Air Quality Field Operator	Spot checked By Polk County Air Quality QA Officer
AQS data summaries	Polk County Air Quality Field Operators	AQS (U.S. EPA)	Spot checked by Polk County Air Quality QA Officer

Polk County Air Quality will report all ambient air quality data and information specified by the AQS Users Guide (Volume II, Air Quality Data Coding, and Volume III, Air Quality Data Storage), coded in

the AQS format. Such air quality data and information will be fully screened and validated and be submitted directly to the AQS via electronic transmission on a monthly and quarterly basis.

19.6 AQS Data Submittal

Eventually, all required data will reside in the AQS database.

Information on the AQS database is described in the AQS user manuals which are available online on the EPA website. These documents and manuals should be available to data management personnel. The AQS database contains a number of files in which data are entered and stored.

One of the functions of the AQS is to read transactions coded by State, local and regional users of AQS, validate these transactions, and use them to update the AQS database. To accomplish this, there are two primary players: AQS users and AQS database administrators (ADBA). An AQS user has 'read only' status; whereas an ADBA has access to raw data and precision/accuracy data. For Polk County Air Quality, the ADBAs are the Polk County QAM, QAO, or Field Operators. The ADBA are responsible for the following steps in the update process:

- Load
- Edit
- Correct
- Post
- Critical Review
- Delete
- Update

It is of utmost importance that all precision and bias (P&B) assessment readings from an analyzer be processed exactly as ambient readings recorded at the time would be processed. External or hand processing of such readings may be done if it entails extreme care. After processing, the readings can be removed from the final ambient data listing and used in the DQA calculations.

19.7 Data Storage and Retrieval

As stated in Section 12.7, the electronic data collected from the monitors via the 8832 data logger is transferred to the hosted server system on an hourly basis using the Agilaire AirVision software. The Hosted server is backed up on a daily basis. Data archival policies applicable to Polk County Air Quality are shown on Table 19-2.

Table 19-2 Data Archive Policies

Data Type	Medium	Location	Retention Time
Field data forms (copies)*	Hard copy	PCAQ Office	5 years (Minimum)
Calibration/ verification forms	Hard copy	PCAQ Office	5 years (Minimum)
QA/QC documentation	Hard copy	PCAQ Office	5 years (Minimum)
AQS format files	Electronic	PCAQ Office	Indefinitely
Audit results	Hard copy	PCAQ Office	Indefinitely

* The Iowa DNR's contracted laboratory will maintain permanent possession of the original field data forms as they pertain to $PM_{2.5}$ FRM, PM_{10} FRM sample filters and Carbonyl sample cartridges.

Any data or forms stored or generated by Polk County Air Quality will reside (but are not limited to) on a IBM-PC compatible computer. This computer has the following specifications:

* Manufacturer: HP Inc.
* Processor: Intel® Core™ i5-6500 CPU@ 3.20 GHz
* Operating System: Windows 7 Professional
* Memory: 64 MB
* Storage: 599 GB
* Backup: Intra-office share drive, SQL Server

20.0 Assessments and Response Actions

This section will describe and detail those efforts taken by Polk County Air Quality to measure the performance or effectiveness of its quality system, the establishment of its monitoring network and various measurement phases of the data operation.

20.1 State and Local Organization Performance Evaluations

State and local organizations conduct performance evaluations. The Iowa Department of Natural Resources conducts a performance evaluation of Polk County Air Quality every two years as part of their Program Review of the PCAQD. This evaluation includes an assessment of the QA/QC activities performed in operating the Polk County Air Quality Network and makes recommendations for any concerns or discrepancies that maybe discovered.

20.1.1 Network Plan

The IDNR is responsible for the preparation of the annual and 5-year Network Plans for the State of Iowa which incorporates the Polk County ambient air monitoring network.

20.1.2 Corrective Actions

Should the Iowa Department of Natural Resources find any discrepancies in the Polk County Air Quality Monitoring Program, it will be the responsibility of Polk County Air Quality personnel to rectify any problems discovered. Once action has been taken to correct the problem, Polk County Air Quality personnel will contact The Iowa Department of Natural Resources via phone, mail, e-mail or another acceptable manner as to their actions. The IDNR also contracts with SHL to conduct an annual TSA of the PCAQD, Ambient Air Monitoring Network. Upon completion, a copy of this annual TSA is provided to PCAQD.

20.2 EPA External Audits

Polk County Air Quality Monitoring Program shall participate in a Technical Systems Audit (TSA) conducted by EPA Region 7 as scheduled by EPA Region 7. Typically, TSAs of primary quality assurance organizations (PQAOs) are conducted at least every 3-years by EPA. This audit consists of an on-site review and inspection of a Polk County Air Quality's Ambient Air Monitoring Program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data.

The scope of a systems audit is of major concern to both EPA Region 7 and Polk County Air Quality. A TSA, as defined in the context of this document, includes an appraisal of the following program areas: network management, field operations, laboratory operations, data management, quality assurance and reporting. The TSA results present a clear, complete and accurate picture of the Polk County Air Quality's acquisition of ambient air monitoring data.

The components of a TSA are described in 2017 *QA Handbook for Air Pollution Measurement Systems, Volume II.*

20.2.2 Performance Evaluation Program (PEP)

NPEP includes the $PM_{2.5}$ PEP and Lead PEP which audit filter samplers. These audits are typically conducted independently by EPA Regional personnel and focus on any lead and $PM_{2.5}$ samplers used for comparison to the NAAQS. On a yearly basis, PCAQD determines whether to continue using the federal implementation of the PEPs. Frequency of audits are described in 40 CFR Part 58, Appendix A.

20.2.3 National Performance Audit Program (NPAP)

NPAP is a NPEP program implemented by EPA that audits gas analyzers which includes Through the Probe (TTP) audits. These audits are typically conducted by EPA Regional personnel and focus on criteria pollutant gas monitor(s) that are used for comparison to the NAAQS. On a yearly basis, PCAQD determines whether to continue using the federal implementation of the NPAP. Frequency of audits are described in 40 CFR Part 58, Appendix A.

20.2.4 Gaseous and Flow Rate Audit Standards

As part of the SRP Program, monitoring organizations provide a level 2 transfer standard (TS) for verification against the level 1 standard on an annual basis. PCAQD provides their level 2 TS to EPA Region 7 on an annual basis, typically during the non-ozone season. Ambient Air Protocol Gas Verification Program (AAPGVP) is a service provided by the EPA to help State and local monitoring agencies judge the quality of the calibration gasses used in their networks. For more discussion see sections 14 and 16.

20.2.5 Corrective Actions

Should EPA Region 7 staff find discrepancies in the Polk County Air Quality monitoring program, it is the responsibility of Polk County Air Quality personnel to rectify any problems discovered. Once action has been taken to correct the problem, Polk County Air Quality personnel will contact EPA Region 7 via phone, mail, e-mail or another acceptable manner as to their actions.

20.3 Data and Information Management Audits

With the implementation by many agencies of automated data acquisition systems, the data management function has, for the most part, become increasingly complex. Therefore, a complete systems audit must include a review of the data processing and reporting procedures starting at the acquisition stage and terminating at the point of data entry into the AQS computer system.

This audit will be performed as a part of the Technical Systems Audit performed by EPA Region 7 and its staff at their discretion.

Corrective Actions – Should EPA Region 7 staff find discrepancies in the Polk County Air Quality monitoring program, it will be the responsibility of Polk County Air Quality personnel to rectify any problems discovered. Once action has been taken to correct the problem, Polk County Air Quality personnel will contact EPA Region 7 via phone, mail, e-mail or another acceptable manner as to their actions.

20.4 Network and Site Review

20.4.1 Network Review

Conformance with network requirements of the Polk County Ambient Air Monitoring Network are set forth in 40 CFR Part 58, Appendices D and E, are determined through an Annual Network Review of the Ambient Air Monitoring System. The network review is used to determine how well a particular air monitoring network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. Polk County Air Quality will perform this review once per year in conjunction with EPA Region 7.

The following criteria will be considered during the review:

- Date of last review
- Areas where attainment/nonattainment re-designations are taking place or are likely to take place
- Results of special studies, saturation sampling, point-source oriented ambient monitoring
- Proposed network modifications

Other considerations that are emphasized during a review include:

Number of Monitors – For SLAMS, the number of monitors required for each pollutant monitored in the network is discussed in 40 CFR Part 58.

Location of Monitors – For SLAMS, the location of monitors is not specified in the regulations, but is determined by Polk County Air Quality personnel in conjunction with The Iowa Department of Natural Resources. However, consideration of monitoring objectives must adhere to those specified in 40 CFR Part 58, Appendix D.

20.4.2 Site Review

The purpose of this review is to ensure that all sites adhere to siting criteria specified in 40 CFR Part 58, Appendix E. The site review will be performed by Polk County Air Quality annually. A site review will include, but is not limited to, the following:

- The most recent hard copy of site description including any available photographs
- Data on the seasons with the greatest potential for high concentrations for specified pollutants
- Predominant wind direction by season

Furthermore, while at the site review the following:

- Probe height above ground
- Distance from trees or roadways
- Check equipment for missing, damaged or worn-out parts
- If applicable to the site, shelter inspection
- Ensure notebook is present and is being utilized

20.4.3 Data Quality Assessments

PCAQD completes DQAs on a regular basis; refer to Section 24. One component of the DQAs is the Quarterly Reports which are described in detail in Section 21.

20.4.4 Corrective Actions

Should any discrepancies in the monitoring network, site review, or DQAs occur, it is the responsibility of Polk County Air Quality personnel to rectify any problems discovered. Once action has been taken to correct the problem, Polk County Air Quality personnel will ensure that all activities are documented with the appropriate paperwork and filed.

21.0 Reports to Management

This section describes the quality-related reports and communications to management necessary to support SLAMS/SPMs network operations and the associated data acquisition, validation, assessment, and reporting.

Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Quality assessment, including the evaluation of the technical systems, the measurement of performance, and the assessment of data, is conducted to help insure that measurement results meet program objectives and to insure that necessary corrective actions are taken early, when they will be most effective.

Effective communication among all personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following:

< adherence to scheduled delivery of data and reports
< documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality
< analysis of the potential uncertainties in decisions based on the data

21.1 Frequency, Content, and Distribution of Reports

Required reports to management for ambient air monitoring and the SLAMS program in general are discussed in various sections of 40 CFR Parts 50, 53, and 58. Guidance for management report format and content are provided in guidance developed by EPA's Quality Program and the Office of Air Quality Planning and Standards (OAQPS). These reports are described in the following subsections.

21.1.1 QA Annual Report and work plan

Periodic assessments of SLAMS data quality are required to be reported to EPA (40 CFR 58 Appendix A, Section 1.4). Polk County Air Quality will perform the following quality control activities and report the results to EPA AQS.

- One-Point Quality Control (QC) Checks for gaseous monitors (Section 3.1.1)
- “Annual” performance evaluation audits for gaseous monitors (Section 3.1.2)
- Flow rate verifications and audits for PM samplers (Section 3.2 and 3.3)
- Data from collocated Federal Reference Method PM samplers (Sections 3.2.3 and 3.3.4)
- Assessment of Bias using the FRM (PEP) Audit procedures for PM 2.5 samplers conducted by EPA or their contractor (Section 3.2.4)

EPA will perform the calculations as prescribed in 40 CFR Part 58, Appendix A, Section 4. These calculations will use the QC results submitted to AQS by Polk County Air Quality. As stated in section 4, the QAM develops the annual Quality Assurance Report, Annual Network Review and annual work plan (e.g., annual contract between Polk and DNR) for the AQM.

21.1.2 Network Review

As required by 40 CFR Part 58, Appendix A, Section 5.1, Polk County Air Quality will provide a list of all monitoring sites and their AQS site identification codes to the EPA Region 7 office and AQS. This list is part of the Annual SLAMS report. The Network Review will be completed and copies submitted to Iowa DNR no later than March 15th and to EPA Region 7 no later than May 1st of each year. Polk County Air Quality will notify EPA Region 7 and AQS of any changes to the list of monitoring sites. No later than March 15th of each year Polk Co. submits to the Iowa DNR the annual State and Local Air Monitoring Stations (SLAMS) report consisting of an AMP 600 and 450NC along with a letter, signed by the QAM, certifying the accuracy of the report based on a review of all materials contained in the annual review. The final certification materials sent to EPA Region 7 would be signed by the AQM.

21.1.3 Quarterly Reports

Each quarter, Polk County Air Quality will report to AQS, the results of all precision, bias and accuracy tests it has carried out during the quarter. The quarterly reports will be submitted, consistent with the data reporting requirements specified for air quality data as set forth in 40 CFR Parts 58.16 and 40 CFR Part 58 Appendix A, Section 5.1.1.

Air quality data submitted for each reporting period will be edited, validated and entered into AQS using the procedures described in the AQS Users Guide, Volume II, Air Quality Data Coding. Polk County Air Quality staff will prepare the report to be reviewed and submitted by the QA Officer.

Table 21-1 Identifies the reporting periods and the dates the report is due.

Table 21-1 Quarterly Report Schedule

Reporting Period	Due on or Before
January 1-March 31	June 30
April 1-June 30	September 30
July 1-September 30	December 31
October 1-December 31	March 31 (following year)

21.1.4 Weekly Status Report

Each week Polk County Air Quality will report to the Iowa DNR the status of all equipment, monitor or software malfunctions. The information will include the site, pollutant, and estimated time of arrival (ETA) on resolution of any issues in the network to resume data collection. These reports are generated by Technical field staff and review by the QAO and Air Quality Manager prior to transmittal.

21.1.5 Technical System Audit Reports

The Polk County Air Quality Department performs Technical System Audits (TSA) of the monitoring system. These reports are issued by the QA officer and are reviewed by the Air Quality Manager. These reports will be filed and made available to EPA personnel during their technical systems audits.

21.2 Responsible Organizations

This section outlines the responsibilities of individuals within the monitoring organization for preparing quality reports, evaluating their impact, and implementing follow-up actions. Changes made in one area or procedure may affect another part of the project. Only by defining clear-cut lines of communication and responsibility can all the affected elements of the monitoring network remain current with such changes. The documentation for all changes should be maintained and included in the reports to management. The following paragraphs describe key personnel involved with QA reporting.

Polk County Air Quality Manager (AQM) - The ultimate responsibility for the quality of the data and the technical operation of the fine particulate monitoring network rests with the Polk County Air Quality Manager. The manager's responsibilities with respect to air quality reporting are delegated to the Polk County Quality Assurance Manager. These responsibilities include defining and implementing the document management and quality assurance systems for the monitoring network.

Quality Assurance Manager (QAM) - The Quality Assurance Manager is responsible for operation of the Air Quality Network Quality Assurance/Quality Control Program. The Air Quality Manager shall appoint an individual to serve as QAM. This individual must have organizational independence from groups generating, compiling and evaluating environmental data, and have access to the Air Quality Manager in order to plan, assess, and improve Polk County's Quality Management System. The QAM reports directly to the AQM on quality assurance issues.

The QAM reviews and approves all corrective actions in the monitoring program. The QAM works in conjunction with the AQM on all budgetary and contractual items. The QAM provides regular required reports indicated in the QAPP to the AQM to provide information as to the acceptability of the Quality System. The AQM will provide support to the QAM to correct problems addressed in the QA report.

Polk County Air Quality Assurance Officer - The Quality Assurance (QA) Officer is specifically responsible for assuring the timely submittal of quarterly and annual data summary reports. The QA officer works closely with the Air Quality Specialist/Compliance Technician with QA procedures, arranging for audits, and reporting QA data. The QA Officer is appointed by the Air Quality Manager to be responsible for day-to-day conduct of QA activities for the Ambient Air Monitoring Program. The QA Officer's responsibilities for QA reports to management include the following:

- Assist the Quality Assurance Manager with data quality assessments and other internal audits
- Calculate and/or review precision and bias data generated by the collocated monitors
- Review control charts and other laboratory QC materials
- Monitor Response/Corrective Action Reports

Polk County Air Quality Specialist/Compliance Technician - The Air Quality Specialist/Compliance Technician is responsible for identifying problems and issuing appropriate Response/Corrective Action Reports related to laboratory activities. He/she is also responsible for reviewing laboratory QC data such as control charts and for assuring that repairs and preventive maintenance are completed and that the maintenance is effective. The Air Quality Specialist/Compliance Technician is also responsible for maintaining any documentation files as defined in the relevant SOPs. The Air Quality Specialist/Compliance Technician will assist the QA Officer in preparing QA reports and summaries and is responsible for disseminating information appearing in audit reports and other quality-related documents. The Air Quality Specialist/Compliance Technician is responsible for coordinating the

information management activities for SLAMS/SPMS data. Specific responsibilities related to management reports include:

- Ensuring access to data for timely reporting and interpretation
- Ensuring timely delivery of all required data to the AQS system

22.0 Data Review, Validation, & Verification

Success of the Polk County Ambient Air Quality Program objectives relies on data and its interpretation. It is critical that data available to users are:

- Reliable
- Of known quality
- Easily accessible to a variety of users
- Aggregated in a manner consistent with it prime use

This section describes how Polk County will verify and validate the data collection operations associated with the Ambient Air Monitoring Network in accordance with 40 CFR Part 58, Appendix A. Verification can be defined as confirmation, through provision of objective evidence, that specified requirements have been fulfilled. Validation can be defined as confirmation, through provision of objective evidence, that the particular requirements for a specific intended use are fulfilled. Although there are a number of objectives for ambient air data, the major objective, and intended use, for the Polk County Air Quality Network is comparison to the NAAQS.

Review by EPA and approval of this QAPP, provide initial agreement that the processes described in the QAPP, if implemented, will provide data of adequate quality. In order to verify and validate the phases of the data collection operation, Polk County Air Quality will use various qualitative assessments (i.e., technical systems audits, network reviews). To verify that the QAPP is being followed, they will rely on the various quality control samples to validate that the data will meet the DQOs.

22.1 Sampling Design

Section 10 describes the sampling design for the network established by Polk County Air Quality. It covers the number of sites required, their locations, and the frequency of data collection. The objective of the sampling design is to represent the population of interest at adequate levels of spatial and temporal resolution. Most of these requirements have been described in the CFR. However, it is the responsibility of Polk County Air Quality to ensure that the intent of the regulations are properly administered and carried out.

22.1.1 Sampling Design Verification

Verification of the sampling design will occur through three processes:

Network Design Plan Confirmation – The Network Design Plan that discusses the initial deployment of the network must be submitted, reviewed and approved by EPA prior to implementation. This process verifies the initial sampling design.

Internal Network Reviews – Once a year, Polk County Air Quality will perform a network review to determine whether the network objectives, as described in the Network Design Plan, are still being met, and that the sites are meeting the CFR siting criteria (see Section 20).

External Network Reviews – At their discretion the EPA Regional Office will conduct a network review to determine whether the network objectives, as described in the Network Design Plan, are still being met and that the sites are meeting the CFR siting criteria.

22.2 Sample Collection Procedures

22.2.1 Sample Collection Verification

Sample collection procedures, described in detail in Sections 11 and 12, are developed to ensure proper sampling and to maintain sample integrity. The following processes will be used to verify the sampling collection activities:

EPA External Audits – will be conducted by EPA Region 7. Refer to Section 20.2.

The Technical Systems Audits, PEPs, and NPAP will be used to verify that the sample collection activity is being performed as described in this QAPP and SOPs. Deviations from the sample collection activity will be noted in audit finding forms and corrected in accordance with activities described in Section 20.

22.2.2 Sample Collection Validation

The sample collection activity is just one phase of the measurement process. The use of QC samples that have been placed throughout the measurement process can help validate the activities occurring at each phase. The review of QC data such as the collocated sampling data, field blanks, the FRM performance evaluation and the sampling equipment verification checks that are described in Sections 14 and 16 can be used to validate the data collection activities. Any data that indicates unacceptable levels of bias or precision or a tendency will be flagged and investigated.

22.3 Handling of PM2.5 FRM, PM10 FRM and Air Toxics

Sections 11 and 12 detail the requirements for sample handling, including the types of sample containers and the preservation methods used to ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Due to the size of the filters and the nature of the collected particles, sample handling is one of the phases where inappropriate techniques can have a significant effect on sample integrity and data quality.

22.3.1 Verification of Sample Handling

As mentioned in the above section, External Systems Audits will be performed to ensure the specifications mentioned in this QAPP are being followed. The audits would include checks on the identity of the sample (i.e., proper labeling and chain-of-custody records), packaging in the field, and proper storage conditions (i.e., chain-of-custody and storage records) to ensure that the sample continues to be representative of the field sampler environment as it moves through the data collection operation.

22.3.2 Validation of Sample Handling

The review of data from collocated sampling, field blanks, and the FRM performance evaluations, described in Sections 14 and 16, can be used to validate the sample handling activities. Acceptable precision and bias in these samples would indicate that the sample handling activities are adequate. Any data that indicates unacceptable levels of bias or precision or a tendency will be flagged and investigated.

22.4 Analytical Procedures

Polk County Air Quality will perform no laboratory analyses of data collected from the PM2.5 FRM, PM10 FRM or Air Toxics networks. This responsibility will be given to the Iowa DNR's contracted laboratory.

22.5 Quality Control

Sections 14 and 16 of this QAPP specify the QC checks that are to be performed during sample collection, handling and analysis.

22.5.1 Verification of Quality Control Procedures

As mentioned in the above section, EPA External Audits and will be performed to ensure the QC methods specified in this QAPP are being followed.

22.5.2 Validation of Quality Control Procedures

Validation activities of many of the other data collection phases mentioned in this subsection use the quality control data to validate the proper and adequate implementation of that phase. Therefore, validation of QC procedures will require a review of the documentation of the corrective actions that were taken when QC samples failed to meet the acceptance criteria, and the potential effect of the corrective actions on the validity of the routine data. Section 14 describes the techniques used to document QC review/corrective action activities.

22.6 Calibration

Section 16 details the calibration activities and requirements for the critical pieces of equipment in the Polk County Air Quality Monitoring Network.

22.6.1 Verification of Calibration Procedures

As mentioned in the above sections, External Systems Audits and State Performance Evaluations will be performed to calibration and corrective action specifications mentioned in this QAPP. Deviations from the calibration procedures will be documented and corrected using the procedures described in Section 20.

22.6.2 Validation of Calibration Procedures

The review of calibration data, described in Sections 14 and 16, can be used to validate calibration procedures. Calibration data within the acceptance requirements would indicate that the sample collection measurement devices are operating properly. Any data that indicates unacceptable levels of bias or precision or a tendency will be flagged and investigated as described in Sections 14 and 16. This investigation could lead to a discovery of inappropriate calibration procedures, or equipment problems requiring corrective action as detailed in this section. Validation would include the review of the documentation to ensure corrective action was taken as prescribed in the QAPP.

22.7 Data Reduction and Processing

22.7.1 Verification of Data Reduction and Processing Procedures

As mentioned in the above section, EPA External Audits will be performed to ensure the data reduction and processing activities specified in this QAPP are being followed.

22.7.2 Validation of Data Reduction and Processing Procedures

As part of the audits of data quality (part of the EPA External Audits), discussed in Section 20, a number of sample IDs, chosen at random will be identified. All raw data files, including the following will be selected:

- Sampling
- Calibration – the calibration information represented from that sampling period
- Sample handling/custody
- Corrective action
- Data reduction

This raw data will be reviewed by Polk County Air Quality to ensure that final values submitted to AQS are valid. The data will also be reviewed by the Polk County Air Quality QA Officer to ensure that associated flags or any other data qualifiers have been appropriately associated with the data and that appropriate corrective actions were taken.

23.0 Validation & Verification Methods

Many of the processes for verifying and validating the measurement phases of the data collection operation have been discussed in Section 22. Data review and validation for continuous and discrete samplers is also discussed in the Polk "Data Retrieval and Submission SOP". If these processes, as written in the QAPP, are followed, and the sites are representative of the boundary conditions for which they were selected, one would expect to achieve the appropriate DQOs. However, exceptional field events may occur and have an adverse effect on sample integrity. Similarly, it can be anticipated that some of the QC checks will fail to meet acceptance criteria. It is important to determine how these failures affect the routine data.

23.1 Data Validation and Verification Process

23.1.1 Verification of Data

Data verification is defined as the confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Polk County Air Quality will conduct a thorough review of all data involved to ensure completeness and data accuracy. All data will be reviewed for routine statistical outliers and data outside of acceptance criteria. This data will be flagged appropriately, "re-verified" and entered correctly.

The items reviewed during the data verification procedure are as follows:

- The data operations are performed according to the SOP governing the operation.
- The data operation was performed on the correct time and date required by the NAAQS.
- The monitor performed correctly based upon individual checks such as flow checks, leak checks, audits and QC performance checks and that all items where documented. These items are checked by the Polk County Air Quality QAO or QAM on a monthly basis and noted in the field logbooks for each monitor.
- The data operations performed met the DQOs associated for that specific data operation.

If the QAM deems all of the above items acceptable, the data are verified as acceptable.

A qualifier may be applied to data to further explain circumstances surrounding the data collection. When a qualifier is applied to data, the reason must be documented in the field logbooks, and notated in AirVision Software. EPA's AQS qualifier categories include:

- Null qualifiers: required when submitting a null (i.e., nothing was collected) sample measurement; all null qualifiers are available for every parameter.
- QA qualifiers: quality assurance qualifiers are used when data is valid but you want to note something (i.e. measurement was "below lowest calibration level").
- Inform qualifiers: informational qualifiers are used in place of a Request Exclusion qualifier; use only when an exclusion of the data will not be requested.
- ReqExc qualifiers: required when submitting data that is affected by an Exceptional Event and for which an exclusion will be requested.

For a Full list of AQS qualifier codes and null value codes see Appendix D of this QAPP.

In 2017, EPA expanded the options for the types of QC/QA data that the AQS national database stores for gas analyzers. When a check is performed, both the calibration system and the analyzer might be functioning properly, but there are two other possible scenarios.

- Scenario #1: the calibration system is working, and the analyzer is not.
- Scenario #2: the calibration system is malfunctioning, and therefore the analyzer only appears to "fail" Redbook acceptance criteria.

Prior to 2017, Iowa Reporting Organizations didn't record either of these two cases in the precision check portion of AQS. EPA issued a memo with coding guidance in August 2017, which Polk County has adopted in part. Specifically, for the first scenario, the AMP 504 should not show a string for the failed check, while data is withheld from the AMP 501 using a null code.

For scenario #2 the AMP 504 should show neither check concentration, and a "1C" null code; while the AMP 501 will show valid raw data. The "1C" flag is not appropriate in cases where the check was not even initiated. (This would be especially true for a multi-day interval, where it's established after the first day that the equipment is not functional.) For single day instances, if a check was started and it failed midway through the check, the 1C flag may be appropriate on a case by case basis.

Exceptional Events Rule. PCAQD will follow the Exceptional Events Rule (codified at 40 CFR 50.1, 50.14 and 51.930), if practically feasible and applicable, to exclude data when making certain regulatory decisions. Some examples of exceptional events are indicated in Appendix D (AQS codes).

At the end of each calendar year, an evaluation of continuous PM $_{2.5}$ monitors is conducted by the IDNR and presented in their Annual Network Plan. In the event that Polk County's continuous $PM_{2.5}$ samplers to not meet Class 111 Acceptance Criteria (see Table C-4 of 40 CFR Part 53) with respect to FRM samplers as the same site; NAAQS exclusion flags will be added at SPM monitors, and the data will be coded as 88502 (Acceptable for AQI only) at SLAMs monitors

23.1.2 Validation of Data

Data validation is defined as examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. The purpose of data validation is to detect and verify any data values that may not represent actual air quality conditions at the sampling station. For analytical work contracted to outside laboratories (i.e., $PM_{2.5}$ FRM, PM_{10} FRM and Carbonyls), Polk County Air Quality's QA Manager will be responsible for validating or invalidating data. These validation decisions will be made primarily, but not exclusively, on the basis of field and/or transportation activities. As appropriate, the Polk QA Manager will also convey any validity or qualifier flags that have been assigned by the DNR's contract laboratory.

The purpose of data validation is to detect and then verify any data values that may not represent actual air quality conditions at the sampling station. The Polk County Air Quality QAO or QAM reviews the ambient data collected from the Polk County Air Quality monitoring network on a monthly basis looking for any data points that seem out of character for the target pollutant such as a large difference between two successive data values of the 1-hour increment for Ozone.

For automated methods, if zero, span or precision check validation limits are exceeded, ambient measurements must be invalidated back to the most recent point in time where such measurements are known to be valid. For Polk County Air Quality, this is the point of a previous validated QC check. Zero drift may also be indicated when the daily minimum concentration tends to increase or decrease from the norm over a period of several days. Data following an analyzer malfunction or period of non-operation

should be regarded as invalid until a calibration verification is performed. The Measurement Quality Objectives in pollutant SOP will be used in determining the status of data.

For manual methods (i.e. particulate monitors), the first level of data validation should be to accept or reject data based upon results from operational checks selected to monitor the critical parameters and observing all limitations described in the reference and equivalent methods.

The field personnel shall flag any data which does not follow the acceptance criteria outlined in the parameter MQOs. The reason for flagging of data is noted on the field COC sheet, as well as the associated site/pollutant field logbook, which is then reviewed by the QAM/QAO during the monthly QA/QC data process activities. Similarly, transportation activity requirements (i.e., maintenance of temperatures) will determine data validity and must be considered. The Measurement Quality Objectives in pollutant SOP will be used in determining the status of data.

Critical criteria checks are a part of a validation template that were developed for all criteria pollutants by EPA and the monitoring organizations. Monitoring organizations may identify additional checks that they deem critical. EPA issued a 2018 memo to provide guidance on data validation following an exceedance of critical criteria checks. Also, the most recent documents provided online by EPA on the AMTIC Data Certification/Validation web page are used as guidance.

All valid data must be “bracketed” by valid QC checks, or in other words, must have a valid QC check on either end of the data.

According to Appendix D of the QA Handbook, any observations that do not meet every criterion on the Critical Criteria should be invalidated unless there are compelling reasons for not doing so. Compelling evidence is data, such as (but not limited to) an independent audit point(s), a multi- point calibration, and/or a prior zero/span check that establishes whether the analyzer was in fact operating within the percent difference critical criteria acceptance limits and whether the 1-point QC check itself is considered valid or invalid.

A valid QC check is one that is conducted using certified, properly functioning equipment, conducted in a manner that adheres to appropriate procedures (SOPs) and the test concentration is considered accurate.

An invalid QC check is a check in which there were technical issues with the generation of its test concentration and the test concentration is not considered accurate.

Criteria that are important for maintaining and evaluating the quality of the data collection system are included under Operational Criteria. Violation of a criterion or a number of criteria may be cause for invalidation. The decision maker should consider other quality control information that may or may not indicate the data are acceptable for the parameter being controlled. Therefore, the sample or group of samples for which one or more of these criteria are not met are suspect unless other quality control information demonstrates otherwise and is documented. The reason for not meeting the criteria MUST be investigated, mitigated or justified.

Finally, those criteria which are important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples are included on the third table, the Systematic Criteria. For example, the data quality objectives are included in this table. If the data quality objectives are not met, this does not invalidate any of the samples but it may impact the uncertainty associated with the attainment/non-attainment decision.

Polk County Air Quality will not automatically invalidate data based on results from performance audits required in 40 CFR 58 Appendices A and B for data validation, because such performance audits are classified as Operational Criteria in the Quality Assurance Handbook for Air Pollution Measurement Systems Volume II.

Records of all invalid samples will be filed. Information will include a brief summary as to why the sample was invalidated along with the associated flag.

Corrective Action – Polk County will assume responsibility for identifying and correcting any problems that may arise in the field or during transportation that could affect the validity of data for a sampling period. This will be accomplished in accordance with the appropriate Polk County Air Quality SOP and documented with the appropriate paperwork.

24.0 Reconciling Results with DQOs

Section 4, Section 7, and Section 20 all touch on the DQO process, which is an important planning tool to determine the objectives of an environmental data operation, to understand and agree upon the allowable uncertainty in the data, and with that information, optimize the sampling design. This information, along with sampling and analytical methods and appropriate QA/QC, should be documented in the Polk County Air Quality QAPP.

The QAPP is then implemented by Polk County Air Quality under the premise that if followed, the DQO should be met. Reconciliation with the DQO involves reviewing both routine and QA/QC data by the QAM/ QAO to determine whether DQO has been attained, and that the data are adequate for its intended use. This process by which the QAM/QAO evaluates the data against the DQO has been termed the DQA.

The Polk County Air Quality QAM/ QAO is responsible for the DQA process. This is done monthly, quarterly, and annually. The DQA has been developed for cases where a formal DQO has been established. DQA guidance can be found in the document EPA QA/G-9. This document focuses on evaluating data for use in decision-making and provides the graphical and statistical tools.

By using the DQA process, one can answer two fundamental questions:

< Can the decision be made with the desired confidence, given the quality of the data?
< How well can the sampling design be expected to perform over a wide range of possible outcomes?

DQA is an important part of the overall QA assessment of Polk County Air Quality.

Routine data, QC performance and evaluation data are inputs for the data verification/validation process. The output of this process is Validated/Verified Data. This output is then used as input for the DQA, which include the following five steps:

< Review by QAM of DQO and sampling design: This is the review of the DQO outputs to assure that they are still applicable. Review of the sampling design and data collection documentation.
< Conduct preliminary data review: As noted in this QAPP, this includes review of QA reports and the calculations of basic statistics, such as the number of samples, mean concentrations, standard deviations, min/max concentrations and P&B data.
< Selection of statistical test: Use the guidance document to select the most appropriate procedure for summarizing and analyzing the data of the particular criteria pollutant. For Polk County Air Quality this was determined to be the AirVision Software, as well as EPA AQS QA Transaction Generator, P&B spreadsheets and AQS statistical summary reports.
< Verify the assumptions of the statistical test: The QAM evaluates whether the underlying assumptions hold given the actual data and other information about the measurement. The assumptions behind the test include those associated with the development of the DQO, in addition to the bias and precision assumptions.
< Draw conclusion from the data: Perform the calculations required for the statistical test chosen and document the resulting inferences.

The output from the DQA is the conclusions drawn from the data. This can then be used in the decision and policy-making procedures. Results are documented and communicated in reports to management, discussed in Section 21 of this QAPP.

As with any data set, limitations and assumptions are made when using it. When using the air monitoring data, it should be noted that while they are used as a representation of the county's air quality, they may not pick up localized air quality issues. For example, idling trucks, open burning, etc. may affect the air quality on a localized scale, but if they are not in close proximity to our air monitors, the data likely won't reflect that.

Appendix A: PCAQD SOP Table

Appendix A: Polk County Air Quality Division SOP

1. Ozone (O_3) 49*i*
2. $NO/NO_2/NO_x$ 42*i*
3. Ozone (O_3) 49*iQ*
4. $PM_{2.5}$ and PM_{10} 205*i*
5. $NO/NO_2/NO_x$ 42*iQ*
8. Air Toxics
9. Meteorological Station
10. Barometers
11. Field Thermometers
12. Streamline FTS
13. BIOS Drycal DC
14. Cole Palmer Digi-sense
15. Data Retrieval and Submission
18. Agilaire AirVsion
19. Chain of Custody and Transport of Filters
25. Zero Air Teledyne 701
26. Dynamic Gas Calibrator Thermo 146
29. Met-One BAM 1022

Appendix B: Measure Quality Objectives (MQO) and Data Quality Objectives (DQO)

Ozone Validation Template
NO, NO_2, NO_x Validation Template
PM2.5 Filter Based Local Conditions Validation Template
Continuous PM2.5 Local Conditions Validation Template
PM10c for PM10-2.5 Low –Volume, Filter-Based Local Conditions Validation Template
PM10 Low Volume STP Filter-Based Local Conditions Validation Template

Ozone Validation Template

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

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

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

NO_2, NOx, NO Validation Template

1) Requirement (NO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- NO_2			
Sampler/Monitor	***NA***	***Meets requirements listed in FRM/FEM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One Point QC Check Single analyzer	***Every 14 days***	< ±15.1% (percent difference) or < ± 1.5 ppb difference whichever is greater	1 and 2) 40 CFR Part 58 App A Sec. 3.1.1 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.5 QC Check Conc range 0.005 - 0.08 ppm and 05/05/2016 Technical Note on AMTIC
Zero/span check	Every 14 days	Zero drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14 day) Span drift < ± 10.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
Converter Efficiency	During multi-point calibrations, span and audit Every 14 days	***(≥96%)*** 96% – 104.1%	1) 40 CFR Part 50 App F Sec. 1.5.10 and 2.4.10 2) Recommendation 3) 40 CFR Part 50 App F Sec. 1.5.10 and 2.4.10 Regulation states ≥ 96%, 96 – 104.1% is a recommendation.
OPERATIONAL CRITERIA- NO_2			
Shelter Temperature Range	Daily (hourly values)	20.0 to 30.0° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2 Generally, the 20-30.0 ° C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30 ° C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	< 2.1° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Shelter Temperature Device Check	every 182 days and 2/calendar year	< ± 2.1° C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Annual Performance Evaluation Single Analyzer	***Every site every 365 days and 1/ calendar year***	Percent difference of audit levels 3-10 < ±15.1% Audit levels 1&2 < ± 1.5 ppb difference or < ±15.1%	1) 40 CFR Part 58 App A Sec. 3.1.2 2) 40 CFR Part 58 App A Sec. 3.1.2 3) Recommendation - 3-audit concentrations not including zero. AMTIC Technical Memo
Federal Audits (NPAP)	20% of sites audited in calendar year	Audit levels 1&2 < ± 1.5 ppb difference all other levels percent difference < ± 15.1%	1 & 2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP

1) Requirement (NO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving Every 182 day and 2/ calendar year if manual zero/span performed biweekly Every 365 day and 1/ calendar year if continuous zero/span performed daily	Instrument residence time ≤ 2 min Dynamic parameter ≥ 2.75 ppm-min All points <± 2.1 % or ≤ ± 1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 ± .05	1) 40 CFR Part 50 App F 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
Gaseous Standards	All gas cylinders	**NIST Traceable** (e.g., EPA Protocol Gas) 50-100 ppm of NO in Nitrogen with < 1 ppm NO_2	1) 40 CFR Part 50 App F Sec. 1.3.1 2) NA Green Book 3) 40 CFR Part 50 App F Sec. 1.3.1. A technical memo may change the concentration requirment. Gas producer used must participate in EPAAmbient Air Protocol Gas Verification Program 40 CFR Part 58 App A Sec. 2.6.1
Zero Air/ Zero Air Check	Every 365 days and 1/ calendar year	Concentrations below LDL	1) 40 CFR Part 50 App F Sec. 1.3.2 2 and 3) Recommendation
Gas Dilution Systems	Every 365 days and 1/ calendar year or after failure of 1 point QC check or performance evaluation	Accuracy < ± 2.1 %	1, 2 and 3) Recommendation based on SO2 requirement in 40 CFR Part 50 App A-1 Sec. 4.1.2
Detection (FEM/FRMs) Noise and Lower Detectable Limits (LDL) are part of the FEM/FRM requirements. It is recommended that monitoring organizations perform the LDL test to minimally confirm and establish the LDL of their monitor. Performing the LDL test will provide the noise information.			
Noise	Every 365 days and 1/ calendar year	***≤ 0.005 ppm***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Lower detectable level	Every 365 days and 1/ calendar year	***≤ 0.01 ppm***	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA- NO_2			
Standard Reporting Units	***All data***	***ppb (final units in AQS)***	1, 2 and 3) 40 CFR Part 50 App S Sec. 2 (c)
Rounding convention for data reported to AQ S	***All routine concentration data***	***1 place after decimal with digits to right truncated***	1, 2 and 3) 40 CFR Part 50 App S Sec. 4.2 (a) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
Completeness	***Annual Standard***	***≥ 75% hours in year***	1) 40 CFR Part 50 App S Sec. 3.1(b) 2) 40 CFR Part 50 App S Sec. 3.1(a) 3) 40 CFR Part 50 App S Sec. 3.1(b)
	1-hour standard	***1) 3consecutive calendars years of complete data 2) 4 quarters complete in each year 3) ≥75% sampling days in quarter 4) ≥ 75% of hours in a day***	1) 40 CFR Part 50 App S Sec. 3.2(b) 2) 40 CFR Part 50 App S Sec. 3.2(a) 3) 40 CFR Part 50 App S Sec. 3.2(b) More details in 40 CFR Part 50 App S

1) Requirement (NO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
Sample Residence Time Verification	Every 365 days and 1/ calendar year	***≤ 20 Seconds***	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 9 (c)
Sample Probe, Inlet, Sampling train	***All sites***	***Borosilicate glass (e.g., Pyrex®) or Teflon®***	1, 2 and 3) 40 CFR Part 58 App E Sec. 9 (a) FEP and PFA have been accepted as equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Secs 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
Precision (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	***90% CL CV < 15.1%***	1) 40 CFR Part 58 App A Sec. 2.3.1.5 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
Bias (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	***95% CL < ± 15.1%***	1) 40 CFR Part 58 App A Sec. 2.3.1.5 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3

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

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

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

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

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Field Filter Blank	10% or 1 per weighing session	<± 30.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.1 2 and 3) Method 2.12 Table 7-1 & Sec.10.5
Lab Filter Blank	10% or 1 per weighing session	<± 15.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.2 2 and 3) Method 2.12 Sec. 10.5
Balance Check (working standards)	beginning, 10th sample, end	< ±3.1 µg from certified value	1, 2 and 3) Method 2.12 Sec. 10.6 Standards used should meet specifications in Method 2.12, Sec. 4.3.7
Routine Filter re-weighing	1 per weighing session	<± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8
Microbalance Audit	every 365 days and once a calendar year	<± 0.003 mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	***At installation*** every 365 days and once a calendar year	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.11 3) NA
Lab Temperature Certification	every 365 days and once a year	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Calibration & Check Standards -			
Working Mass Stds. Verification Compared to primary standards	Every 90 days	< ±2.1 ug	1, 2 and 3) Method 2.12 Sec. 9.7
Primary standards certification	every 365 days and once a calendar year	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
SYSTEMATIC CRITERIA -$PM_{2.5}$ Filter Based Local Conditions			
Siting	every 365 days and once a calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	***Annual Standard***	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
	24- Hour Standard	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	***all filters***	***µg/m³ at ambient temp/pressure ($PM_{2.5}$)***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Rounding convention for design value calculation	***all filters***	***to one decimal place, with additional digits to the right being truncated***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Annual 3-yr average	***all concentrations***	***nearest 0.1 µg/m³*** (≥ 0.05 round up)	1, 2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
24-hour, 3-year average	***all concentrations***	***nearest 1 µg/m³*** (≥ 0.5 round up)	1, 2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
Detection Limit			
Lower DL	***all filters***	***≤ 2 µg/m³***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.1
Upper Conc. Limit	***all filters***	***≥ 200 µg/m³***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.2
Precision			
Single analyzer (collocated monitors)	every 90 days	Coefficient of variation (CV) < 10.1% for values ≥ 3.0 µg/m³	1, 2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
Primary Quality Assurance Org.	***Annual and 3 year estimates***	***90% CL of CV < 10.1 % for values ≥ 3.0 µg/m³***	1, 2 and 3) 40 CFR Part 58, App A, Sec. 4.2.1 and 2.3.1.1
Bias			
Performance Evaluation Program (PEP)	***5 audits for PQAOs with ≤ 5 sites 8 audits for PQAOs with > 5 sites***	***< ± 10.1% for values ≥ 3.0 µg/m³***	1, 2 and 3) 40 CFR Part 58, App A, Sec. 3.2.4, 4.2.5 and 2.3.1.1
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	every 365 days and once a calendar year	***< ± 2.1% of NIST Traceable Std.***	1) 40 CFR Part 50, App. L Sec. 9.1 & 9.2 2) Method 2-12 Sec. 4.2.2 & 6.4.3 3) 40 CFR Part 50, App. L Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Clock/timer Verification	Every 30 days	***1 min/mo***	1 and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App. L Sec. 7.4.12
Laboratory Activities			
Microbalance Readability	***At purchase***	***1 µg***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.1
Microbalance Repeatability	At purchase	1 µg	1) Method 2.12 Sec. 4.3.6 2) Recommendation 3) Method 2.12 Sec. 4.3.6
Primary Mass/Working mass Verification/Calibration Standards	At purchase	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7

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

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

Continuous PM2.5 Local Conditions Validation Template

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

Technical Systems Audit Checklists

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

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

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

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

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

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

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

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

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

PM10c for $PM_{10-2.5}$ Low –Volume, Filter-Based Local Conditions Validation Template

NOTE: The following validation template was constructed for use of PM_{10} at local conditions where PM_{10c} is used in the calculation of the $PM_{10-2.5}$ measurement or for objectives other than comparison to the PM_{10} NAAQS. Although the PM $_{10-2.5}$ method is found in 40 CFR Part 50 Appendix O, Appendix O references Appendix L (the $PM_{2.5}$ Method) for the QC requirements listed below. Therefore, the information action column, in most cases, will reference 40 CFR Part 50 App L. Monitoring organizations using PM_{10} data for a NAAQS comparison purposes should refer to the PM_{10} validation template for STP (standard temperature and pressure correction). In addition, since the samplers are very similar to the PM2.5 samplers, Guidance Document 2.12 *Monitoring PM2.5 in Ambient Air Using Designated Reference or Class 1 Equivalent Methods* is referred to where appropriate.

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM10c Filter Based Local Conditions			
Field Activities			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM/ARM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Filter Holding Times			
Pre-sampling	***all filters***	***≤ 30 days before sampling***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.5
Sample Recovery	***all filters***	***≤7 days 9 hours from sample end date***	1, 2 and 3) 40 CFR Part 50 App L Sec. 10.10
Sampling Period (including multiple power failures)	***all filters***	***1380-1500 minutes, or value if < 1380 and exceedance of NAAQS*** [1/] ***midnight to midnight local standard time***	1, 2 and 3) 40 CFR Part 50 App L Sec. 3.3 See details if less than 1380 min sampled
Sampling Instrument			
Average Flow Rate	***every 24 hours of op***	***average within 5% of 16.67 liters/minute***	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	***every 24 hours of op***	***CV ≤ 2%***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.2
One-point Flow Rate Verification	***every 30 days each seperated by 14 days***	***± 4% of transfer standard*** ± 5% of flow rate design value	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.5, 40 CFR Part 58 App A Sec. 3.3.1
Design Flow Rate Adjustment	***After multi-point calibration or verification***	***< ± 2.1% of design flow rate***	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
Individual Flow Rates	***every 24 hours of op***	***no flow rate excursions > ±5% for > 5 min.*** [1/]	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.1
Filter Temp Sensor	***every 24 hours of op***	***no excursions of > 5° C lasting longer than 30 min*** [1/]	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.11.4
External Leak Check	***Before each flow rate verification/calibration*** and before and after $PM_{2.5}$ separator maintenance	***< 80.1 mL/min*** (see comment #1)	1) 40 CFR Part 50 App L, Sec. 7.4.6.1 2) 40 CFR Part 50 App L Sec.t 9.2.3 and Method 2-12 Sec. 7.4.3 3) 40 CFR Part 50, App. L, Sec. 7.4.6.1

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Internal Leak Check	If failure of external leak check	*< 80.1 mL/min*	1) 40 CFR Part 50, App. L, Sec. 7.4.6.2 2) Method 2-12, Sec. 7.4.4 3) 40 CFR Part 50, App. L, Sec. 7.4.6.2
Laboratory Activities			
Post-sampling Weighing	*all filters*	*Protected from exposure to temperatures above 25C from sample retrieval to conditioning* *≤10 days from sample end date if shipped at ambient temp, or* *≤30 days if shipped below avg ambient (or 4° C or below for avg sampling temps < 4° C) from sample end date*	1, 2 and 3) 40 CFR Part 50 App L Sec. 8.3.6
Filter Visual Defect Check (unexposed)	*all filters*	*Correct type & size and for pinholes, particles or imperfections*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 10.2
Filter Conditioning Environment			
Equilibration	*all filters*	*24 hours minimum*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.5
Temp. Range	*all filters*	*24-hr mean 20.0-23.0° C*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.1
Temp.Control	*all filters*	*< 2.1° C SD* over 24 hr*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.2 SD use is a recommendation
Humidity Range	*all filters*	*24-hr mean 30.0% - 40.0% RH or within ±5.0% sampling RH but > 20.0%RH*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.3
Humidity Control	*all filters*	*< 5.1% SD* over 24 hr.*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.4 SD use is recommendation
Pre/post Sampling RH	*all filters*	*difference in 24-hr means ≤ ± 5.1% RH*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.3
Balance	*all filters*	*located in filter conditioning environment*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.2
OPERATIONAL EVALUATIONS TABLE- PM10c Filter Based Local Conditions			
Field Activities			
Sampling Instrument			
Routine Verifications			
One-point Temp Verification	every 30 days	≤± 2.1°C	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec. 7.4.5 and Table 6-1 3) Recommendation
Pressure Verification	every 30 days	≤ ± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec. 7.4.6 and Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
Temperature multi-point Verification/Calibration	on installation, then every 365 days and once a calendar year	≤± 2.1°C	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.4.4 Table 6-1

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Pressure Verification/Calibration	on installation, then every 365 days and once a calendar year	<± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
Flow Rate Multi-point Verification/ Calibration	***Electromechanical maintenance or transport or*** every 365 days and once a calendar year	<± 2.1% of transfer standard	1) 40 CFR Part 50, App. L, Sec. 9.2. 2) 40 CFR Part 50, App. L, Sec. 9.1.3, Method 2.12 Sec. 6.3 & Table 6-1 3) Recommendation
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1, 2 and 3) Recommendation
Precision			
Collocated Samples	***every 12 days for 15% of sites by method designation***	CV < 10.1% of samples ≥ 3.0 µg/m^3	1) and 2) Part 58 App A Sec. 3.2.3 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.1
Accuracy			
Temperature Audit	every 180 days and at time of flow rate audit	<± 2.1°C	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	<±10.1 mm Hg	1, 2 and 3) Method 2.12 Sec. 11.2.3
Semi Annual Flow Rate Audit	***Twice a calendar year and 5-7 months apart***	<± 4.1% of audit standard <± 5.1% of design flow rate	1 and 2) Part 58, App A, Sec. 3.2.2 3) Method 2.12 Sec. 11.2.1
Monitor Maintenance			
$PM_{2.5}$ Separator (WINs)	every 5 sampling events	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.2.2
$PM_{2.5}$ Separator (VSCC)	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3.3
Inlet Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Downtube Cleaning	every 90 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.4
Filter Housing Assembly Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Circulating Fan Filter Cleaning	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	< ±15.1 µg change between weighings	1, 2, 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor. Method 2.12 Sec. 10.5
Exposure Lot Blanks	3 filters per lot	< ±15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.5 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1, 2 and 3) Method 2.12 Sec. 10.7 and 10.3
Lab QC Checks			

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Field Filter Blank	10% or 1 per weighing session	<± 30.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.1 2 and 3) Method 2.12 Table 7-1 & Sec.10.5
Lab Filter Blank	10% or 1 per weighing session	<± 15.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.2 2 and 3) Method 2.12 Sec. 10.5
Balance Check (working standards)	beginning, 10th sample, end	< ±3.1 µg from certified value	1, 2 and 3) Method 2.12 Sec. 10.6 Standards used should meet specifications in Method 2.12, Sec. 4.3.7
Routine Filter re-weighing	1 per weighing session	<± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8
Microbalance Audit	every 365 days and once a calendar year	<± 0.003 mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	***At installation*** every 365 days and once a calendar year	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.11 3) NA
Lab Temperature Certification	every 365 days and once a year	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Calibration & Check Standards -			
Working Mass Stds. Verification Compared to primary standards	Every 90 days	< ± 2.1 ug	1, 2 and 3) Method 2.12 Sec. 9.7
Primary standards certification	every 365 days and once a calendar year	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
SYSTEMATIC CRITERIA - PM10c Filter Based Local Conditions			
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	NA	≥ 75% scheduled sampling days in each quarter	1, 2 and 3) Recommendation based on PM2.5 requirements in 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	***all filters***	***µg/m³ at ambient temp/pressure (PM2.5)***	1, 2 and 3) 40 CFR Part 50 App N
Rounding convention for design value calculation	***all filters***	***to one decimal place, with additional digits to the right being truncated***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.
Lower DL	***all filters***	***≤ 3 µg/m³***	1, 2 and 3) 40 CFR Part 50, App O Sec. 3.1
Upper Conc. Limit	***all filters***	***≥200 µg/m³***	1, 2 and 3) 40 CFR Part 50, App O Sec. 3.2

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Precision			
Single analyzer (collocated monitors)	every 90 days and 4 times a calendar year.	Coefficient of variation (CV) < 10.1% for values ≥ 3 µg/m^3	1, 2 and 3) Recommendation in order to provide early evaluation of achievement of DQOs.
Primary Quality Assurance Org.	***Annual and 3 year estimates***	***90% CL of CV < 10.1% for values ≥ 3 µg/m^3***	1, 2 and 3) Recommendation in order to provide early evaluation of achievement of DQOs.
Bias			
Performance Evaluation Program (PEP)	Once every 6-7 years	***< ±10.1% for values ≥ 3 µg/m^3***	1, 2 and 3) Recommendation based on pending guidance.
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	every 365 days and once a calendar year	***< ± 2.1% of NIST-traceable Std.***	1) 40 CFR Part 50, App. L Sec. 9.1 & 9.2 2) Method 2-12 Sec. 6.3.3 and Table 3-1 3) 40 CFR Part 50, App. L Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Verification/Calibration Clock/timer Verification	every 30 days	***1 min/mo***	1 and 2) Method 2.12 Sec 4.2.1 3) 40 CFR Part 50, App. L, Sec. 7.4.12
Laboratory Activities			
Microbalance Readability	***at purchase***	***1 µg***	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 8.1
Microbalance Repeatability	at purchase	1 µg	1) Method 2.12 Sec. 4.3.6 2) Recommendation 3) Method 2.12 Sec. 4.3.6
Primary Mass. Verification/Calibration Standards	at purchase	0.025 mg tolerance (class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
Comment #1 The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

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

PM_{10} Low Volume STP Filter-Based Local Conditions Validation Template

Monitoring organizations can use low-volume PM instruments for PM_{10} monitoring. However, PM_{10} data collection for NAAQS purposes must be reported in standard temperature and pressure (STP). 40 CFR Part 50 App J describes the reference method for PM_{10} but this method was promulgated for dichot and high volume methods that have improved over the years. Since monitoring organization may be able to use the low volume methods for multiple uses (PM_{10c}, PM_{10}-Pb) it is suggested that the validation criteria for this method follow the method requirements associated with the $PM_{2.5}$ which is Appendix L. Where there are particular requirement directly related to the NAAQS evaluation App J will be used.

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{10} Lo-Vol Filter Based STP			
Field Activities			
Sampler/Monitor	NA	*Meets requirements listed in FRM/FEM/ARM designation*	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Sample Recovery	*all filters*	*≤7 days 9 hours from sample end date*	1, 2 and 3) 40 CFR Part 50 App L Sec. 10.10
Pre-sampling	*all filters*	*≤ 30 days before sampling*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.5
Sampling Instrument			
Average Flow Rate	*every 24 hours of op*	*average within < 5.1% of 16.67 liters/minute*	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	*every 24 hours of op*	*CV < 2.1%*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.2
One-point Flow Rate Verification	*every 30 days each seperated by 14 days*	*< ± 4.1% of transfer standard* < ± 5.1% of flow rate design value	1) 40 CFR Part 50, App. L, Sec. 9.2.5, 40 CFR Part 58, App A Sec. 3.3.1 2) Part 58, App A, Sec. 3.3.1 3) 40 CFR Part 50, App. L, Sec. 9.2.5 & 7.4.3.1
Design Flow Rate Adjustment	*at one-point or multi-point verification/calibration*	*< ± 2.1% of design flow rate*	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
Individual Flow Rates	*every 24 hours of op*	*no flow rate excursions > ±5.1% for > 5 min.* 1/	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.1
Filter Temp Sensor	*every 24 hours of op*	*no excursions of > 5° C lasting longer than 30 min* 1/	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.11.4
External Leak Check	*Before each flow rate verification/calibration* and before and after maintenance	*< 80.1 mL/min* (see comment #1)	1) 40 CFR Part 50 App L, Sec. 7.4.6.1 2) 40 CFR Part 50, App. L Sec. 9.2.3 Method 2-12 Sec. Table 8-1 3) 40 CFR Part 50, App. L, Sec. 7.4.6.1
Internal Leak Check	every 5 sampling events	*< 80.1 mL/min*	1) 40 CFR Part 50, App. L, Sec. 7.4.6.2 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App. L, Sec. 7.4.6.2
Laboratory Activities			

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Post-sampling Weighing	*all filters*	*Protected from exposure to temperature ≤10 days from sample end date if shipped at ambient temp, or ≤30 days if shipped below avg ambient (or 4° C or below for avg sampling temps < 4° C) from sample end date*	1, 2 and 3) 40 CFR Part 50 App L Sec. 8..3.6
Filter Visual Defect Check (unexposed)	*all filters*	*Correct type & size and for pinholes, particles or imperfections*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 10.2
Filter Conditioning Environment			
Equilibration	*all filters*	*24 hours minimum*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.5
Temp. Range	*all filters*	*24-hr mean 20.0-23.0° C*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.1
Temp.Control	*all filters*	*< 2.1° C SD* over 24 hr*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.2 SD use is recommendation
Humidity Range	*all filters*	*24-hr mean 30.0% - 40.0% RH or <5.1% sampling RH but ≥ 20.0%RH*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.3
Humidity Control	*all filters*	*< 5.1% SD* over 24 hr.*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.4 SD use is recommendation
Pre/post Sampling RH	*all filters*	*difference in 24-hr means < ± 5.1% RH*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.3
Balance	*all filters*	*located in filter conditioning environment*	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.2
OPERATIONAL EVALUATIONS TABLE PM_{10} Lo-Vol Filter Based STP			
Field Activities			
Sampling Instrument			
Routine Verifications			
One-point Temp Verification	every 30 days	< ± 2.1°C	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec. 7.4.5 and Table 6-1 3) Recommendation
Pressure Verification	every 30 days	< ± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2) Method 2.12 Sec 7.4.6 and Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
Temperature multi-point Verification/Calibration	on installation, then every 365 days and once a calendar year	< ± 2.1°C	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.4.4 and Table 6-1
Pressure Verification/Calibration	on installation, then every 365 days and once a calendar year	< ± 10.1 mm Hg	1) 40 CFR Part 50, App. L, Sec. 9.3 2 and 3) Method 2.12 Sec. 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year

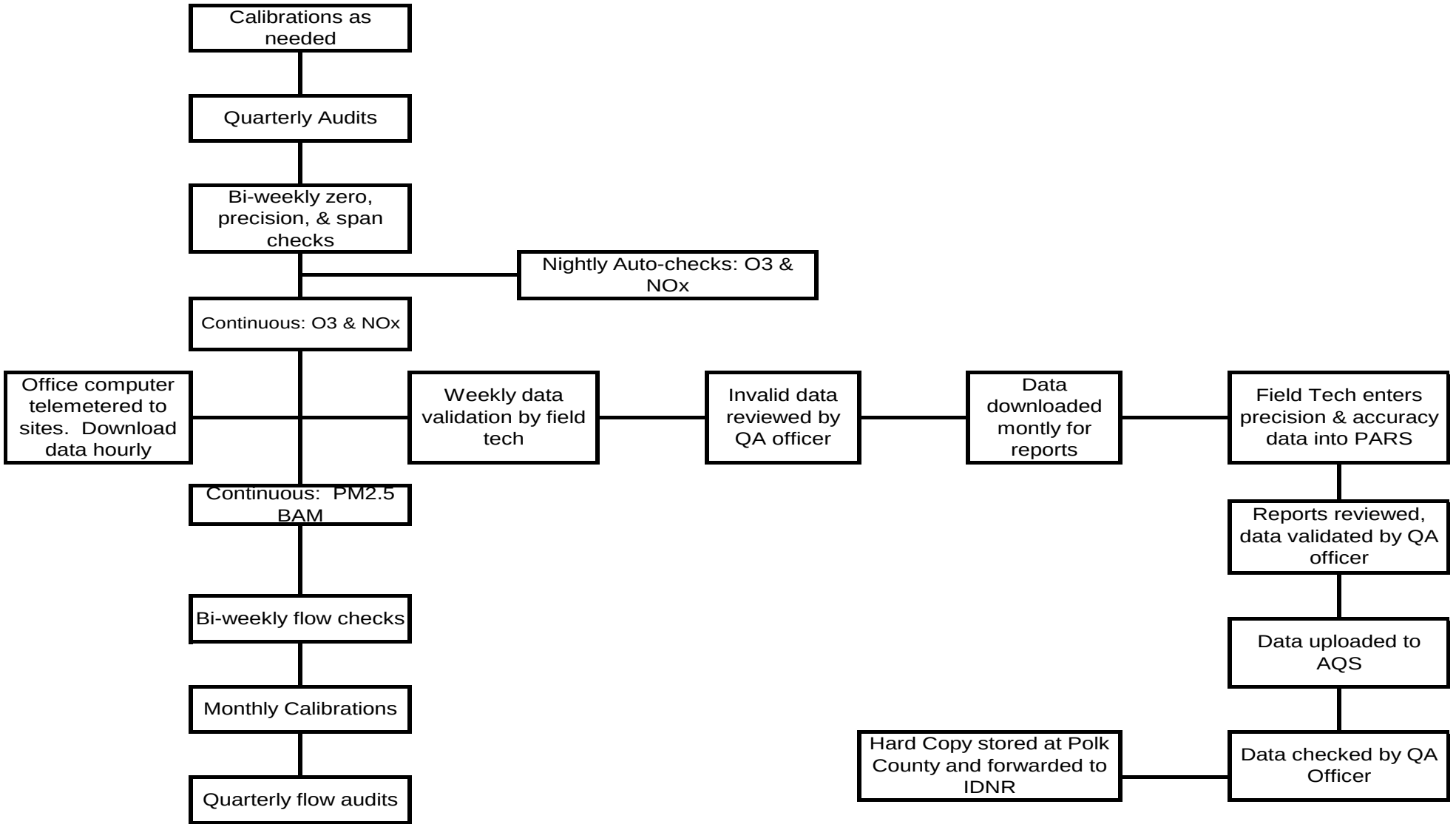
1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Flow Rate Multi-point Verification/ Calibration	***Electromechanical maintenance or transport or*** every 365 days and once a calendar year	< ± 2.1% of transfer standard	1) 40 CFR Part 50, App. L, Sec. 9.2. 2) 40 CFR Part 50, App. L, Sec. 9.1.3, Method 2.12 Sec. 6.3 Table 6-1 3) Recommendation
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1, 2 and 3) Recommendation
Precision			
Collocated Samples	***every 12 days for 15% of sites***	CV < 10.1% of samples ≥ 3.0 µg/m^3	1) and 2) 40 CFR Part 58 App A Sec. 3.3.4 3) Recommendation
Accuracy			
Temperature Audit	every 180 days and at time of flow rate audit	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	< ±10.1 mm Hg	1, 2 and 3) Method 2.12 Sec. 11.2.3
Semi Annual Flow Rate Audit	***Twice a calendar year and 5-7 months apart***	< ± 4.1% of audit standard < ± 5.1% of design flow rate	1 and 2) Part 58, App A, Sec. 3.3.3 3) Method 2.12 Sec. 11.2.1
Monitor Maintenance			
Inlet Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Downtube Cleaning	every 90 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.4
Filter Chamber Cleaning	every 30 days	cleaned	1, 2 and 3) Method 2.12 Sec. 8.3
Circulating Fan Filter Cleaning	every 30 days	cleaned/changed	1, 2 and 3) Method 2.12 Sec. 8.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	< ±15.1 µg change between weighings	1, 2, 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor. Method 2.12 Sec. 10.5
Exposure Lot Blanks	3 filters per lot	< ± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.5 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1, 2 and 3) Method 2.12 Sec. 10.3 and 10.7
Lab QC Checks			
Field Filter Blank	10% or 1 per weighing session	< ± 30.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.1 2 and 3) Method 2.12 Table 7-1 & Sec. 10.5
Lab Filter Blank	10% or 1 per weighing session	< ± 15.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.2 2 and 3) Method 2.12 Sec. 10.5
Balance Check (working standards)	beginning, 10th sample, end	< ± 3.1 µg from certified value	1, 2 and 3) Method 2.12 Sec. 10.6 Standards used should meet specifications in Method 2.12, Sec. 4.3.7
Routine Filter re-weighing	1 per weighing session	< ± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Microbalance Audit	every 365 days and once a calendar year	< ± 0.003 mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	***At installation*** every 365 days and once a calendar year	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.11 3) NA
Lab Temperature Certification	every 365 days and once a year	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	< ± 2.1%	1, 2 and 3) Method 2.12 Sec.4.3.8 and 9.4
Calibration & Check Standards -			
Working Mass Stds. Verification Compared to primary standards	Every 90 days	< ± 2.1 ug	1, 2 and 3) Method 2.12 Sec. 9.7
Primary standards certification	every 365 days and once a calendar year	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
SYSTEMATIC CRITERIA - PM_{10} Lo-Vol Filter Based STP			
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	***24- Hour Standard***	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b
Reporting Units	all filters	µg/m^3 at standard temperature and pressure	1, 2 and 3) 40 CFR Part 50 App K Sec. 1
Rounding convention for design value calculation	***Each routine concentration***	***nearest 10 µg/m^3 (≥ 5 round up)***	1, 2 and 3) 40 CFR Part 50 App K Sec. 1 The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.
Detection Limit			
Lower DL	***all filters***	***≤ 2 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.1
Upper Conc. Limit	***all filters***	***≥200 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.2
Precision			
Single analyzer	every 90 days and 4 times a calendar year.	Coefficient of variation (CV) < 10.1% ≥ 3.0 µg/m^3	1, 2 and 3) Recommendation
Single analyzer	1/ yr	CV < 10.1% ≥ 3.0 µg/m^3	1, 2 and 3) Recommendation
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV < 10.1% ≥ 3 µg/m^3	1, 2 and 3) Recommendation
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			

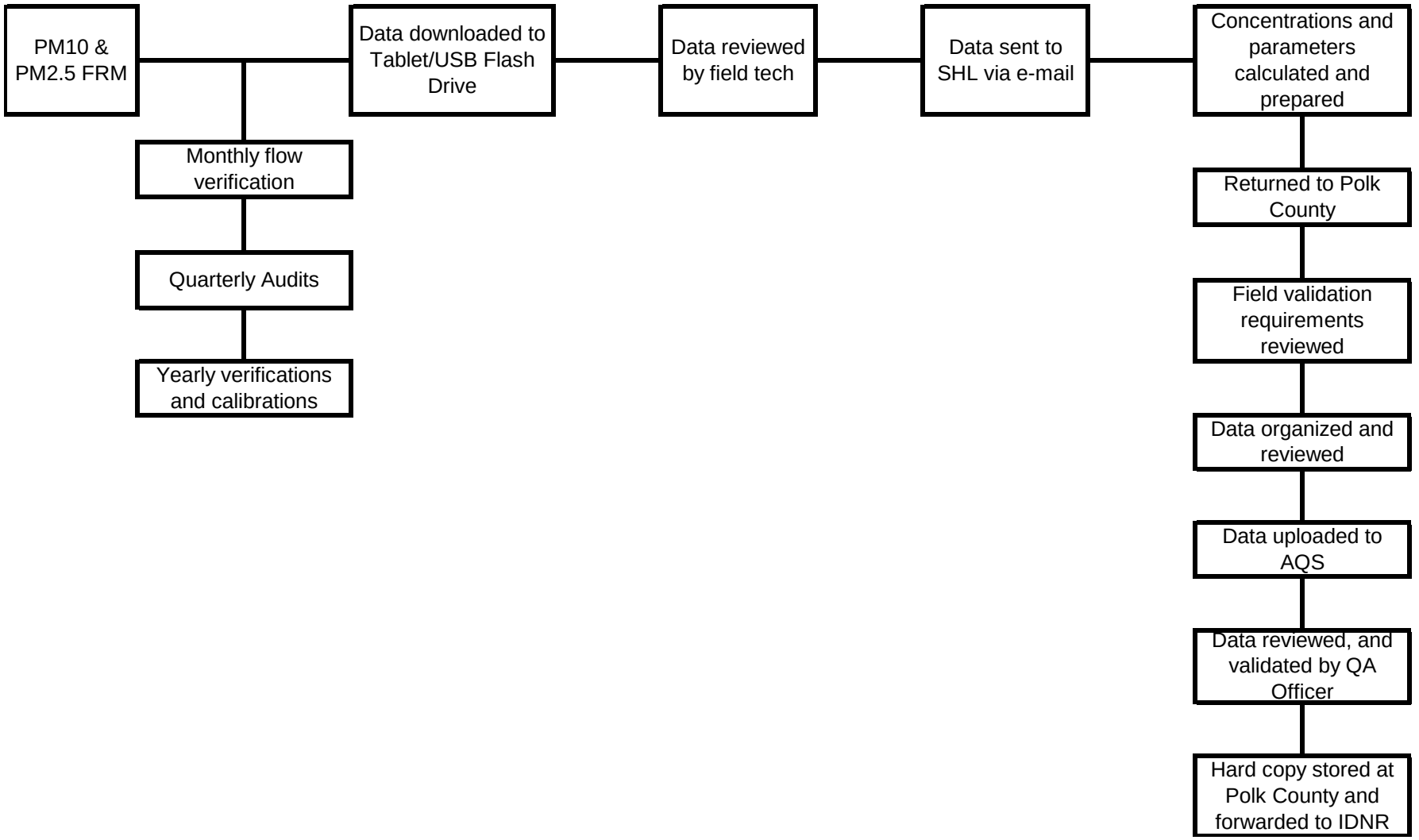
1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Flow Rate Transfer Std.	**every 365 days and once a calendar year**	***< ± 2.1% of NIST Traceable Std.***	1) 40 CFR Part 50, App. L Sec. 9.1 & 9.2 2) Method 2.12 Sec.4.2.2 & 6.4.3 3) 40 CFR Part 50, App. L Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Clock/timer Verification	every 30 days	***1 min/mo***	1and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App. L Sec. 7.4.12
Laboratory Activities			
Microbalance Readability	***at purchase***	***1 µg***	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.1
Microbalance Repeatability	at purchase	1 µg	1) Method 2.12 Sec. 4.3.6 2) Recommendation 3) Method 2.12 Sec. 4.3.6
Primary Mass. Verification/Calibration Standards Recertifications	at purchase	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
Comment #1 The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

Appendix C: Data Handling Flowcharts

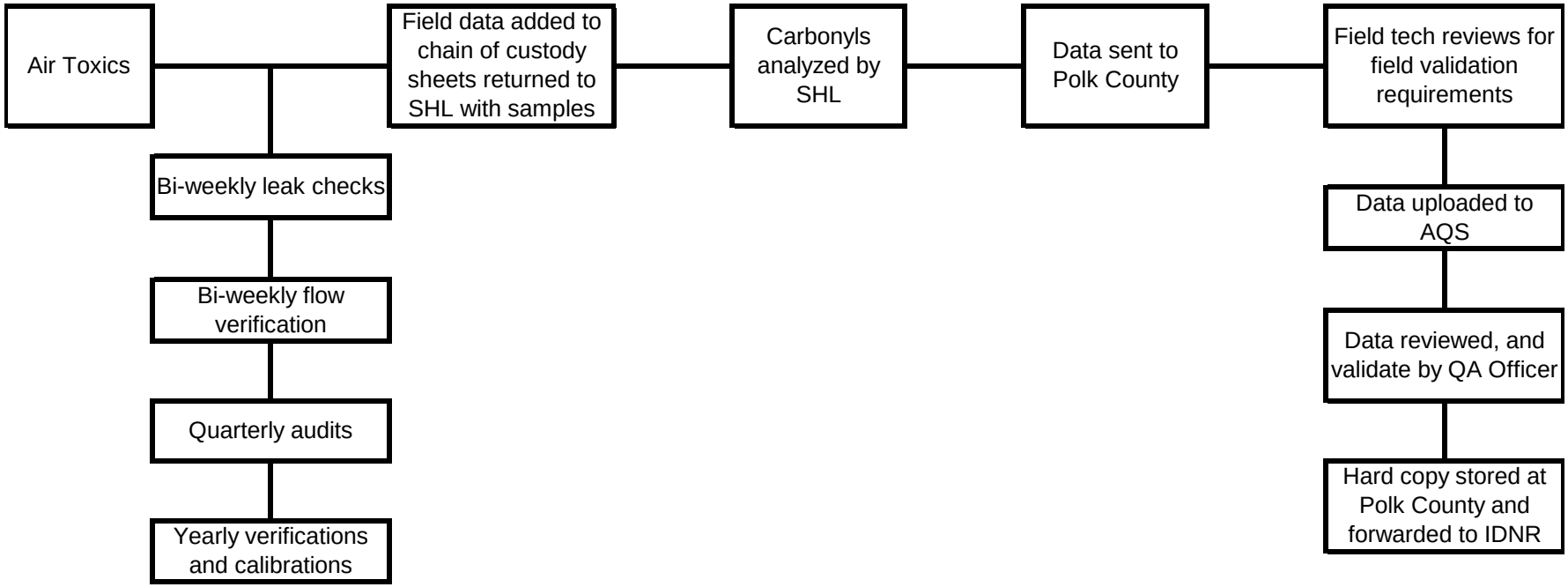
DATA HANDLING FLOW CHART: CONTINUOUS DATA



DATA HANDLING FLOW CHART: PM10 FRM, PM2.5 FRM



DATA HANDLING FLOW CHART: AIR TOXICS



Appendix D: AQS Codes

Appendix B AQS Codes

AQS Code	Qualifier Description	Qualifier Type
RA	African Dust.	REQEXC
RB	Asian Dust.	REQEXC
RC	Chemical Spills & Industrial Accidents.	REQEXC
RD	Cleanup After a Major Disaster.	REQEXC
RE	Demolition.	REQEXC
RF	Fire - Canadian.	REQEXC
RG	Fire - Mexico/Central America.	REQEXC
RH	Fireworks.	REQEXC
RI	High Pollen Count.	REQEXC
RJ	High Winds.	REQEXC
RK	Infrequent Large Gatherings.	REQEXC
RL	Other.	REQEXC
RM	Prescribed Fire.	REQEXC
RN	Seismic Activity.	REQEXC
RO	Stratospheric Ozone Intrusion.	REQEXC
RP	Structural Fire.	REQEXC
RQ	Terrorist Act.	REQEXC
RR	Unique Traffic Disruption.	REQEXC
RS	Volcanic Eruptions.	REQEXC
RT	Wildfire-U. S.	REQEXC
1	Deviation from a CFR/Critical Criteria Requirement.	QA
1V	Data reviewed and validated.	QA
2	Operational Deviation.	QA
3	Field Issue.	QA
4	Lab Issue.	QA
5	Outlier.	QA

AQS Code	Qualifier Description	Qualifier Type
6	QAPP Issue.	QA
7	Below Lowest Calibration Level.	QA
9	Negative value detected - zero reported.	QA
CB	Values have been Blank Corrected.	QA
CC	Clean Canister Residue.	QA
CF	Canister Bias: NATTS/UATMP Data for compounds that have failed certification for the canister.	QA
CL	Surrogate Recoveries Outside Control Limits.	QA
DI	Sample was diluted for analysis.	QA
DN	DNPH peak less than NATTS TAD requirement, reported value should be considered an estimate.	QA
EH	Estimated; Exceeds Upper Range.	QA
FB	Field Blank Value Above Acceptable Limit.	QA
FX	Filter Integrity Issue.	QA
HT	Sample pick-up hold time exceeded.	QA
LB	Lab blank value above acceptable limit.	QA
LJ	Identification Of Analyte Is Acceptable; Reported Value Is An Estimate.	QA
LK	Analyte Identified; Reported Value May Be Biased High.	QA
LL	Analyte Identified; Reported Value May Be Biased Low.	QA
MD	Value less than MDL.	QA
MS	Value reported is 1/2 MDL substituted.	QA
MX	Matrix Effect.	QA
ND	No Value Detected, Zero Reported.	QA
NS	Influenced by nearby source.	QA
QP	Pressure Sensor Questionable.	QA
QT	Temperature Sensor Questionable.	QA
QX	Does not meet QC criteria.	QA
SB	Sampler Bias: NATTS/UATMP Data for compounds that have failed certification for the sampler.	QA
SP	NATTS/UATMP data with Spike Recovery outside acceptance limits.	QA
SQ	Values Between SQL and MDL.	QA
SS	Value substituted from secondary monitor.	QA

AQS Code	Qualifier Description	Qualifier Type
SX	Does Not Meet Siting Criteria.	QA
TB	Trip Blank Value Above Acceptable Limit.	QA
TT	Transport Temperaure is Out of Specs.	QA
V	Validated Value.	QA
VB	Value below normal; no reason to invalidate.	QA
W	Flow Rate Average out of Spec.	QA
X	Filter Temperature Difference or Average out of Spec.	QA
Y	Elapsed Sample Time out of Spec.	QA
AA	Sample Pressure out of Limits.	NULL
AB	Technician Unavaliable.	NULL
AC	Construction/Repairs in Area.	NULL
AD	Shelter Storm Damage.	NULL
AE	Shelter Temperature Outside Limits.	NULL
AF	Scheduled but not Collected.	NULL
AG	Sample Time out of Limits.	NULL
AH	Sample Flow Rate or CV out of Limits.	NULL
AI	Insufficient Data (cannot calculate).	NULL
AJ	Filter Damage.	NULL
AK	Filter Leak.	NULL
AL	Voided by Operator.	NULL
AM	Miscellaneous Void.	NULL
AN	Machine Malfunction.	NULL
AO	Bad Weather.	NULL
AP	Vandalism.	NULL
AQ	Collection Error.	NULL
AR	Lab Error.	NULL
AS	Poor Quality Assurance Results.	NULL
AT	Calibration.	NULL
AU	Monitoring Waived.	NULL

AQS Code	Qualifier Description	Qualifier Type
AV	Power Failure.	NULL
AW	Wildlife Damage.	NULL
AX	Precision Check.	NULL
AY	Q C Control Points (zero/span).	NULL
AZ	Q C Audit.	NULL
BA	Maintenance/Routine Repairs.	NULL
BB	Unable to Reach Site.	NULL
BC	Multi-point Calibration.	NULL
BD	Auto Calibration.	NULL
BE	Building/Site Repair.	NULL
BF	Precision/Zero/Span.	NULL
BG	Missing ozone data not likely to exceed level of standard.	NULL
BH	Interference/co-elution/misidentification.	NULL
BI	Lost or damaged in transit.	NULL
BJ	Operator Error.	NULL
BK	Site computer/data logger down.	NULL
BL	QA Audit.	NULL
BM	Accuracy check.	NULL
BN	Sample Value Exceeds Media Limit.	NULL
BR	Sample Value Below Acceptable Range.	NULL
CS	Laboratory Calibration Standard.	NULL
DA	Aberrant Data (Corrupt Files, Aberrant Chromatography, Spikes, Shifts).	NULL
DL	Detection Limit Analyses.	NULL
EC	Exceeds Critical Criteria.	NULL
FI	Filter Inspection Flag.	NULL
MB	Method Blank (Analytical).	NULL
MC	Module End Cap Missing.	NULL
QV	Quality Control Multi-point Verification.	NULL
SA	Storm Approaching.	NULL

AQS Code	Qualifier Description	Qualifier Type
SC	Sampler Contamination.	NULL
ST	Calibration Verification Standard.	NULL
SV	Sample Volume out of limits.	NULL
TC	Component Check & Retention Time Standard.	NULL
TS	Holding Time Or Transport Temperature Is Out Of Specs.	NULL
XX	Experimental Data.	NULL
1C	A 1-Point QC check exceeds acceptance criteria but there is compelling evidence that the analyzer data is valid.	NULL QC
1F	No 1 Point QC but need to count for completeness	NULL QC
IA	African Dust.	INFORM
IB	Asian Dust.	INFORM
IC	Chem. Spills & Indust Accidents.	INFORM
ID	Cleanup After a Major Disaster.	INFORM
IE	Demolition.	INFORM
IF	Fire - Canadian.	INFORM
IG	Fire - Mexico/Central America.	INFORM
IH	Fireworks.	INFORM
II	High Pollen Count.	INFORM
IJ	High Winds.	INFORM
IK	Infrequent Large Gatherings.	INFORM
IL	Other.	INFORM
IM	Prescribed Fire.	INFORM
IN	Seismic Activity.	INFORM
IO	Stratospheric Ozone Intrusion.	INFORM
IP	Structural Fire.	INFORM
IQ	Terrorist Act.	INFORM
IR	Unique Traffic Disruption.	INFORM
IS	Volcanic Eruptions.	INFORM
IT	Wildfire-U. S.	INFORM

AQS Code	Qualifier Description	Qualifier Type
J	Construction.	INFORM
E	Forest Fire.	REQEXC
RU	Wildland Fire Use Fire-U. S.	REQEXC
8	QA/QC Unknown.	QA
PQ	Values Between PQL And MDL.	QA
T	Multiple PM2.5 Validity Flags.	QA
A	High Winds.	INFORM
B	Stratospheric Ozone Intrusion.	INFORM
C	Volcanic Eruption.	INFORM
D	Sandblasting.	INFORM
F	Structural Fire.	INFORM
G	High Pollen Count.	INFORM
H	Chem. Spills & Indust. Accidents.	INFORM
I	Unusual Traffic Congestion.	INFORM
IU	Wildland Fire Use Fire-U. S.	INFORM
K	Agricultural Tilling.	INFORM
L	Highway Construction.	INFORM
M	Rerouting of Traffic.	INFORM
N	Sanding/Salting of Streets.	INFORM
O	Infrequent Large Gatherings.	INFORM
P	Roofing Operations.	INFORM
Q	Prescribed Burning.	INFORM
R	Cleanup After a Major Disaster.	INFORM
S	Seismic Activity.	INFORM
U	Sahara Dust.	INFORM
Z	Other event.	INFORM

QAPP Document Change Log

Date	Page	Update
3/7/2022		QAPP updated to reflect most recent EPA Guidance. Changes made throughout entire document
2/22/2023	7	Update for personnel changes at IDNR
2/22/2023	33	Site information updated to remove Indian Hills Samplers and add Public Works
2/22/2023	41	Table 10.2 Updated for Public Works and removed Indian Hills
2/22/2023	44	Updated for the addition of the Thermo 42*iQ*-TL analyzer