

**STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT BOARD**

IN THE MATTER OF PROPOSED NEW REGULATION,
20.2.50 NMAC – Oil and Gas Sector – Ozone Precursor Pollutants

No. EIB 21-27 (R)

DIRECT TESTIMONY OF BRENT ELLINGTON

1 My name is Brent Ellington, and I am an Environmental Scientist Specialist with the
2 Ambient Air Monitoring Section of the New Mexico Environment Department’s (“Department”
3 or “NMED”) Air Quality Bureau (“Bureau”). I am presenting this written testimony on behalf of
4 the Department in this proceeding on proposed new air quality regulations at 20.2.50 NMAC
5 (“Part 50”). My testimony will address the following topics: ozone monitoring, methods and
6 procedures, and federal requirements for monitoring equipment.

7 **I. QUALIFICATIONS**

8 I have been employed by the Bureau for approximately 7 years as an ambient air quality
9 monitoring section operator and supervisor. I have over 17 years of experience as an environmental
10 scientist for the State of New Mexico, having worked for the New Mexico Office of the State
11 Engineer and the New Mexico Interstate Stream Commission prior to joining the Department.

12 My full background and qualifications are set forth in my resume, which is marked as
13 NMED Exhibit 28.

14 **II. AMBIENT AIR QUALITY MONITORING**

15 **The NMED Ambient Air Quality Monitoring Network**

16 The Department is responsible for collecting ambient air data to document present air
17 quality and significant trends in pollutant concentrations. This data must be of high quality
18 because its use may have significant health, social, and economic impacts. The data collected is

1 used to determine the State's status with regard to compliance with federal National Ambient Air
2 Quality Standards ("NAAQS"), which are designed to protect the public health and avoid
3 secondary effects such as damage to vegetation or property, or the reduction of public values
4 such as visibility. The Bureau's public awareness programs are designed to provide current air
5 quality information to the public.

6 New Mexico consists of eight Air Quality Control Regions ("AQCRs") located in 33
7 counties covering a total area of 120,000 square miles. Three of these AQCRs encompass areas
8 with surrounding states, and five lie entirely within New Mexico.

9 The NMED ambient air quality monitoring network ("NMED Air Monitoring Network")
10 consists of State and Local Air Monitoring Stations ("SLAMS") and Special Purpose Monitors
11 ("SPMs"). The purpose of the network is to support the NAAQS, and the Bureau is designated
12 by EPA to operate the monitors. The network is designed to: (1) determine highest pollutant
13 concentrations expected to occur in the area covered by the network; (2) determine
14 representative pollutant concentrations in areas of high population density; (3) determine the
15 impact on ambient pollution levels of significant sources or source categories; and (4) determine
16 general background concentration levels. The monitoring locations are appropriately sited to
17 determine highest concentrations expected to occur.

18 **Overview of the NMED Air Monitoring Network**

19 The existing NMED Air Monitoring Network includes monitors in the areas of highest
20 population density: Dona Ana, Santa Fe, and Sandoval Counties. The monitors in the network
21 are sited to determine the impact on ambient pollution levels of significant sources and source
22 categories, in particular those in San Juan County, a region of concentrated energy development

1 and generation. The network includes sites that measure general background concentrations,
2 including sites in San Juan County and in Carlsbad, La Union, and Santa Teresa.

3 The current network is capturing data that enables NMED to determine the extent of
4 regional pollutant transport among populated areas. The Navajo Lake site serves this purpose for
5 transport between San Juan County and Southwestern Colorado. The monitoring objective of the
6 Coyote Ranger District site is to determine regional ozone transport. The monitoring objective of
7 the Las Cruces site is to determine regional PM 2.5 transport.

8 Data gathered from the current network of monitoring sites can be used to determine
9 welfare-related impacts in rural and remote areas. Data from the network is being used by citizen
10 groups in both the Four Corners Region and the Border Region of New Mexico/US and Mexico.
11 There are currently 14 ozone analyzers deployed at various monitoring stations throughout New
12 Mexico. *See* NMED Air Quality Bureau Air Monitoring Quality Assurance Project Plan 2020,
13 Section A.

14 **Federal Regulations Governing the NMED Air Monitoring Network**

15 The locations of the SLAMS and SPMs meet the general ambient monitoring site types
16 specified in the U.S. Environmental Protection Agency's ("EPA") regulations at 40 CFR Part 53
17 and 58. The Bureau maintains air monitoring instruments in such a manner as to attain 95%
18 probability goals for accuracy and precision within EPA's required limits. The Bureau adheres to
19 the Measurement Quality Objectives and Validation Templates as published in Appendix D of
20 the EPA QA Handbook for Air Pollution Measurement Systems, Vol. II (EPA-454/B-17-001)
21 (January 2017).¹

¹ Available at https://www.epa.gov/sites/production/files/2020-10/documents/app_d_validation_template_version_03_2017_for_amtic_rev_1.pdf

Air Pollutants Required to be Monitored

The Department monitors sulfur dioxide (SO²), nitrogen dioxide (NO²), ozone (O³), and particulate matter (PM₁₀ and PM_{2.5}) in areas of New Mexico where the respective pollutants are expected to occur at significant levels, such as in and near cities and near coal-fired power plants, mining operations, oil and gas operations, and petroleum refineries. The data collected are compared to the NAAQS and the New Mexico Ambient Air Quality Standards, both of which are health-based standards developed for protection of the general public. *See* NMED Exhibit 29, Ambient Air Monitoring Quality Assurance Project Plan 2020, Section A (“Monitoring QA Plan 2020”).

Ambient air data collected by the Bureau is submitted to EPA for inclusion in the Air Quality System (“AQS”) and is used to determine compliance with state and federal air quality regulations. Also submitted to AQS are quality assurance data showing precision and accuracy comparisons, which are used for compiling statistics on data quality.

The majority of data collected by the Bureau is obtained continuously by automated methods. This data describes the current air quality conditions in New Mexico and is disseminated to the public. The Bureau’s ozone and fine particulate matter data is also submitted automatically every hour to the EPA’s AirNow program, which publishes maps of pollutant concentrations for the country. The Bureau also makes air pollutant data available via its Air Quality Index and Monitoring Data Website.² Information on this site includes the pollutant concentration values and Air Quality Indices that provide a common scale for comparison and interpretation of air quality. Also included are maps and locations of the

² Available at: <https://www.nmaqinow.net/>

1 various monitoring sites.

2 **Equipment Used to Monitor Ozone Pollution**

3 The Bureau currently utilizes the Thermo Fisher Model 49i Ultra-Violet Photometric
4 Ozone Analyzer (“Model 49i”) to monitor ozone. Model 49i is designated by EPA as a Federal
5 Equivalent Method (“FEM”) for the measurement of ambient concentrations of ozone pursuant
6 with the federal regulations at Title 40, Part 53. A FEM is an EPA approved method to determine
7 the concentration of air pollutants and is required by EPA. EPA developed standard monitoring
8 and calculation methods such as the FEM to ensure consistency at monitoring stations and how
9 pollutant concentrations are determined across states. Equipment utilized to maintain the
10 calibration of the 49i ozone analyzer are a Thermo 146i Dynamic Gas Calibrator and a Thermo
11 49iQPS Ozone Primary Standard. Calibrations are required by EPA to ensure that the ambient
12 pollutant data is accurate by verifying the analyzer is operating within manufacturer
13 specifications. The ozone analyzer and the calibrators are operated according to manufacturer
14 specifications and Bureau Standard Operating Procedures (“SOPs”).

15 **Monitoring of Ambient Ozone Levels**

16 The Thermo 49i ozone analyzer calculates the ambient air concentration of ozone at a
17 monitoring station by counting the molecules of ozone that are present as they pass by an
18 ultraviolet (UV) lamp inside the analyzer over a defined period of time. The calculated ozone
19 concentration is then reported to the station datalogger computer and is available on the Bureau’s
20 Air Quality Index and Monitoring Data website for public review.

21 **Auditing and Calibration Requirements of Ozone Monitors**

22 Weekly calibration checks, referred to by the Bureau as “QC checks,” are performed by
23 the in-station data logger computer and calibration systems. The Bureau evaluates the results of

1 the QC checks as part of the data validation process. Results are reported to EPA through the
2 AQS. Station operators perform unscheduled calibrations of the ozone analyzer whenever the
3 results of a scheduled calibration check exceed the thresholds specified in 40 CFR part 58. SOPs
4 have been adopted by the Bureau for the operation/calibration of the 49i, 49iQPS, and 146i
5 equipment. These SOP's are followed by all operations staff to maintain uniform practices and
6 quality control at each of the AQB ambient air monitoring stations.

Brent A. Ellington

Cellular (505)690-0624

brent.ellington1@state.nm.us

EDUCATION

Eastern New Mexico University, Portales NM
Bachelor of Science - May 2002
Major: Biology Minor: Chemistry

Eastern New Mexico University-Roswell, Roswell, NM
Associate of Arts - December 1997

RESEARCH EXPERIENCE

Undergraduate Research, 1/01- 5/02

Eastern New Mexico University

Project: Multiple Antibiotic Resistant (MAR) Enteric Bacteria from Dairy Farm Topsoil. Bacteria collected from the dairy farms were identified genotypically as well as phenotypically. MICs were determined by antibiotic resistance assays. The presence of the MAR operon in the enteric bacteria was determined by PCR and gel electrophoresis.

EMPLOYMENT EXPERIENCE

Environmental Scientist/Specialist Supervisor-Laboratory Manager 09/18 – Present
New Mexico Environment Department-Air Quality Bureau

Responsibilities: Supervise Northern NM operations staff in order to provide the NMED AQB with accurate and complete air monitoring data in accordance with Title 40 Code of Federal Regulations Parts 50 and 58. Coordinate special projects in support of NMED and AQB State and Federal initiatives. Perform the duties of an AQB operator in order to maintain a high level of data capture within the statewide ambient air monitoring network. Train operations staff in State /Federal methodologies relative to National Ambient Air Quality Standards and evaluate operations staff performance. Maintain a working knowledge of the theory of operation for Thermo 42i, 43i, and 49i continuous pollutant gas monitors, calibration equipment, and BAM1020, TEOM, and Partisol samplers.

Water Resource Specialist Senior-Field Coordinator and Well Field Operations Manager 4/15 – 09/18

New Mexico Interstate Stream Commission-Pecos River Bureau

Responsibilities: Assist in oversight of operation of the ISC Pecos River augmentation well fields, including well field equipment installation, operation, maintenance, repair and replacement; gathering of water use data from totalizing meters, ensuring proper implementation of operations agreement and plans with private entities. Develop work plans and work budgets and present to the commission for approval. Maintain professional contracts within a fiscal year by processing and approving invoicing for payment. Assist in the development and protection of ISC water rights designated to meet the requirements of the Pecos River Decree, Carlsbad Irrigation District Settlement Agreement, and state law. Research and observe the configuration and use of water

rights to determine the potential impacts on ISC programs. Gather, compile and disseminate stream flow data through downloading of stream gage data loggers and perform field measurement of live stream flow and electrical conductivity for water quality analysis. Work with federal and state agencies related to biological opinions of endangered aquatic species in order to comply with Endangered Species Act requirements. Serve as point of contact in the Lower Pecos River area for local, state, and federal agencies providing field and technical assistance as needed. Conduct public meetings as required. Develop and implement Health and Safety Program for field operations. Coordinate training of staff and contractors to comply with OSHA 1910 and ANSI requirements. Maintain OSHA certificate as competent person for confined space entry programs as well as electrical hazard and lock out tag out certifications.

Adjunct Instructor of Biology/Geology, 06/04- Present

Eastern New Mexico University-Roswell

Responsibilities: Conduct lecture and laboratory courses in an online and on-campus setting in the subjects of Biology, Wildlife Biology, Geology, and Environmental Geology at ENMU-R. Instruction includes fall, spring and summer semesters.

Environmental Scientist/Specialist Supervisor 8/13 – 4/15

New Mexico Environment Department-Air Quality Bureau

Responsibilities: Supervise Southern NM operations staff in order to provide the NMED AQB with accurate and complete air monitoring data in accordance with Title 40 Code of Federal Regulations Parts 50 and 58. Coordinate special projects in support of NMED and AQB State and Federal initiatives. Perform the duties of an AQB operator in order to maintain a high level of data capture within the statewide ambient air monitoring network. Train operations staff in State /Federal methodologies relative to National Ambient Air Quality Standards and evaluate operations staff performance. Maintain a working knowledge of the theory of operation for Thermo 42i, 43i, and 49i continuous pollutant gas monitors, calibration equipment, and BAM1020, TEOM, and Partisol samplers.

Environmental Scientist/Specialist Operational 8/11 – 08/13

New Mexico Environment Department-Air Quality Bureau

Responsibilities: Operate, calibrate and maintain continuous pollutant gas and particulate monitors. Operate, collect filters, calibrate and maintain Partisol Plus PM 2.5 and Wedge PM 10 particulate samplers. Monitor and maintain operational status of automated data logger and calibration systems at multiple ambient air monitoring sites. Maintain multiple software and hardware systems as they relate to the continuous operation and function of ambient air quality gas and particulate monitors. Maintain an uninterrupted annual air quality sampling schedule at multiple sites in SE NM.

Probation/Parole Officer, 04/10- 8/11

New Mexico Department of Corrections

Responsibilities: Supervise caseload of 120 felony offenders. Ensure public safety by conducting arrests of said felons for violations of State Statutes and court orders, prepare court documents and testify in District and Magistrate Court.

Certified New Mexico State Police Officer, 08/09- 04/10

New Mexico State Police

Responsibilities: Conduct patrols for public safety in rural and municipal areas. General duties of a certified police officer to include enforcement of State Statutes, apprehension and arrest of criminal offenders and attend judicial/court proceedings as required.

Roswell Artesian Basin Supervisor, 3/07 – 8/09

Office of the State Engineer District II, Roswell, NM

Responsibilities: Perform duties of water resource specialist listed below. In addition to those duties, responsible for coordinating all applications for permit that pertain to the Roswell Artesian Basin consisting of 11,000 square miles in southeast NM.

Water Resource Specialist, 6/03- 8/09

Office of the State Engineer District II, Roswell, NM

Responsibilities: Administration of NMSA 1978 Chapter 72: Water Law. Assist public in research of water rights information; in addition to performing the same duties as technician. Conduct investigations into water right applications as submitted by individuals to the OSE District II for approval. Investigations include hydrogeologic analyses and review of effects on groundwater and surface sources within the jurisdiction of District II. Process all relevant documents with each water right investigation. Maintain proficiency in the use of GIS technology and associated hardware and software in hydrogeologic analyses of water right applications submitted to the OSE District II.

Water Resource Technician, 9/02- 06/03

Office of the State Engineer District II, Roswell, NM

Responsibilities: Compile and interpret water right permits and well logs; enter data into the Water Administration Technical Engineering Resource System. Research/abstract water right files, adjudication and associated maps. Work independently in an office environment with occasional fieldwork. Fieldwork includes identifying well locations using GIS and measuring well depths.

PUBLICATIONS

Burgos, J., Ellington, B.A., Varela, M.F. *Presence of Multidrug-Resistant Enteric Bacteria in Dairy Farm Topsoil.* Journal of Dairy Science. 2005 88: 1391-1398.

ABSTRACTS

Burgos, J., Ellington, B.A., Varela, M.F. (2002). *Multiple Antibiotic Resistant (MAR) Enteric Bacteria from Dairy Topsoil.* Rio Grande ASM Conference 2/02.

COMPUTER SKILLS

Flow Tracker stream gaging, EQuis Database, programming and operation of Sutron dataloggers, programming and operation of Danfoss Variable Frequency Drives (480V, 3 phase) for groundwater well turbine pump operation. W.A.T.E.R.S., I.W.A.T.E.R.S, NMWRRS, Arc Map, Arc View, GPS Pathfinder, Trimble XM/XT unit, Microsoft Office Suite, Envista, Comet, RPCOMM, pcAnywhere, VNC-viewer, TUS BioPac; HP Infrared Spectroscopy software and associated hardware. HNMR/C¹⁴NMR software and associated hardware. Foss120 infrared spectrophotometer and associated software.

Quality Assurance Project Plan

For

Ambient Air Monitoring

March 2020

State of New Mexico Environment Department

Air Quality Bureau

Quality Assurance and Ambient Air Monitoring Sections

525 Camino de los Marquez

Suite 1

Santa Fe, New Mexico 87505

(505) 476-4300

EPA Region 6 QTRAK # _____

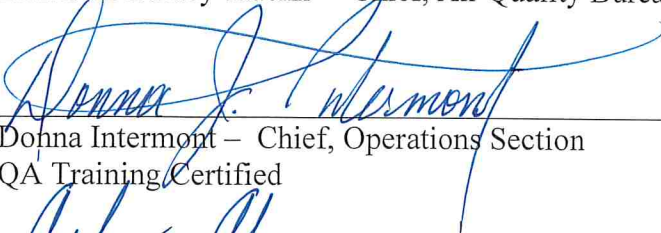
Quality Assurance Project Plan

For Ambient Air Monitoring

Approval Signatures

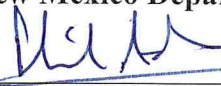
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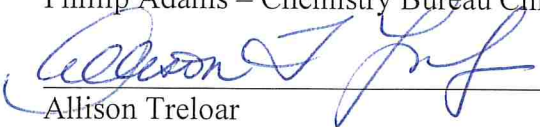

Elizabeth Bisbey-Kuehn – Chief, Air Quality Bureau
2/7/20
Date


Donna Intermont – Chief, Operations Section
QA Training Certified
02/05/2020
Date


Andrew Ahr – Manager, Quality Assurance
2/5/2020
Date

New Mexico Department of Health, Scientific Laboratory Division Signatures:


Phillip Adams – Chemistry Bureau Chief
1/27/2020
Date


Allison Treloar
– Director, Office of Quality, Safety, Security
And Emergency Preparedness
28 Jan 2020
Date


Frank See – Supervisor, Air and Heavy Metals Section
1-27-2020
Date

Environmental Protection Agency - Region 6 Signatures

EPA Region 6 Program Officer
Date

EPA Region 6 Technical Reviewer
Date

EPA Region 6 QTRAK # _____

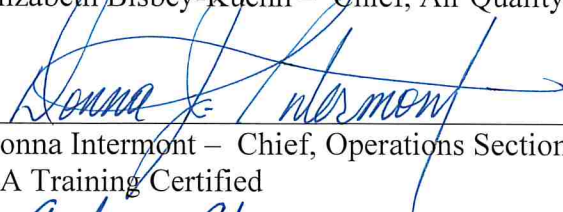
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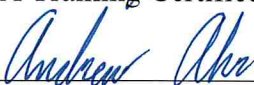
For Ambient Air Monitoring

Approval Signatures

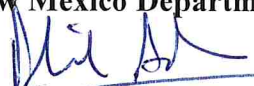
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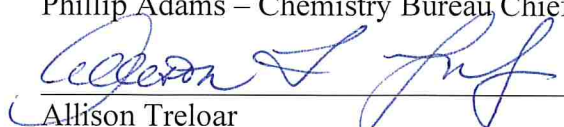

Elizabeth Bisbey-Kuehn – Chief, Air Quality Bureau
Date 2/7/20

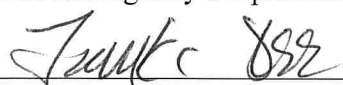

Donna Intermont – Chief, Operations Section
QA Training Certified
Date 02/05/20


Andrew Ahr – Manager, Quality Assurance
Date 2/5/2020

New Mexico Department of Health, Scientific Laboratory Division Signatures:


Phillip Adams – Chemistry Bureau Chief
Date 1/27/2020


Allison Treloar
– Director, Office of Quality, Safety, Security
And Emergency Preparedness
Date 28 Jan 2020


Frank See – Supervisor, Air and Heavy Metals Section
Date 1/27/2020

Environmental Protection Agency - Region 6 Signatures

EPA Region 6 Program Officer
Date

EPA Region 6 Technical Reviewer
Date

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History of This Document

From October 2003 to October 2004, and continuing to the present with upgrades, the Air Quality Bureau (AQB) has worked on automating its ambient air and meteorological monitoring systems, and using data acquisition software (“DAS”). The automation was applied to both the operational processes at the monitoring stations and the management of ambient air and meteorological data collected at these stations.

The Ambient Air Monitoring Quality Assurance Project Plan submittal was revised in 2018 to conform with the standardized elements set forth in EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5) (EPA/240/B-01-003 March 2001).

A3: Distribution List

The individuals listed below will receive copies of this approved Quality Assurance Project Plan. Supervisory staff of the Air Quality Bureau Ambient Air Monitoring Section will distribute or make available all appropriate sections of the plan to all staff responsible for implementation. The document is also available electronically to all staff within the Air Quality Bureau by its storage within the Bureau's shared file system.

Name	Position	Organization
Donna Intermont	Operations Section Chief	NMED AQB
Andrew Ahr	Staff Manager, Quality Assurance Unit	NMED AQB
Mary Hilbert	QA Data Handling Specialist	NMED AQB
Ryan Maxfield	QA Auditor	NMED AQB
Vacant	QA Auditor	NMED AQB
Roman Szkoda	Staff Manager, Ambient Air Monitoring Unit	NMED AQB
Brent Ellington	Supervisor, Ambient Air Monitoring Unit	NMED AQB
Michaela Lane-Sanchez	Supervisor, Ambient Air Monitoring Unit	NMED AQB
Phillip Adams	Chemistry Bureau Chief	NM DOH, Scientific Laboratory Division
Allison Treloar	Director, Office of Quality, Safety, Security and Emergency Preparedness	NM DOH, Scientific Laboratory Division
Frank See	Supervisor Air & Heavy Metals	NM DOH, Scientific Laboratory Division
Mariama Mitchell	Project Officer	EPA Region 6, Air, State and Tribal Operations Section

Table A3: Distribution List

A4: PROJECT/TASK ORGANIZATION

The structure of the Air Quality Bureau's Quality Assurance and Ambient Air Monitoring Units is shown in Figure A4.1. A current personnel roster for the two sections is given in Table A4.1.

A. Air Quality Bureau

The Air Quality Bureau is part of the New Mexico Environment Department's Environmental Protection Division, one of four divisions within the Department. The Bureau is composed of four major Sections: Planning, Compliance and Enforcement, Permitting and Operations. The Air Quality Bureau Chief is responsible for overseeing all activities and personnel within the Bureau. Directly reporting to the Bureau Chief are the Section Chiefs who are in charge of the four major Sections in the Bureau.

B. Operations Section

The Operations Section Chief is responsible for overseeing all activities and personnel within the Operations Section, which includes managing the operations of the administrative staff, the statewide air quality monitoring network, the quality assurance of monitoring data, the invoicing and collection of the Bureau's Permitting fees, and oversees Bureau's budgets and EPA grants.

C. Ambient Air Monitoring Unit

Upon hire and annually thereafter, all Ambient Air Monitoring staff are required to review the current Ambient Air Monitoring QAPP and Appendices, and the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance, and submit a signed statement to the Staff Manager that they have done so. This document is also available electronically to all staff within the Air Quality Bureau by its storage within the Bureau's shared file system.

Monitoring Manager: This is the program manager responsible for overseeing the work performed by the Ambient Air Monitoring Unit. In addition to working with Unit personnel to assign duties and evaluate their performance, specific duties include:

1. Manage monitoring operations so that 75% data capture and other EPA grant conditions are met.
2. Provide or delegate staff to give necessary information to QA staff to assist in evaluating monitor operations and data validation.
3. Prepare or delegate staff to assemble and update SOPs for ambient air monitoring.
4. Develop training schedules to ensure that Unit personnel are provided with up-to-date information concerning their job duties.
5. Create and maintain a monitor replacement schedule to ensure that monitoring equipment is kept technically current.
6. Work with Operations Chief and financial staff to identify resources to meet Unit priorities such as equipment purchase, supplies and contracts for sample analyses.
7. Conduct monitoring network reviews to identify trends, redundancy or special needs to recommend to Operations Section Chief.
8. Oversee special monitoring projects.

9. Prepare yearly Network Review and 5-year Network Assessments according to EPA requirements.

Environmental Scientist & Specialist - Supervisor: The Environmental Scientist & Specialist - Supervisor is responsible for the performance of automated analyzers operated by the Air Quality Bureau. Currently, there are two Supervisors for the respective north and south geographic areas of the state. Specific duties include:

1. Supervise, train, and evaluate the respective northern network site operators and southern network site operators.
2. Install and test new equipment at monitoring sites. Repair sampling equipment when necessary.
3. Set up and operate special purpose monitors as required by Department/Bureau priorities or public health emergencies.
4. Maintain an inventory of spare parts, tools, and supplies required to service continuous and non-continuous analyzers. Distribute these items to operators throughout the state as needed to maintain daily operations and achieve the greatest data capture.
5. Keep informed of data acquisition software upgrades to allow for full utilization of the product and expansion of its functionality. Share this information with site operators.
6. Provide technical information to QA staff as needed for validation of data.
7. Maintain contact with data acquisition system contractor and download data acquisition software upgrades to allow for full utilization of the product and expansion of its functionality. Share this information with site operators.

Site Operators Advanced and Operational: Site operators are based in field offices around the state to run the monitoring sites in their areas. Specific duties include:

1. Oversee operation of all analyzers and all supporting equipment at assigned monitoring sites. Each Monday morning review results of qc checks performed by calibrators on gas monitors by viewing the DAS calibration reports for one's assigned sites. Take action on invalid or out-of-range results.
2. Perform quarterly multipoint calibrations on automated analyzers and calibrators/transfer standards operated by the Air Quality Bureau.
3. Perform manual precision checks, zero/span checks on gas monitors as needed. Perform regularly scheduled flow checks and maintenance on particulate monitors. Make adjustments necessary to maintain instruments within prescribed operational limits.
4. Document in detail in the DAS site log all site visits and instrument repairs, calibrations, and adjustments performed on monitoring equipment and calibrators. This information is used for subsequent repairs and also by QA to document data gaps and monitor malfunctions.
5. Report equipment malfunctions immediately to the supervisor and Monitoring Manager for corrective action.
6. Provide assistance to the Quality Assurance staff as needed for validation of data.

7. Maintain cleanliness and order at assigned monitoring sites. Follow safety rules.
8. Perform monitor repairs as needed.
9. Assist QA Auditor in performing semi-annual audits and repairs as needed on meteorological equipment in the field.
10. Set up and operate special purpose monitors as required by Department/Bureau priorities or public health emergencies.

D. Quality Assurance Unit

Upon hire and annually thereafter, all Quality Assurance Unit staff are required to review the current Ambient Air Monitoring QAPP and Appendices, and the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance, and submit a signed statement to the QA Manager that they have done so.

QA Manager: The Quality Assurance Manager is responsible for coordinating all quality assurance activities. This position does not generate any data. In addition to working with Unit personnel to assign duties and evaluate their performance, specific duties include:

1. Write, update and obtain yearly approval for all Bureau quality assurance documents required by EPA. These documents include the Bureau's Quality Management Plan (QMP) and Quality Assurance Project Plans (QAPPs) for any projects within the Bureau that collect environmental data. For QAPPs dealing with projects outside the Ambient Monitoring Unit, the QA Manager will enlist assistance from staff members directly related to the projects, such as the Emissions Inventory Project and the Four Corners Modeling Project.
2. Write, update, and obtain yearly EPA approval for the Quality Assurance Plan for Ambient Air Monitoring. Maintain updated SOP appendices for monitoring and quality assurance activities and obtain SOPs from SLD (DOH State Laboratory Division) for filter-weighing to determine particulate deposition.
3. Ensure that quality control checks are performed on schedule and that quality control procedures are observed. Confirm that standards and reference materials required for the quality assurance program are certified on schedule.
4. Ensure that Monitor Siting Criteria Audits are conducted periodically throughout the year. Report site criteria deficiencies and provide recommendations to the Operations Section Chief and Monitoring Manager.
5. Investigate training opportunities for the Quality Assurance Unit.
6. Oversee any corrections to the ambient air data including the updating of the in-house DAS database and the EPA/AQS database.
7. Manage quality assurance to ensure that 75% data capture is met. Report instances of data loss to Operations Section Chief who reports instances of data loss to EPA Region 6 Air Quality Analysis Chief.
8. Ensure that hourly data is being submitted to EPA's AIRNOW.

9. Consult with the Operations Section Chief and the Data Handling Specialist to review and officially certify to EPA the Ambient Monitoring Data for previous year by May 1 of the following year. Official certification includes AQS AMP600 report, AMP450NC report, and an official letter sent to both Region 6 and OAQPS.

QA Auditor: The QA Auditor performs accuracy audits on ambient air monitoring instruments using independent and separate equipment and gases; performs semi-annual audits on meteorological equipment and annual audits on federal siting criteria. Specific duties include:

1. Conduct accuracy audits on ambient air pollution monitors in accordance with federal requirements and an auditing schedule that ensures that all gas monitors are audited annually and particulate monitors audited semi-annually according to EPA requirements. Monitors showing extreme problems or requiring in-depth repairs will be audited more frequently. It is NMED's intention to perform audits on instruments to be removed and on replacement instruments within a week of each action. If a problem with an instrument indicates that it needs to be replaced/repaired, then an audit shall be conducted within a week on the failing unit before it is removed and an audit within a week on the replacement instrument once it is installed.
2. Work with Monitoring Manager to evaluate and document air pollution monitoring sites to ensure that EPA guidelines are followed and federal siting criteria are met by conducting siting criteria audits annually and upon request.
3. Coordinate, schedule and perform semiannual field audits of meteorological monitoring equipment with the assistance of field operators.
4. Assist site operators in understanding and performing quality control procedures as necessary to ensure high quality data results.
5. At the time of meteorological audits, update the site Digi Modems (if applicable) modems with latest Preferred Roaming List (PRL). Also update site computer with latest version of DAS.
6. Develop, maintain, and/or update QA SOPs as needed.
7. Document in detail in the DAS site log all site visits and any operations performed on monitoring equipment or auxiliary equipment.
8. Assist Data Handling Specialist with review of questionable data.
9. Maintain all local primary standards used by the Bureau keeping them in excellent working condition.
10. Certify transfer standards on schedule.
11. Keep track of and order gas cylinders as needed.
12. Maintain records of all certifications and verifications.
13. Perform acceptance tests on new equipment.
14. Order needed replacement parts for the meteorological audits and various other items.

Data Handling Specialist: The Data Handling Specialist is responsible for processing and verifying all ambient air data generated by the Air Quality Bureau. Specific duties include:

1. Collect, review and edit continuous ambient air data through the entire process from raw data through submittal to AIRS/AQS.
2. Retrieve all non-continuous particulate data from SLD and perform calculations on blanks and particulate concentrations. Load non-continuous particulate data into the DAS database. Format and report these data to EPA/AQS.
3. Provide feedback to field operators and the Scientific Laboratory Division concerning problems or changes in data collection matters.
4. Report precision and accuracy results to EPA/AQS. Retrieve precision results from DAS calibration reports and format them through DR-DAS Reporter. Enter accuracy results on spreadsheet provided by AQS and report these results to AQS.
5. With assistance of QA Auditor, validate all meteorological data.
6. Assist the QA Manager in filling data requests and preparing reports.
7. Flag data appropriately to reflect Exceptional Events situations. See Appendix F: Exceptional Events Flow Chart.
8. Ensure that hourly data is being submitted and backfill data if a system has gone offline.

Figure A4.1: New Mexico Environment Department Air Quality Bureau (Simplified)

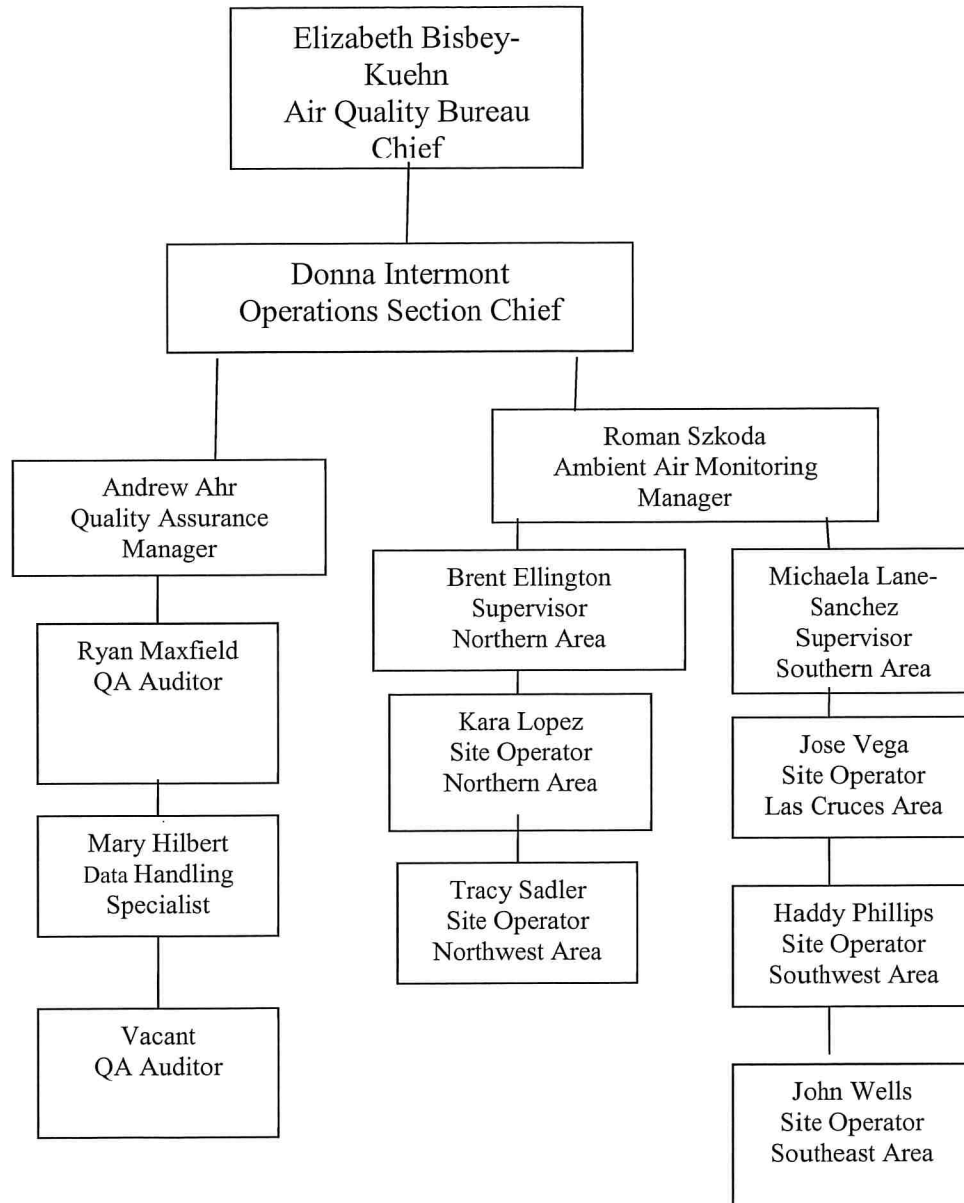


Table A4.1 - List of Persons Filling Monitoring & QA Positions

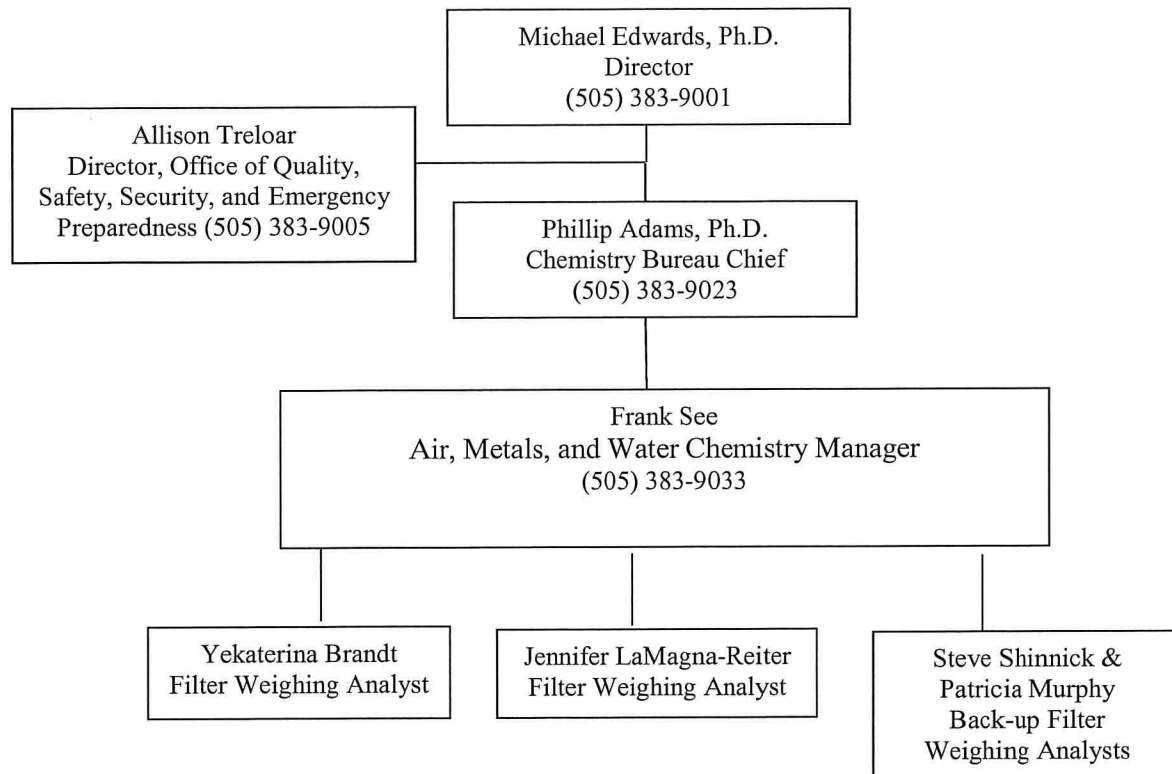
Name	Title	Section	Location	Phone Number
Donna Intermont	Section Chief	Operations	Santa Fe	505.476.4348
Roman Szkoda	Staff Manager	Monitoring	Santa Fe	505.476.4316
Brent Ellington	Supervisor	Monitoring	Santa Fe	505.827.9685
Kara Lopez	Site Operator	Monitoring	Santa Fe	505.827.0032
Tracy Sadler	Site Operator	Monitoring	Farmington	505.566.9747
Michaela Lane-Sanchez	Supervisor	Monitoring	Las Cruces	575.915.1106
Haddy Phillips	Site Operator	Monitoring	Silver City	575.388.1934
Joey Vega	Site Operator	Monitoring	Las Cruces	575.915.1085
John Wells	Site Operator	Monitoring	Roswell	575.624.6046
Andrew Ahr	Staff Manager	Quality Assurance	Santa Fe	505.476.4314
Mary Hilbert	Data Handling Specialist	Quality Assurance	Santa Fe	505.476.4320
Vacant	QA Auditor	Quality Assurance	Santa Fe	505.827.0133
Ryan Maxfield	QA Auditor	Quality Assurance	Las Cruces	575.915.1104

C. Scientific Laboratory Division Organization

The Air Quality Bureau uses the analytical services of the Chemistry Bureau of the Scientific Laboratory Division (SLD) of the New Mexico Department of Health located in Albuquerque, New Mexico. A basic organizational chart of the Scientific Laboratory Division is illustrated in Figure A4.2. The Chemistry Bureau is divided into six sections; the Air and Heavy Metals Section is the only section that provides services to the Air Quality Bureau. It prepares and weighs particulate PM₁₀ and PM_{2.5} filters before and after sampling.

Appendix B to this QAPP contains detailed descriptions of the procedures used by SLD in weighing the particulate filters.

Figure A4.2: New Mexico Department of Health Scientific Laboratory Division (Simplified)



A5: PROBLEM DEFINITION

The Air Quality Bureau (AQB) of the New Mexico Environment Department (NMED) is responsible for collecting ambient air data to document present air quality and significant trends in pollutant concentrations. This data must be of high quality because its use may have significant health, social, and economic impacts. The data collected is used to determine the State's status with regard to compliance with National Ambient Air Quality Standards (NAAQS) designed to protect the public health and avoid secondary effects such as damage to vegetation or property, or the reduction of public values such as visibility. The AQB's public awareness programs are designed to provide current air quality information to the public.

New Mexico consists of eight Air Quality Control Regions (AQCRs) located in 33 counties covering a total area of 120,000 square miles (Figure A6.1). Three of these AQCRs are shared with surrounding states, and five are completely within New Mexico.

The NMED/AQB network consists of State and Local Air Monitoring Stations (SLAMS) and Special Purpose Monitors (SPMs). The purpose of the network is to support the National Ambient Air Quality Standards (NAAQS). It is designed to:

- determine highest concentrations expected to occur in the area covered by the network
- determine representative concentrations in areas of high population density
- determine the impact on ambient pollution levels of significant sources or source categories
- determine general background concentration levels.

Based on United States Census estimates for 2018, the population of New Mexico is about 2.09 million. Approximately 679,701, or 32.4%, of these people reside in Bernalillo County. The Albuquerque Environmental Health Department is a separate reporting agency responsible for air programs within Bernalillo County. The Air Quality Bureau is responsible for monitoring ambient air quality in all other counties of New Mexico. The three next population-dense counties within the State are Doña Ana County with 10.4% of the State's total population, Santa Fe County with 7.2% of the State's total population, and Sandoval County with 6.9% of the State's total population.

The Air Quality Bureau monitors sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), and particulate matter (PM₁₀ and PM_{2.5}) in areas of New Mexico where the respective pollutants are expected to occur at significant levels, e.g. in and near cities, near coal-fired power plants, mining operations, and petroleum refineries. As designated by the US Environmental Protection Agency (EPA), the Bureau operates SLAMS. The data collected are compared to the NAAQS and the New Mexico Ambient Air Quality Standards (NMAAQS). These health-based standards were developed for protection of the general public.

Ambient air data collected by the State is submitted to the EPA for inclusion in the Air Quality System (AQS) and is used to determine compliance with state and federal air quality regulations. Also submitted to AQS are quality assurance data showing precision and accuracy comparisons, which are used for compiling statistics on data quality.

The majority of data collected by AQB is obtained continuously by automated methods. This data describes the current air quality conditions in New Mexico and is disseminated to the public. AQB's ozone and fine particulate data is also submitted automatically every hour to the EPA's AirNow program that publishes pollution maps for these pollutants. The AQB also makes pollution data available via AQB's Air Quality Index and Monitoring Data Website (<http://nmaqinow.net/>). Information on this site includes the concentration values and Air Quality Indices that provide a common scale for comparison and interpretation of air quality. Also included are maps and locations of the various monitoring sites.

To evaluate sites for continuation, relocation or termination, the Bureau performs an annual review of the network. The document is submitted to the EPA and the results of the review are conveyed to NMED. The Bureau considers federal requirements, federal recommendations, changes in nearby sources, changes in demographics, and expressed public interest or concern.

The five-year assessment of the ambient air monitoring network submitted to the EPA by NMED provides an opportunity to evaluate the network and the monitoring data at each location, consider emerging monitoring needs and consider changes to the network, as well as recommend special projects that would provide useful information to NMED.

A6: PROJECT/TASK DESCRIPTION

The overall purpose of the Bureau's Quality Assurance Unit is to ensure both the scientific and legal integrity of all ambient air data collected by the State. The purpose of this Quality Assurance Project Plan (QAPP) is to document the procedures of the AQB's Ambient Air Monitoring and Quality Assurance Units in obtaining quality data for this air quality monitoring project. This QAPP documents the specific responsibilities, activities and procedures employed by the Bureau. This plan complies with EPA's QA requirements (EPA QA/R-5 EPA/240/B-01/003).

All measurements reported to the EPA are considered critical and so all procedures used are approved EPA reference or equivalent methods. The specific equipment and methods are listed in Section B of this QAPP. Because of the importance of these measurements, the entire project, technical methods for monitoring, sample collection and analysis and data management are reviewed and audited on a regular basis as described in Section B5: Quality Control and Section D1: Data Review Validation, and Verification Requirements and Methods.

The monitoring described in this project plan is designed to directly support regulatory and policy decisions. As such it is considered to be a Use Category I project. The EPA, the State of New Mexico and the public are the customers for this project.

The NMED/AQB air monitoring network is comprised of eight air quality control regions (AQCRs). These regions are noted in Table A6.1 below.

New Mexico AQCR	EPA Region	Counties in AQCR	Monitors in AQCR
1	014	San Juan	1H; 1NL; 1ZB
2	152	Sandoval; Valencia	2LL; 2ZJ
3	157	Santa Fe; Taos; Rio Arriba	3SFA; 3ZD; 3CRD
4	154	San Miguel, Mora, Colfax, Union, Harding; Torrance	None
5	155	Eddy; Lea	5ZR; 5ZS
6	153	Doña Ana	6CM; 6O; 6Q; 6WM; 6ZK; 6ZL; 6ZM; 6ZN; 6ZQ
7	012	Luna	7E
8	156	Socorro, Catron, Cibola	None

Table A6.1: Air Quality Control Regions

Depending on the site, parameters monitored are ozone, sulfur dioxide, nitrogen dioxide, PM₁₀, and PM_{2.5}. The continuous monitoring sites also monitor meteorological data. Pertinent site information can be found in Appendix C: Network Elements Spreadsheet. Maps of these areas and their respective sites are found in Figures A6.1, A6.2 and A6.3. The public can retrieve hourly data from the continuous sites at the following site: <http://nmaqinow.net/>

The five-year assessment of the NMED ambient air quality network was submitted to the EPA on October 8, 2015. Appendix C: Network Element Spreadsheet contains detailed descriptions of each site, and an evaluation of the data collected at each site.

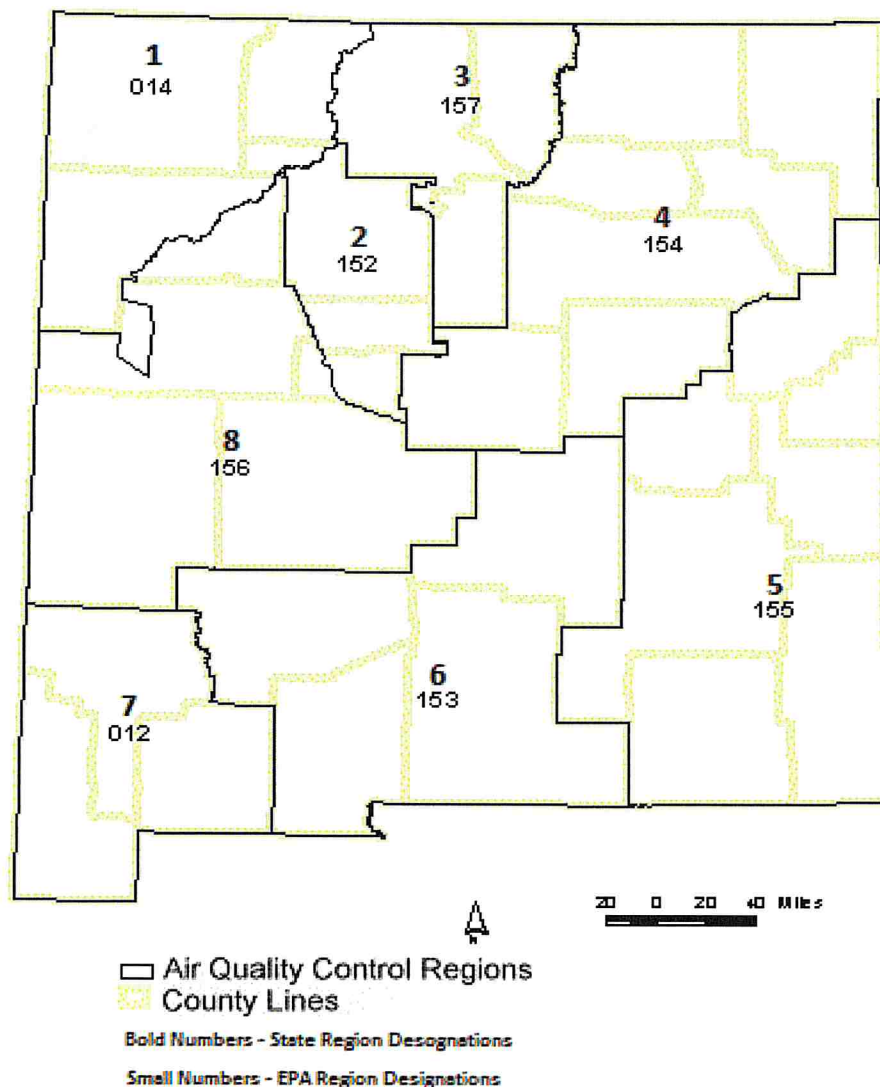


Figure A6.1: Air Quality Control Regions in New Mexico

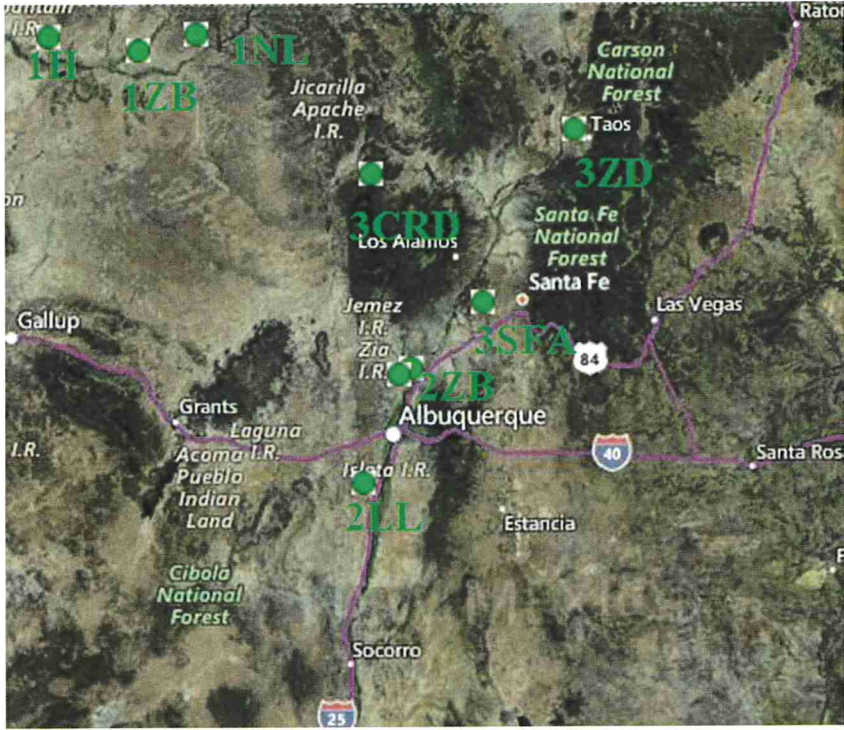


Figure A6.2: NMED Northern Sampling Sites



Figure A6.3: NMED Southern Sampling Sites

Code	Site Name	Code	Site Name	Code	Site Name
1H	San Juan Substation	3ZD	Taos Fire Station	6ZK	Chaparral
1NL	Navajo Lake	5ZR	Carlsbad	6ZL	Holman Road
1ZB	Bloomfield	5ZS	Hobbs Jefferson	6ZM	Desert View
2LL	Los Lunas	6CM	Anthony	6ZN	Santa Teresa
2ZJ	Bernalillo	6O	La Union	6ZQ	Solano Road
3CRD	Coyote Ranger District	6Q	Las Cruces ED	7E	Deming Airport
3SFA	Santa Fe Airport	6WM	West Mesa		

Table A6.2: Monitoring Site Codes

The NMED network of SLAMS and SPMs meets the six general site types put forth in 40 CFR Part 58, Appendix D 1.1.1:

- a. The monitoring locations are appropriately sited to determine highest concentrations expected to occur. See Appendix C: Network Elements Spreadsheet.
- b. The existing network includes monitors in the areas of high population density: Doña Ana, Santa Fe, and Sandoval Counties.
- c. The monitors in the network are sited to determine the impact on ambient pollution levels of significant sources and source categories, in particular, those in San Juan County, a region of concentrated energy development and generation.
- d. The network includes sites that adequately measure general background concentrations, including sites in San Juan County and the sites of Carlsbad, La Union, and Santa Teresa.
- e. The current network is capturing data that enables NMED to determine the extent of regional pollutant transport among populated areas. The Navajo Lake site serves this purpose for transport between San Juan County and Southwestern Colorado. The monitoring objective of the Coyote Ranger District site is to determine regional ozone transport. The monitoring objective of the Las Cruces site is to determine regional PM_{2.5} transport.
- f. Data gathered from the current network of monitoring sites can be used to determine welfare-related impacts in rural and remote areas. Data from the network is being used by citizen groups in both the Four Corners Region and the Border Region of New Mexico/US and Mexico.

A7: Quality Objectives and Criteria

It is the intention of the Air Quality Bureau to provide accurate, complete, representative, and comparable air pollution monitoring data to accomplish the following specific objectives:

1. Ensure that New Mexico and Federal Air Quality Standards are met.
2. Detect sources that may cause violations of National Ambient Air Quality Standards.

3. Establish background concentrations for criteria pollutants.
4. Evaluate air pollution trends in order to project impacts and make judgments on land use planning, industrial growth, transportation planning, population growth, and to develop future Air Quality Control Regulations.

The Air Quality Bureau expects to maintain air monitoring instruments in such a manner as to attain 95% probability goals for accuracy and precision within the EPA required limits. The Air Quality Bureau adheres to the Measurement Quality Objectives and Validation Templates as published in Appendix D of the EPA QA Handbook for Air Pollution Measurement Systems, Vol. II (EPA-454/B-17-001) January 2017.

A data capture rate of over 75% is expected. Typically, AQB data capture rates are in the 90% range. For representativeness, only EPA approved methods and procedures are used to collect and evaluate ambient air monitoring data. For comparability, all parameters will be reported in standard units (e.g. $\mu\text{g}/\text{m}^3$, ppm, etc.) and EPA recommended formats.

When the Bureau detects sources that may cause exceedances of NAAQS, the QA staff review logs, meteorological data and data on the performance of the specific monitors to ensure that the data is reliable. The QA staff confers with staff in Policy and Planning. Sometimes special studies are performed to gather more information, for example, the Paso del Norte particulate monitoring study in Dona Ana County conducted in 2009.

To ensure that Federal Air Quality standards are met, the Bureau works with local and regional groups, for example, the U.S.-Mexico Border Joint Advisory Committee in Dona Ana County and the Four Corners Air Quality Task Force in San Juan County.

New Mexico has standards for ambient air quality (20.2.3. NMAC, see below, hereinafter referred to as "NMAAQs"). NMAAQs are used for air quality permitting purposes, and differ from NAAQS as follows:

- The size of total suspended particulates is not differentiated in NMAAQs as it is in NAAQS (PM_{10} and $\text{PM}_{2.5}$).
- NMAAQs has 24-hour and annual averages for sulfur dioxide, while NAAQS has 1- and 3-hour.
- NMAAQs has standards for hydrogen sulfide and total reduced sulfur, while NQAAS has none.
- NMAAQs has 8-hour and 1-hour averages for carbon monoxide as 8.7 ppm and 13.1 ppm respectively, while NAAQS are 9ppm and 35 ppm.
- NMAAQs has 24-hour and annual arithmetic averages for nitrogen dioxide as 0.10 ppm and 0.05 ppm respectively. NAAQS are 100 ppb and 53 ppb for 1-hour and 1-year averaging times.

Below is an excerpt from Title 20, "Environmental Protection", of the New Mexico Administrative Code regarding the NMAAQs.

20.2.3.108 PREAMBLE: Ambient Air Quality Standards are not intended to provide a sharp dividing line between air of satisfactory quality and air of unsatisfactory quality. They are, however, numbers which represent objectives that will preserve our air resources. It is understood that at certain times, due to unusual meteorological conditions, these standards may be exceeded for short periods of time without the addition of specific pollutants into the atmosphere. The adoption of these statewide ambient air quality standards does not prohibit the promulgation of standards for specific areas, functions, and conditions within the state such as air sheds, municipalities, and certain counties, as authorized under the Act. As scientific data accumulates on the effects of a contaminant, these standards may be revised or additional standards added.

[11/30/95; 20.2.3.108 NMAC - Rn, 20 NMAC 2.3.108 10/31/02]

20.2.3.109 TOTAL SUSPENDED PARTICULATES: The maximum allowable concentrations of total suspended particulate in the ambient air are as follows:

- A. 24-hour average: 150 ug/m3;
- B. 7-day average: 110 ug/m3;
- C. 30-day average: 90 ug/m3;
- D. Annual geometric mean: 60 ug/m3.

[11/30/95; 20.2.3.109 NMAC - Rn, 20 NMAC 2.3.109 10/31/02]

20.2.3.110 SULFUR COMPOUNDS: The maximum allowable concentrations of the following sulfur-containing air contaminants in the ambient air are as follows:

- A. Sulfur Dioxide:
 - (1) For the state except on the area within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley:
 - (a) 24-hour average: 0.10 ppm;
 - (b) Annual arithmetic average: 0.02 ppm;
 - (2) For the area within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley:
 - (a) 24-hour average, not be exceeded more than once per year: 0.14 ppm;
 - (b) 3-hour average, not to be exceeded more than once per year: 0.50 ppm;
 - (c) Annual arithmetic average: 0.03 ppm.
- B. Hydrogen Sulfide:
 - (1) For the state, except the Pecos-Permian Basin Intrastate Air Quality Control Region (1-hour average, not to be exceeded more than once per year): 0.010 ppm;
 - (2) For the Pecos-Permian Basin Intrastate Air Quality Control Region (1/2 hour average): 0.100 ppm;
 - (3) For within corporate limits of municipalities within the Pecos-Permian Basin Intrastate Air Quality Control Region (1/2 hour average): 0.030 ppm;
 - (4) For within five miles of the corporate limits of municipalities having a population of greater than twenty thousand and within the Pecos-Permian Basin Intrastate Air Quality Control Region (1/2 hour average): 0.030 ppm.
- C. Total Reduced Sulfur:
 - (1) For the state, except the Pecos-Permian Basin Intrastate Air Quality Control Region except for hydrogen sulfide (1/2 hour average): 0.003 ppm;
 - (2) For the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide (1/2 hour average): 0.010 ppm;
 - (3) For within corporate limits of municipalities within the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide (1/2 hour average): 0.003 ppm;

(4) For within five miles of the corporate limits of municipalities having a population of greater than twenty thousand and within the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide (1/2 hour average): 0.003 ppm.

[11/30/95; 20.2.3.110 NMAC - Rn, 20 NMAC 2.3.110 10/31/02]

20.2.3.111 OTHER AIR CONTAMINANTS: The maximum allowable concentrations of the following air contaminants in the ambient air are as follows:

- A. Carbon Monoxide:
 - (1) 8-hour average: 8.7 ppm;
 - (2) 1-hour average: 13.1 ppm;
- B. Nitrogen Dioxide:
 - (1) 24-hour average: 0.10 ppm;
 - (2) Annual arithmetic average: 0.05 ppm.

A8: Special Training/Certification

All staff working with monitoring and data collection are hired through the New Mexico State Personnel Office (SPO). The SPO positions of staff involved with this project are Natural Science Manager and Environmental Scientist & Specialist (Operational, Advanced, and Supervisor). The distinguishing characteristics of the Technical Occupation Group are found in Appendix A: New Mexico Personnel Board Technical Occupation Group Descriptors for Environmental Scientists and Specialists, Including Health, which list minimum education and experience qualifications for all employees who can be considered for these positions. It is the responsibility of the State Personnel Office to screen applicants for the minimum qualifications.

In addition to the formal schooling required to obtain air quality positions, all staff are required to review and adhere to the Air Quality Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. The manual is updated as equipment is added to or removed from the network, and as procedures are refined. A list of the Standard Operating Procedures currently in the Manual is attached hereto as Appendix G.

New staff receive on-the-job training from co-workers. They are supervised in sampling, monitor audits and data collection and review until they can perform these tasks independently.

All staff may attend any applicable courses presented by EPA's Air Pollution Training Institute. They also attend conferences and workshops sponsored by the EPA, NMED, Air and Waste Management Association, WESTAR, and other groups. Vendors of equipment used by the QA and Monitors staff provide specialized training. With supervisor approval, any staff member is encouraged to take pertinent courses that are presented by local academic institutions. Computer systems training is encouraged due to the many automated procedures in use to collect, review, and report the data.

There is no special certification required for these positions; however, the Operations Section Chief and Quality Assurance Manager, who will certify the data, review and revise the QMP and QAPP, must have the proper training. The QMP and QAPP training certificates can be

found in Appendix E. New QA Manager, Andrew Ahr, will receive QMP and QAPP training in 2020.

A9: Documents and Records

All data is submitted to EPA's national database, the Air Quality System (AQS), after validation. The validation path and procedures are described more fully in Section D2. The procedures for documents and records are listed in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. The formatting for these submittals is prescribed by AQS and accomplished through the DAS Reporter software.

Details of operation of the continuous monitors and manual samplers at all of the sites are documented by the operators in the electronic logbook within the DAS application. The operator or auditor may access the electronic logbook through the site computer or remotely using a laptop. The electronic logbook is accessed through the DAS "Operational" menu option. In the "Log Book" tab, "Add" is selected to enter information, or "Report" is selected to review entries at a site for a designated time period.



Figure A9.1: DAS Menu for Entering and Reviewing Log Book Notes

The site operator can choose "Log Book - Add" and enter information in the "Generic List" box. The operator selects the appropriate instrument selection (e.g., NO₂ or O₃) from the drop down list, and enters his or her name, the type of visit (i.e. scheduled weekly, monthly), and details of the visit in the space provided. Log notes include dates and times of all calibrations, precision and accuracy audits as well as details of unusual operation or repair. The log notes are saved before exiting or starting a second set of log notes.

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Figure A9.2: Example of DAS Log Book Report

Staff can access log book events by selecting “Report” and entering site information. Figure A9.2 shows a Report of entries made concerning a monitoring site.

The DAS maintains a record of all automatic precision and zero/span checks, referred to as qc checks, which are performed on the continuous gas monitors every Sunday. Qc check reports are used to review validity of data produced by each gas monitor. Operators may perform additional qc checks to check on a monitor at other times. These results are also maintained in the DAS.

Monitor calibrations on both gaseous and particulate matter continuous monitors are performed quarterly by the site operators. The dates and times of these calibrations are noted in the electronic log. The actual concentrations are entered on an Excel spreadsheet for calculating results. QA auditors record dates, times and general results of accuracy audits in the electronic log, and use a separate Excel spreadsheet to calculate the audit results. Both the monitor calibrations and the accuracy audits made available to the Data Handling Specialist, who verifies associated data. The Data Handling Specialist enters the audit results into AQS.

Filter tapes used by the BAM-1020 particulate matter monitors are discarded after use, as there is no federal requirement to archive or retain the filter tapes from continuous FEM monitors.

For manual samplers, SLD provides an AQ Analytical Request and Chain of Custody Form (see Figure A9.3) for each filter sent to the site operator for the specific manual sampling equipment. User Code 55600 indicates a PM₁₀ sample filter, and Use Code 55625 indicates a PM_{2.5} sample filter. Submitter Code 304 identifies NMED-AQB. The User Site ID, the Alpha-Numeric code assigned to the monitoring location, is also entered by SLD.

After the filters have collected the particulate samples, original field records are annotated by the site operators with the sample collection time and priority. In the Sample Priority section, operators enter “3” to indicate a normal priority. The Field Remarks section is used by the site

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operator to note any voided filters due to equipment issues or power failures, conditions at the site, or problems such as flows or temperatures. This is important information that after analysis may deem a sample filter as void per determination by the SLD, Data Handling Specialist or QA Manager. The field records are sent to the SLD as hard-copy forms along with the exposed filters. Copies of the completed Chain of Custody forms are sent to the QA Manager by SLD monthly. The QA Manager reviews the forms for notations regarding the filters that may warrant further review by the Data Handling Specialist or QA Manager. This Standard Operating Procedure for Chain of Custody Forms is in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

NEW MEXICO DEPARTMENT OF HEALTH		AQ ANALYTICAL REQUEST FORM		SLD Accession #	
User Code: _____	LAB use >> only	Date/time <<receipt @ SR	Sample Priority: _____	If 1 or 2 call SLD	
Submitter Code: _____	User Site ID: _____	Sample Temp Receipt @ SLD _____ °C			
Submitter Name: _____					
Submitter Address: _____		County: _____	City: _____	State: _____	
Sampling Location: _____					
Sample Collection: On: ____ / ____ / ____ By: _____		Last Name: _____			
At: ____ : ____ 24 Hr Clock		First Name: _____			
Sample Info Phone: _____		If not collector, please print name: _____			
Contact: _____					
Sample Type: _____		Filter #: _____			
		Magazine #: _____			
PM Fraction: Please check the appropriate box below to indicate fraction					
☐ PM 10 ☐ PM 2.5					
Field Remarks: _____					
AQ Use Only - Sample Run Date: _____		Average Ambient Temp. (24 hr): _____		Thermometer Reset Temp: _____	
SLD Chain-Of-Custody Form					
Please use this CHAIN OF CUSTODY FORM to show transfer to the SLD Sample Receiving Section					
		Present & Intact	Not Present	Present & Damaged	
The sample identified on the container, and this form, was collected at the date and time shown in the form fields above, and by the sampler listed above, and was transferred with a tamper-proof seal.		☐	☐	☐	
By (print): _____ Signed: _____					
The sample identified on the container and this form was accepted either at the DATE / TIME STAMP shown in the top center of this form, or at the date and time entered below (by the non-lab person below), and with a tamper-proof seal.		☐	☐	☐	
By (print): _____ Signed: _____ Date: _____ Time: _____					
The sample identified on the container and this form was accepted either at the DATE / TIME STAMP shown in the top center of this form, or at the date and time entered below (by the person listed below), and with a tamper-proof seal		☐	☐	☐	
By (print): _____ Signed: _____ Date: _____ Time: _____					

Authorized on: 02-May-2019. Authorized by: Twila Kunde. Document Unique Reference: view_only. Due for review on: 02-May-2020

SLD Form 107-v1:2

Figure A9.3: AQ Analytical Request and Chain of Custody Form

The SLD maintains data in a secure LabWare LIMS data base, and extracts data in crystal reports from the LIMS and exports them to a spreadsheet for AQB's use. AQB's Data Handling Specialist employs a macro that brings the SLD's initial and final weights into AQB's Excel spreadsheet for the calculation of particulate concentrations. The results are uploaded from Excel to the main DAS database.

After weighing, the 47-mm filters are archived at SLD. In accordance with 40 CFR 58.16(f), SLD archives all sample filters in the laboratory for a minimum of five years. The archiving period includes cold storage of the filters after post-sampling laboratory analyses for at least twelve months.

AQB's main DAS database contains monitoring data as well as electronic logbook and qc check data for access, review and retention. Ten years of data are retained in the DAS database.

B Data Generation and Acquisition

B1: Sampling Process Design

The monitoring performed in this project is to determine ambient concentrations of criteria air pollutants. These air pollutants have been determined to be injurious to the health and welfare of the public, and ambient standards have been established on the state and federal levels. The National and New Mexico Ambient Air Quality Standards have been developed to protect the public from excessive exposure. The design of the project follows strict federal guidance as found in 40 CFR Part 58 and the *Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air Quality Monitoring Program* (EPA-454/B-17-001) ("QA Handbook").

Data from the monitors in the AQB network are used to determine attainment status defined in the Federal Clean Air Act. Because of the importance of the results of the monitoring, only EPA Reference and Equivalent Methods are reported to AQS. Sampling time intervals, 1-hour for continuous monitors and 24-hour for non-continuous monitors, are used to generate data that relate to the time period of the applicable standards.

Note: Values for ambient air quality standards are collected to the decimal precision in which the standard is promulgated plus one decimal place. Measurement values are truncated to the level of precision of the standard for reporting purposes.

The network has been designed to monitor suspected pollutants in areas where they may be reasonably expected to occur at relatively high levels. Financial and logistical constraints may limit the number of actual locations. The Air Quality Bureau prefers to locate monitors on public properties in order to assure continued permission to operate. New monitoring sites are established in several stages: identifying a possible air quality problem or responding to public concern, finding and evaluating potential sampling sites, and selecting the best site. Among the criteria used to select sites are monitoring objectives, location of the highest expected concentration, and the availability of power, space, and security specified in 40 CFR Part 58, Appendix D, the siting regulations set forth in 40 CFR Part 58, Appendix E, and relevant EPA guidance. The Ambient Air Monitoring Program Manager collaborates with other Operations Section staff, the Operations Section Chief and the Air Quality Bureau Chief to determine locations of new monitoring sites when needed.

All procedures are described in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance and are based on guidelines obtained from EPA, including the QA Handbook.

All automated instruments are housed in clean, insulated, and air-conditioned shelters. All manual analyzers are inherently weatherproof.

B2: Sampling Methods

To ensure that air quality measurements are made with methods proven to be accurate and reliable, only EPA reference or equivalent methods for collection and analysis are used. Criteria used to select monitoring instruments are price, noise, drift, linearity, accuracy and long-term reliability. All equipment is prepared in accordance with manufacturer's instructions. The continuous monitors analyze samples immediately so there is no relevant sample preservation or custody issues. For non-continuous monitors, the sampling methods are discussed in the in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. Table B2 below lists the current monitoring instrumentation employed in this network and the respective sampling methods utilized.

Pollutant	Manufacturer	Model	Principle	EPA Method Code	Method Type
SO ₂	Thermo Fisher	43i	Pulsed Fluorescence	060	FEM
SO ₂	Thermo Fisher	43i	Pulsed Fluorescence	009	FEM
NO ₂	Thermo Fisher	42i	Chemiluminescence	074	FRM
O ₃	Thermo Fisher	49i	UV Photometry	047	FEM
PM ₁₀	Thermo Fisher Partisol	2025i	Low Volume, Size Selective Inlet	127	FRM
PM ₁₀	MET One BAM	1020	Beta Attenuation	122	FEM
PM _{2.5}	Thermo Fisher Partisol	2025i	Low Volume, Size Selective Inlet	145	FRM
PM _{2.5}	MET One BAM	1020	Beta Attenuation	170	FEM

Table B2: Current Monitoring Instrumentation and EPA Methods

B3: Sample Handling and Custody

Continuous Monitors (Electronic Data)

The software for data acquisition and control ("DAS") is installed on a PC set up at each station except stations with only meteorological sensors. The DAS communicates over serial communications lines to obtain data. A Moxa 4 or 8 serial port PCI expansion card is added to each PC to expand the total serial port count on the PC to 6 or 10 as needed. DAS units communicate serially with the existing Campbell Scientific data loggers at the station.

Meteorological sensor signals and analog outputs from analyzers are connected to the Campbell units. For newer analyzers with their own serial ports the DAS will interface serially to obtain data and diagnostics. Elimination of digital-to-analog and analog-to digital circuits with serial communications improves the quality of the measurements by reducing signal conversion errors.

Campbell Scientific CR1000 data loggers are installed at each site where continuous monitors are employed and maintain their own local data storage buffers.

Each DAS data logger in the system is programmed to record sensor inputs from the Campbell data loggers every second and process each signal to form 5, 15, and 60-minute averages. Serial interfaces to analyzers are programmed to sample the analyzer every 15 seconds.

The DAS offers comprehensive in-station support and communications options. All configuration and remote access functions are password-protected. Analyzer status conditions are monitored and the data flagged if the analyzer is reporting a fault. In-station and central location reports allow review of all analyzer status changes. Manual flagging of data can also be performed. Operators can toggle data channels to OFF, and OFF SCAN modes. OFF SCAN continues to report the data values but flags the data. OFF channels do not report values. If a monitor is removed from the station the channel is set to OFF. For maintenance and other quality checks not otherwise tracked by the system the channel is set to OFF SCAN. If the operator were to accidentally fail to return the channel to ON the data can always be recovered by just editing the status flag. Remote access via modem to the station PC allows an oversight such as this to be quickly corrected.

The DAS interfaces serially to the on-site calibrator. The calibrators may be controlled serially or via digital control lines. Calibration control sequences can flag data with zero, span and 5 other span level flags corresponding to the desired dilution levels.

The station data is collected hourly from all stations. Polling PCs running the CommServ communications program are located in Santa Fe. The DAS data loggers hold 10 years of historical data with automatic data recovery in the event communications with a site is interrupted for a period. An operator can also copy data sets to files for upload to the central database by QA staff.

The data collection process writes the data for all the stations to the Department's Oracle Server. Data values and status as initially collected and as edited are stored in separate data tables for each station. These are referred to as the Raw and Standard data tables. The DAS data logger collects and stores the results of automated Zero, Span, and Precision Checks as well as station faults.

Manual Monitors (Filter Based)

Site operators collect filters from non-continuous particulate samplers in the field on a 3-day schedule for PM_{2.5} and a 6-day schedule for PM₁₀. The actual days in the schedules are prescribed by EPA and uniform across the country, so that measurements may be comparable across regions. Special schedules such as every-day sampling may be put into place for problematic areas.

The New Mexico State Scientific Laboratory Division (SLD) provides an AQ Analytical Request and Chain of Custody Form (see Figure A9.3) for each filter sent to the site operator for

the specific manual sampling equipment. User Code 55600 indicates a PM₁₀ sample filter, and User Code 55625 indicates a PM_{2.5} sample filter. Submitter Code 304 identifies NMED-AQB. The User Site ID, the Alpha-Numeric code assigned to the monitoring location, is also entered by SLD. In the Sample Priority section, operators enter “3” to indicate a normal priority.

After the filters have collected the particulate samples, original field records are annotated by the site operators with the sample collection time and priority. The Field Remarks section is used by the site operator to note any voided filters due to equipment issues or power failures, conditions at the site, or problems such as flows or temperatures. This is important information that after analysis may deem a sample filter as void per determination by the SLD, Data Handling Specialist or QA Manager.

The field records are sent to the SLD as hard-copy forms along with the exposed filters. in suitable shipping containers via United Parcel Service. The filters are weighed at the SLD to determine particulate concentrations.

Copies of the completed Chain of Custody forms are sent to the QA Manager by SLD monthly. The QA Manager reviews the forms for notations regarding the filters that may warrant further review by the Data Handling Specialist or QA Manager. The Standard Operating Procedure for Chain of Custody Forms is in the Bureau’s Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

B4: Analytical Methods

The analytical methods employed by the ambient air monitors used in this project may be found in Table B.2: Current Monitoring Instrumentation and EPA Methods.

B5: Quality Control

A. Automated Gas Analyzers

Weekly zero/span/precision checks, referred to by the Air Quality Bureau as qc checks, are performed by the in-station data logger and calibration systems. At stations with other gas analyzer combinations, a gas dilution calibrator and zero air supply are used in conjunction with the station data logger to conduct the qc checks. Except for Ozone, the equipment used for these checks is the same equipment as used for calibrations. Qc check results are available in tabular form as a report from the DAS. The Air Quality Bureau evaluates the results of the qc checks as part of the data validation process. Results for precision points are reported to EPA through AQS, where they are used to calculate precision statistics.

The operators perform unscheduled, confirmatory zero/span/precision checks whenever the results of a scheduled zero/span/precision check exceed the thresholds as set forth in Table B5.

QC Check Measurement	Adjust Monitor if Value is greater than:
Zero Drift	± 2 ppb
Span Drift	$\pm 5\%$ of actual span concentration
Precision Point	$\pm 5\%$ of actual precision concentration

Table B5: AQB QC Check Thresholds Requiring Adjustment

Appendix D of the EPA QA Handbook includes precision and zero and span drift criteria for analyzer adjustments, recalibrations and data invalidation. The Air Quality Bureau follows this guidance.

Monitors are adjusted and a subsequent zero/span check is run after any minor maintenance that might affect the calibration. These zero/span checks are initiated on demand from the automated station data logger, and may also be initiated remotely.

B. Continuous Particulate Monitors (BAM 1020s)

Site operators perform monthly precision flow checks on these monitors using Alicat mass flow meters. Per the manufacturer's recommendation as well as seasonal changes, the site operator performs a BAM 1020 quarterly check to ensure proper flow and operating parameters, such as temperature and pressure. The check performed in the second quarter is recorded as the annual check to conform with the QA Handbook requirements. The results of these precision checks are to determine the quality of monitor operation, and are uploaded to the AQS database.

The QA auditor performs semi-annual accuracy audits on these monitors, auditing the flow, temperature and pressure using instruments dedicated to QA.

C. Manual Particulate Analyzers (Partisols)

Operators perform monthly checks on these instruments. A monthly check consists of a flow audit against a mass flow meter, leak checks, verification of the ambient temperature, filter temperature, filter compartment temperature, and pressure. Annual multi-point flow, temperature and pressure calibrations are also performed, in accordance with the QA Handbook. The results of these precision checks are to determine the quality of monitor operation, and are uploaded to the AQS database.

The QA auditor performs semi-annual accuracy audits on these monitors, auditing the flow, temperature and pressure with instruments dedicated to QA.

D. Corrective Action

When a problem is identified, either during a precision check, accuracy audit, or daily observation of data, the Site Operator is usually the first in line to attempt analysis of the problem. Upon initial failure of any one-point flow or temperature verification failure, Site Operators are directed to trouble shoot and recheck the equipment before calibrating in order to minimize the number of calibrations.

When further information is needed, the Instrumentation Specialist, QA Auditor, or manufacturer might be consulted, and the site operator can review previously completed Corrective Action Reports (CARs) on same or similar instruments as a learning device. The completed CARs can be accessed by the Site Operators and/or QA Auditors in a common folder. The QA Auditors always inform the Site Operator, Instrumentation Specialist, and Monitoring Manager of any problems found. The QA Manager and Data Handling Specialist review problems resulting in data falling outside of acceptance criteria as set forth in the QA Handbook Volume II, Appendix D to decide whether it is appropriate to invalidate or qualify accompanying data. If deletion of data is necessary due to a problem that falls outside of our routine procedures and preventative maintenance schedules, a CAR will be completed. CARs are generally not used unless the problem resulted in data invalidation or qualification greater than 120 hours. The procedure for Corrective Action Reports is fully outlined in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

Quality assurance statistics are calculated both in-house and in the AQS database and are relied upon for performance determinations.

B6: Instrument/Equipment Testing, Inspection and Maintenance

All analyzers in the field are inspected on the routine site visits by site operators and before their quarterly calibrations. Additionally, the Data Handling Specialist will notify the Site Operator or Environmental Specialist Supervisor in the event of suspicious monitor output. The Site Operators test, adjust and clean monitors as a part of the calibration procedure.

The purpose of preventive maintenance is to increase system reliability, increase data completeness, and minimize analyzer down time. Spare parts inventory of the items most likely to fail are maintained for all analyzers and support equipment. Preventive maintenance procedures and frequencies correspond to those recommended by each instrument manufacturer. All routine preventive maintenance is performed at each individual monitoring site and takes place quarterly unless a prior problem is detected. Maintenance for manual analyzers takes place as needed. All Scientific Laboratory Division instruments used for analysis are on a maintenance contract, which includes both corrective and preventive maintenance.

Details of maintenance requirements and procedures for each type of equipment may be found in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

It is Bureau policy to have one backup monitor of each type available at all times in case of monitor failure. This obviates the necessity of maintaining a large inventory of spare parts.

AQB site operators use the DAS software program's electronic log book to record air monitoring operations. The electronic log book is used to document maintenance, calibrations, and repair of equipment. The electronic log book entries are available for viewing by all Monitoring or QA staff members on the DAS reports.

B7: Instrument/Equipment Calibration and Frequency

All calibrations are performed following the procedures and acceptance criteria of the EPA *QA Handbook for Air Pollution Measurement Systems, Vol. II (EPA-454/B-17-001)* ("QA Handbook").

A. Monitoring Equipment

Continuous Gas Monitors

Calibrations are performed on continuous gas monitors quarterly and following major repairs. A calibration is defined as the introduction of reference concentrations to a monitor and comparison with the response of the monitor to determine if the monitor response is linear. Calibration may involve adjustment as necessary to achieve linearity. A calibration sequence includes a zero, span and four additional reference concentrations.

During calibration, the analyzer is operated in the normal sampling mode. Test gases pass through all filters, scrubbers, conditioners, and other components of the normal sampling system.

A gas monitor is considered linear if the concentration response of all points is $< + 2.1 \%$ or $< +1.5$ ppb difference of best-fit straight line whichever is greater and Slope $1 + .05$, per QA Handbook Volume II, Appendix D.

In accordance with the QA Handbook Appendix D, acceptance criteria for the certification/verification of a transfer standard is the relative standard deviation (RSD) of six slopes $\leq 3.7\%$; and standard deviation of 6 intercepts ≤ 1.5 . In accordance with the QA Handbook Volume II, Appendix D, acceptance criteria for the recertification/reverification of a transfer standard is that the new slope is within ± 0.05 of the previous; and the relative standard deviation of six slopes $\leq 3.7\%$; and standard deviation of 6 intercepts ≤ 1.5 .

Calibration equipment used for continuous monitors consists of API and Thermo Fisher brand gas dilution calibrators and ozone transfer standards permanently installed at each site. The performance of the calibration is coordinated through the station DAS data logger. The following methods are used for station calibrations:

<u>Pollutant</u>	<u>Method</u>
SO ₂	Dynamic dilution of a gas standard (NIST traceable SO ₂ or SO ₂ /NO blended gas)
NO ₂	Gas-phase titration of NO and O ₃ (NIST traceable NO or SO ₂ /NO blended gas)
O ₃	Ultraviolet photometry using either the station calibrator or a separate O ₃ transfer standard

Table B7.1: List of Field Calibration Methods

Particulate Monitors

Calibrations are performed on continuous particulate monitors at least twice a year and following major repairs.

Calibrations of non-continuous particulate monitors are performed at least yearly or after any maintenance that could affect flow rate, or after the results of a flow rate check indicate a difference greater than $\pm 4.1\%$ between sampler calibrations as specified in the QA Handbook Volume II and the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. Quality Assurance Auditors conduct independent audits on a semiannual basis.

Details on calibrations of each type of particulate sampler are in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

B. Verification of Audit Equipment and Station Calibration Equipment

Equipment used to conduct accuracy audits and calibrations is subject to verification requirements. Accuracy audit equipment is generically referred to as transfer standards. These are verified on a fixed schedule against local primary standards. The transfer standards used by the Bureau are given in Table B7.2 along with verification intervals and superior standards against which they are verified. Acceptance ranges for all transfer standards conform with the QA Handbook or, if not specified in the QA Handbook, the recommendation of the transfer standard's manufacturer.

Standard	Parameter	Interval	Verified Against
Thermo Fisher 49iPS (Level 2)	O ₃	1 year	EPA's Transfer Standard
Thermo Fisher 49iPS (Level 3)	O ₃	6 months	Thermo Fisher 49iPS (Level 2)

Thermo Fisher 49iQPS (Level 3)	O ₃	6 months	Thermo Fisher 49iPS (Level 2)
API T703/703E	O ₃	6 months	Thermo Fisher 49iPS
API T700 Photometer	O ₃	Quarterly	Thermo Fisher 49iPS and 49iQPS
API T700 Gas Calibrator	Gas flows	Quarterly	Alicat Flow Meter
Thermo Fisher 146i Calibrator	Gas flows	Quarterly	Alicat Flow Meter
Thermo Fisher 146iQ Calibrator	Gas flows	Quarterly	Alicat Flow Meter
Alicat Flow Meter	Gas and air flows	1 year	Fluke Calibration molbloc-L and molbox+1
Fluke Calibration molbloc and molbox (NIST traceable)	Gas and air flows	1 year	Fluke Calibration
Druck DPI 800	Pressure	1 year	Fluke Calibration molbloc-L and molbox+1
Digi-Sense Thermistor Thermometer, NIST-Traceable Calibration	Temperature	1 year	Fluke Temperature Calibration Bath
Fluke Temperature Calibration Bath (NIST-Traceable)	Thermistor Thermometer	1 year	Fluke Calibration

Table B7.2: Transfer Standards

When necessary, gas cylinders are verified according to procedures outlined in EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (EPA-600/R93/224, Revised September 1993). However, this is not done as standard practice. Cylinders that are out of certification are returned to vendor for re-certification or replacement.

Verification audit procedures are detailed in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

C. Scientific Laboratory Division

Particulate filter weighing is done at the Scientific Laboratory Division (SLD) in Albuquerque. The procedures followed by the SLD are detailed in Appendix B.

B8: Inspection/Acceptance of Supplies and Consumables

Filters, analyzers, calibration gases and monitoring equipment are ordered in accordance with State purchasing rules with exact specifications relating to minimum performance, quality, and acceptable tolerances. The QA Auditor assigned to the QA Lab and the Monitoring Unit Staff Manager order and receive the supplies. Included in the monitoring supplies ordered by AQB are filters for Met One BAM particulate monitors. Filter tapes for the BAM-1020 samplers are of the glass fiber type and used for both PM₁₀ and PM_{2.5} monitoring. The BAM-1020 does not contain filters that require pre-weighing by a laboratory since the particulate is indirectly weighed within the monitor. The procedures for inspection and acceptance of supplies and consumables are detailed in are in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

Filters for non-continuous particulate measurements are provided by EPA. EPA provides 47mm Teflon filters for Partisols, which are used for both PM₁₀ and PM_{2.5} monitoring. The Teflon filters undergo acceptance inspections regarding consistent thickness and weight at EPA's RTP laboratories, and are sent to the New Mexico Health Department Scientific Laboratory Division (SLD). There, a laboratory staff member checks in the filters, visually inspects them, and weighs each filter using procedures set forth in Appendix B: Gravimetric Analysis of 47mm Air Filters – AHM Method 41710.

Calibration gases purchased by the Bureau are certified by the vendor and are NIST-traceable. The QA Auditor assigned to the QA Lab distributes cylinder gases to monitoring sites in the most efficient manner in order not to have gases existing in the cylinder longer than the period of valid certification. In cases where the period of certification has expired and a substantial amount of gas is still in the cylinder, the cylinders may be returned to the manufacturer for a re-certification of the gas.

When new analyzers are received, they are unpacked and checked for loose fittings, loose electrical connections, and damage during shipment. The instruments are then assembled and acceptance-tested by the QA Auditor assigned to the QA Lab and Monitoring Staff Manager before use at a monitoring site.

C Assessment and Oversight

C1: Assessments and Response Actions

A. Internal Audits

1. Continuous Monitors

Quality Assurance Auditors perform accuracy audits using a calibrator and transfer standard reserved for exclusive QA use. 40 CFR Part 58, Appendix A 3.1.2.1(a), identifies ten audit levels for each gaseous pollutant:

“3.1.2.1 The evaluation is made by challenging the monitor with audit gas standards of known concentration from at least three audit levels. One point must be within two to three times the method detection limit of the instruments within the PQAOs network, the second point will be less than or equal to the 99th percentile of the data at the site or the network of sites in the PQAQ or the next highest audit concentration level. The third point can be around the primary NAAQS or the highest 3-year concentration at the site or the network of sites in the PQAQ. An additional 4th level is encouraged for those agencies that would like to confirm the monitors' linearity at the higher end of the operational range. ...”

Accuracy audits on gas monitors are performed by challenging each analyzer with known concentration from the selected ranges as listed in Table C1. The analyzer's response is observed using either the station's DAS data logger or directly reading from the monitor.

Audit level	O3 Range, ppm	Range Selected	SO2 Range, ppm	Range Selected	NO2 Range, ppm	Range Selected
Zero						
1	0.004-0.0059		0.00030-0.0029	X	0.0003-0.0029	
2	0.006-0.019	X	0.0030-0.0049		0.0030-0.0049	X
3	0.020-0.039	X	0.0050-0.0079	X	0.0050-0.0079	X
4	0.040-0.069	X	0.0080-0.0199	X	0.0080-0.0199	X
5	0.070-0.089	X	0.0200-0.0499	X	0.0200-0.0499	X
6	0.090-0.119	X	0.0500-0.0999	X	0.0500-0.0999	X
7	0.120-0.139	X	0.1000-0.1499		0.1000-0.2999	X
8	0.140-0.169		0.1500-0.2599		0.3000-0.4999	
9	0.170-0.189		0.2600-0.7999		0.5000-0.7999	
10	0.190-0.259		0.8000-1.000		0.8000-1.000	

Table C1 - Concentration Ranges for Accuracy Audits in PPM

Audits are performed on one-fourth of the gaseous analyzers for each gaseous criteria pollutant each quarter, or at a minimum at least once per year.

The results of these audits are used to identify problems or inconsistencies within the monitoring network. If a certain monitor has significantly different responses to the auditing equipment of the Quality Assurance Auditor and the Site Operator, it points to either monitor malfunction or a possible problem with the calibration of auditing equipment or standards. The auditor or operator notifies the Environment Scientist & Specialist - Supervisor and or Monitoring Operator responsible for the site to discuss additional investigation, re-calibrations or other appropriate actions.

The QA Auditors perform semiannual audits concerning flow, temperature, and pressure on the BAM analyzers. Only the flow audit, which is performed with an Alicat mass flow meter, is reported to EPA.

For Met One BAM 1020 accuracy audits, the QA Auditor begins with an external leak check. If a leak is discovered, the audit is aborted and the site operator is notified immediately. If the leak check passes, the audit continues with a comparison of the flow of the Met One BAM 1020 monitors to the reading on the Alicat flow meter. The Met One BAM 1020's design flow rate is 16.67 liters/minute. Comparisons of the flow rates are submitted to EPA as the accuracy audit for these monitors. Criteria for the comparison of actual flow rates with transfer standard flow rates are $\pm 4.1\%$, consistent with the QA Handbook Appendix D. When these criteria are not met, the auditor or operator notifies the Site Operator and Monitoring Supervisor responsible for the site to discuss appropriate actions.

2. Manual Analyzers

Partisol (PM_{2.5} and PM₁₀)

The QA Auditors perform semiannual audits on flow, temperature, and pressure on the Partisol analyzers. Only the flow audit, which is performed with an Alicat mass flow meter, is reported to EPA.

The QA Auditor does accuracy audits of flow rates on a semiannual basis for each PM_{2.5} and PM₁₀ sampler in the system. These comparisons are reported to EPA as the accuracy audit.

Site operators do similar flow checks once a month on each sampler. The results are used for validation of data and as a check on the calibration. The results of these flow checks are submitted to EPA through AQS.

Precision for particulate samplers is estimated from duplicate samples collected by co-located pairs of samplers. Each sampler in a co-located pair is calibrated, operated and audited identically. During calibrations, flow checks, and audits of each of these samplers, the other sampler is left running to mimic actual operating conditions. The pair of samplers is sited such that they are at least 1 meter but no more than 4 meters apart, in accordance with the requirements set forth at 40 CFR 58, Appendix A, 3.2.3.4(c). At each co-location site, one sampler is designated

as the primary sampler, and the other is designated as the duplicate sampler. The exposed filters from each member of the pair are processed identically and the relative differences incorporated into the quarterly precision and accuracy report.

B. Systems Audit

Once every three years or as EPA budget allows, the Air Quality Bureau undergoes a systems audit performed by staff from the EPA Region 6 Office in Dallas, Texas. EPA evaluates the entire ambient air monitoring program against the systems audit criteria listed in the EPA QA Handbook Volume II.

C. National Performance Audit Program and Performance Evaluation Program

The Air Quality Bureau participates to the maximum extent possible in the National Performance Audit Program (NPAP) and Performance Evaluation Program (PEP), both sponsored by the EPA. Currently, NPAP TTP (through the probe) audits are performed on gaseous monitors by a contractor with the EPA. The same contractor performs audits on the particulate monitors. The PEP is a quality assurance activity which will be used to evaluate measurement system bias of the PM_{2.5} monitoring network. The goal is to audit 20% of the network each year. Scheduling of the audits is managed by EPA Region 6.

D. Other Assessments

1. A Corrective Action Report (CAR) will be filled out any time a problem has been discovered at any monitoring site and that falls outside of our routine procedures and preventative maintenance schedules and results in data loss or qualification of 120 hours or greater, or 2 or more filters. The reports are intended to be used as a tracking, documenting, and learning device for internal review. The internal procedures for Corrective Action Reports are in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. Each CAR is identified and tracked with a unique identifying number. It contains a standard set of questions and will capture specific details about each situation. The person most directly tied to the situation will fill out the CAR within five business days of discovering the problem and it will be filled out as completely as possible. The CAR will be reviewed and approved by the direct supervisor, Monitoring Manager, QA Data Handling Specialist, QA Manager, with final approval given by the Operations Section Chief. Once a CAR has been completed, it will be filed in a central location retrievable by the QA and Monitoring staff. In addition, it may be presented at internal section meetings to serve as a learning tool for coworkers. These reports are retained for a minimum of three years.

2. Many of the assessments are informal. For example, the result of each accuracy audit is distributed with the QA and Monitoring Units. Informal peer reviews take place regularly among the QA staff.

E. Reconciliation with Data Quality Objectives

Detailed procedures of the statistical equations and procedures as they relate to the collection of valid ambient air data are found in 40 CFR Part 58, Appendix A. These procedures are followed in order to assess precision, accuracy and completeness of the collected data. Often the solution to poor precision and accuracy results is repair and replacement of aging and failing monitoring and calibration equipment. Resources available are allocated to remedy the problems identified in the QA process.

C2: Reports to Management

The primary method of informing management of current monitoring performance and results is through data reports retrievable from both DAS and AQS. After quarterly data is uploaded to AQS, a variety of reports may be obtained. Standard reports of interest are the Quicklook Report, Maximum Values Report, Data Completeness Report, Precision/Accuracy Reporting Organization Summary, and the Air Quality Index (AQI) Report. The AQI Report is currently being used as a Bureau performance measure within the NM Environment Department.

Since October 2004 with the inception of the Data Acquisition System, a variety of reports are available as part of the software. The reports most utilized are:

- Station Reports, which retrieve pollutant data from any of the monitoring sites, obtainable in 5 minute, 1 hour, 8 hour, or 24 hour averages
- Calibration Reports, which show actual and indicated results of weekly quality control tests on the gas monitors performed by an automatic calibrator, referred to internally as “QC Reports”
- Wind Reports, which correlate pollutant concentrations with wind speed and direction, to gain an understanding of origin of pollutants or wind speeds that cause high particulate concentrations
- Edit History Reports, which indicate reasons for any data that has been invalidated such as for monitor malfunctions or change of status flags
- Logbook Reports, which retrieve electronic logbook entries for any of the monitoring sites where operators have made electronic entries on the site computers explaining their work to maintain monitors or perform checks on monitor performance when at the monitoring site

D Data Validation and Usability

D1: Data Review, Verification, and Validation

A. Continuous Monitors

DAS software for data acquisition and control is installed on a PC set up at each station. The DAS communicates over serial communications lines to obtain data from the equipment at the station.

The DAS software offers comprehensive in-station support and communications options. All configuration and remote access functions are password-protected. Analyzer status conditions are monitored and the data is flagged if the analyzer is reporting a fault. In-station and central location reports allow review of all analyzer status changes. Manual flagging of data can also be performed. Site operators can toggle data channels to OFF, and OFF SCAN modes. OFF SCAN continues to report the data values but flags the data. OFF channels do not report values. If a monitor is removed from the station, the channel is set to OFF. For maintenance and other quality checks not otherwise tracked by the system, the channel is set to OFF SCAN. If the operator were to accidentally fail to return the channel to ON the data can always be recovered by just editing the status flag. Remote access via modem to the station PC allows an oversight such as this to be quickly corrected.

DAS interfaces serially to the on-site calibrator. The calibrators may be controlled serially or by digital control lines. Calibration control sequences can flag data with zero, span and 5 other span level flags corresponding to the desired dilution levels.

The station data is collected hourly from all stations. Polling PC running the CommServ communications program from the DAS is located in Santa Fe. Cellular modem connections are utilized. The DAS data loggers hold 10 years of historical data with automatic data recovery in the event communications with a site is interrupted for a period. An operator can also copy data sets to files for update to the central database by QA staff.

The data collection process writes the data for all the stations to the Department's Oracle Server. Data values and status as initially collected and as edited are stored in separate data tables for each station. These are referred to as the Raw and Standard data tables. The DAS data logger collects and stores the results of automated Zero, Span, and Precision Checks as well as station faults.

The data collected is subject to quality review at four levels.

- (1) Station data loggers flag values recorded in the field to indicate that the values are considered invalid. Samples used from 5 minute and hourly values are invalidated when instrument maintenance is being performed. Maintenance includes calibrations. All stations are equipped with DAS data logger software, enabling the service or audit staff to flag any data channel in the logger as Off Scan when maintenance or audits are being performed. A defective instrument is flagged as Off to indicate no data are available. In addition the DAS checks for data samples as being above or below the range of the meteorological sensor are excluded from the averages.
- (2) All data averages collected from the monitoring locations are examined contemporaneously by the data collection software to check for outlier values and values that either change too radically or exhibit too little change. The criteria used are based on manufacturer's recommendation, AQB experience and EPA guidelines.
- (3) The QA staff performs a daily visual review of data. This review is supported by the creation of statistical and graphical data presentations that facilitate and highlight data of interest. Data are invalidated whenever there is verifiable evidence of instrument malfunction or departure from the operating specifications.
- (4) Staff members from any of the sections involved in air quality monitoring may access the standard database records and provide information to the QA Section that may facilitate and/or inform the data validation process.

Validity criteria are implemented within the station logger, QA criteria, daily data review procedures and statistical tests. Whenever data needs to be edited (including validity changes) only the QA Data Handling Specialist or QA Manager may do so. Validity criteria and editing procedures are described in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

Note: If suspicious data are observed by QA Staff, it is reported to the Air Monitoring Manager. The manager shall assign staff to investigate the apparent problem and make repairs as needed. The staff's finding shall be reported to the QA Manager for determination of whether data needs to be adjusted, invalidated, or re-validated.

Data within the database is further reviewed whenever the Data Handling Specialist receives information regarding new maintenance actions that have been performed. These records are examined and compared to data collected and checked from the field to determine if data for the documented maintenance periods were in fact flagged correctly. Any apparent differences are submitted to the QA Manager for review and a decision on what if any edits of the database are warranted.

After editing and all validation procedures have been completed, the data is converted into AQS format using the DAS and uploaded to the EPA AQS database. This is accomplished quarterly.

B. Manual Analyzers

Site operators collect filters from particulate samplers in the field on a 3-day schedule for PM_{2.5} and a 6-day schedule for PM₁₀. The actual days in the schedules are prescribed by EPA and uniform across the country so that measurements may be comparable across regions. Special schedules such as every-day sampling may be put into place for problematic areas.

The filters are enclosed in suitable shipping containers and sent along with the Chain of Custody (COC) forms to the Scientific Laboratory Division (SLD) in Albuquerque via UPS. In accordance with 40 CFR 50, Appendix L at 10.13, to protect the integrity of the sample during transport and storage, the filters are maintained as cool as practical and continuously protected from exposure to temperatures over 25 °C. At the SLD, the filters are weighed for determining particulate concentrations. After the filters have been weighed, the SLD sends copies of the completed COC forms to AQB, where they are reviewed in accordance with the Chain of Custody Forms SOP for completeness and adherence to handling criteria set forth in the QA Handbook Volume II, Appendix D.

SLD tabulates exposed PM₁₀ and PM_{2.5} filter weights in a spreadsheet, which is then sent to the Data Handling Specialist. (See Appendice B for SLD's procedures.) The Data Handling Specialist uses an Excel macro to obtain the particulate weights and insert them into an Excel spreadsheet combined with flow data downloaded from Partisol samplers so that particulate concentrations may be calculated. A second macro is used to format the concentration results so that they may be uploaded to the main database.

Operators maintain Excel spreadsheets for each analyzer with flow data, slopes, and intercepts and make these spreadsheets available to the Data Handling Specialist.

Data uploaded to the database are subjected to the quality review procedures, which are detailed in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. Data passing all quality review checks are uploaded to AQS.

Data review, validation and verification take place at four levels in the data collection and data processing activities. These were discussed previously in Section D1.A. Detailed procedures, requirements and methods for data review, validation and verification are given in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. These sections provide the criteria used within the data collection and management system to conduct automated review and validation.

D2: Verification and Validation Methods

Verification is not automated. Verification consists of confirming that the validity assigned to data is correct. This necessitates independent review of the data, validity criteria and other information to verify that the validity criteria have been properly applied.

A. Continuous Monitors

At the DAS data logger, the values received are subject to quality examinations. As the data is collected, the RAW data values are subjected to random checks. These are detailed in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

The Quality Assurance staff review data daily. Details of this review are presented in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance. QA staff also review the results of the weekly Zero/Span and Precision checks of the continuous gas monitors. General invalidation criteria for each pollutant for these checks are provided in the Quality Assurance Handbook Volume II, Appendix D. These criteria are applied routinely, although decisions on all questions of data editing and invalidation are ultimately the responsibility of the QA Manager.

B. Manual Monitors

The manual monitors in the AQB network measure particulate matter. As described in Section A.9, data from the exposed filters from the manual monitors and Chain of Custody forms are sent to the AQB for analysis. The Chain of Custody forms are reviewed in accordance with the procedure detailed in the Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance.

General validation criteria for particulate matter are provided in the Quality Assurance Handbook Volume II, Appendix D. These criteria are applied routinely, although decisions on all questions of data editing and invalidation are ultimately the responsibility of the QA Manager.

D3: Reconciliation with User Requirements

In the case of ambient air monitoring which is required by the EPA, the data quality objectives are to collect data that is accurate, complete, representative and comparable for inclusion in the national database, AQS and also for verification that the state has met all state and federal air quality standards. The ambient air monitoring project is unlike uniquely designed projects, which are devised for making specific decisions. Thus, we consider that data quality objectives have been met when we successfully complete all EPA-approved quality assurance requirements for monitor calibrations, audits, precision checks and data validation.

References

New Mexico Environment Department, Air Quality Bureau: Manual of Standard Operating Procedures Ambient Air Monitoring and Quality Assurance

Environmental Protection Agency: *Regulations on National Primary and Secondary Ambient Air Quality Standards* 40 CFR Ch. 1, Part 50 <http://www.ecfr.gov/cgi-bin/text-idx?SID=41ae02c0a776d964a08f2ca9b57498b0&mc=true&node=pt40.2.50&rgn=div5>

Environmental Protection Agency: *Ambient Air Quality Surveillance* 40 CFR Ch. 1, Part 58 <http://www.ecfr.gov/cgi-bin/text-idx?SID=41ae02c0a776d964a08f2ca9b57498b0&mc=true&node=pt40.6.58&rgn=div5>

Environmental Protection Agency, *Guideline on the Meaning and the Use of Precision and Bias Data Required by 40 CFR Part 58 Appendix A*, EPA-454/B-07-001, January 2007
<https://www3.epa.gov/ttn/amtic/files/ambient/monitorstrat/precursor/07workshopmeaning.pdf>

Environmental Protection Agency, EPA QA/G-5 *Guidance for Quality Assurance Project Plans*, EPA/240/R-02/009 <https://www.epa.gov/quality/guidance-quality-assurance-project-plans-epa-qag-5>

Environmental Protection Agency, *Technical Assistance Document for the Calibration of Ambient Ozone Monitors*, EPA-600/4-79-057
<https://www3.epa.gov/ttn/amtic/files/ambient/criteria/4-79-057.pdf>

Environmental Protection Agency, *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I, A Field Guide to Environmental Quality Assurance* (EPA/600/r-94/038a) April 1994 <https://www3.epa.gov/ttnamti1/qalist.html>

EPA QA Handbook for Air Pollution Measurement Systems, Vol. II (EPA-454/B-17-001) January 2017
https://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/Final%20Handbook%20Document%201_17.pdf

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APPENDIX A

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU



New Mexico State Personnel Office

2600 Cerrillos Road
Santa Fe, New Mexico 87505-0127

Classification Description

ENVIROMENTAL SCIENSTISTS AND SPECIALISTS, INCLUDING HEALTH

Class Title	Class Code	Pay Band	Alt Pay Band*
Environmental Scientists & Spec-B	F2041B	55	65
Environmental Scientists & Spec-O	F2041O	60	70
Environmental Scientists & Spec-A	F2041A	65	75

**In accordance with SPB Rule 1.7.4.10 NMAC, the assignment to alternative pay bands shall be reviewed annually to determine their appropriateness.*

Occupation Description

Conduct research or perform investigation for the purpose of identifying, abating or eliminating sources of pollutants or hazards that affect either the environment or the health of the population. Utilizing knowledge of various scientific disciplines may collect, synthesize, study, report and take action based on data derived from measurements or observations of air, food, soil, water and other sources.

Nature of Work

Environmental scientists and specialists use their knowledge of the natural sciences to protect the environment by identifying problems and finding solutions that minimize hazards to the health of the environment and the population. They analyze measurements or observations of air, food, water, and soil to determine the way to clean and preserve the environment. Understanding the issues involved in protecting the environment degradation, conservation, recycling, and replenishment is central to the work of environmental scientists. They often use this understanding to design and monitor waste disposal sites, preserve water supplies, and reclaim contaminated land and water. They also write risk assessments, describing the likely affect of construction and other environmental changes; write technical proposals; and give presentations to managers and regulators.

Distinguishing Characteristics of Levels

Note: Examples of Work are intended to be cumulative for each progressively higher level of work. The omission of specific statements does not preclude management from assigning other duties which are reasonably within the scope of the duties.

Basic

- Employees in this Role perform routine investigations into environmental problems.
- Employees collect and submit samples for laboratory or field analysis; assist in making inspections; conduct routine field and office project reviews; may compile project-oriented engineering, social, economic and other technical data necessary for public hearings.

ENVIRONMENTAL SCIENTISTS AND SPECIALISTS, INCLUDING HEALTH

New Mexico State Personnel Office

Recommended Education and Experience for Full Performance

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering.

Minimum Qualifications

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering. Any combination of education from an accredited college or university in a related field and/or direct experience in this occupation totaling four (4) years may substitute for the required education and experience.

Classification Description

Operational

- Employees in this Role review applications, preliminary and final plans, and specifications for proposed plants, facilities, and/or equipment to determine completeness, technical feasibility, engineering accuracy, and compliance.
- Employees conduct supplementary investigations, research and surveys as needed; announce and conduct public hearings; issue permits and approvals and notify concerned public of the action; participate in inspections, cost estimates, progress reports, and design change orders; perform tests and audits test results to determine conformity; and compile findings and technical data for reports and projections.

Recommended Education and Experience for Full Performance

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering and four (4) years of work experience in public/environmental health, environmental science, Air Quality Management, Biology, Engineering, Chemistry, Geology, Hazardous Waste Management, Wildlife Management, and/or Water Resources.

Minimum Qualifications

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering and two (2) years of work experience in public/environmental health, environmental science, Air Quality Management, Biology, Engineering, Chemistry, Geology, Hazardous Waste Management, Wildlife Management, and/or Water Resources. Any combination of education from an accredited college or university in a related field and/or direct experience in this occupation totaling six (6) years may substitute for the required education and experience.

Advanced

- Employees in this Role determine adverse and beneficial environmental, social, and economic effects of highway proposals, archaeological sites and excavations.
- Employees coordinate environmental and archaeological activities with project development and design; analyze and generate procedural changes; determine manpower needs; review and authorize mitigation contracts for ongoing and completed projects; assemble data for planning; engage in or monitor research; develop public information programs; assist management in planning objectives, budget, records, and reports; prepare complex scientific reports and advanced analysis of data.

Recommended Education and Experience for Full Performance

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering and six (6) years of work experience in public/environmental health, environmental science, Air Quality Management, Biology, Engineering, Chemistry, Geology, Hazardous Waste Management, Wildlife Management, and/or Water Resources.

ENVIRONMENTAL SCIENTISTS AND SPECIALISTS, INCLUDING HEALTH

New Mexico State Personnel Office

2600 Cerrillos Road

Minimum Qualifications Santa Fe, New Mexico 87505-0127

Bachelor's Degree in Physical, Natural, or Environmental Science, Soil Science, or Engineering and five (5) years of work experience in public/environmental health, environmental science, Air Quality Management, Biology, Engineering, Chemistry, Geology, Hazardous Waste Management, Wildlife Management, and/or Water Resources. Any combination of education from an accredited college or university in a related field and/or direct experience in this occupation totaling nine (9) years may substitute for the required education and experience.

Classification Description

Knowledge and Skills

*Note: This information has been produced by compiling information and documentation provided by O*NET. O*NET™ is a trademark of the U.S. Department of Labor, Employment and Training Administration.*

Knowledge

English Language — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

Chemistry — Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.

Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Biology — Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.

Law and Government — Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.

Engineering and Technology — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

Geography — Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.

Customer and Personal Service — Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

Persuasion — Persuading others to change their minds or behavior.

Negotiation — Bringing others together and trying to reconcile differences.

Social Perceptiveness — Being aware of others' reactions and understanding why they react as they do.

Instructing — Teaching others how to do something.

Physics — Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.

ENVIRONMENTAL SCIENTISTS AND SPECIALISTS, INCLUDING HEALTH

New Mexico State Personnel Office

2600 Cerrillos Road

Santa Fe, New Mexico 87505-0127

Time Management — Managing one's own time and the time of others.

Skills

Classification Description

Science — Using scientific rules and methods to solve problems.

Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.

Reading Comprehension — Understanding written sentences and paragraphs in work related documents.

Speaking — Talking to others to convey information effectively.

Active Listening — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.

Writing — Communicating effectively in writing as appropriate for the needs of the audience.

Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

Coordination — Adjusting actions in relation to others' actions.

Judgment and Decision Making — Considering the relative costs and benefits of potential actions to choose the most appropriate one.

Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.

Statutory Requirements: N/A

Conditions of Employment: Working Conditions for individual positions in this classification will vary based on each *agency's utilization, essential functions, and the recruitment needs* at the time a vacancy is posted. All requirements are subject to possible modification to reasonably accommodate individuals with disabilities.

Default FLSA Status: Exempt. FLSA status may be determined to be different at the agency level based on the agency's utilization of the position.

Bargaining Unit: This position may be covered by a collective bargaining agreement and all terms/conditions of that agreement apply and must be adhered to.

Established: 07/07/2001

Revised: 9/4/2014

**Adapted from the United States Bureau of Labor Statistics and are intended to illustrate the typical education and experience required for this occupation.*

Note: Classification description subject to change. Please refer to the SPO website www.spo.state.nm.us to ensure this represents the most current copy of the description.

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APPENDIX B

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU



SCIENTIFIC LABORATORY DIVISION

Title: Gravimetric Analysis of 47mm Air Filters - AHM Method 41710

Version: 3.0

Index Number: CB AHM 104

Release Date: 24-Apr-2018

Authors: Frank See and Patricia Murphy

Our Name: Air and Heavy Metals

Air and Heavy Metals Methods Manuals

GRAVIMETRIC ANALYSIS of 47mm Air Filters

Effective date: February 28th, 2018

Prepared by Patricia Murphy and Frank See

1. SCOPE AND APPLICATION

- 1.1 This method is a gravimetric analysis for the mass determination of particulates suspended in air. Particle size can vary by the type of particle-size discriminator used on the sampling equipment. The most common have an aerodynamic diameter of less than or equal to either 2.5 or 10 microns; this method is applicable to either size. These fine particulates are collected on 47-mm Teflon filters. The method covers the conditioning and weighing of the filters, data handling and reporting.

2. SUMMARY OF METHOD

- 2.1 Clean filters are conditioned under precisely controlled conditions of temperature and relative humidity until stable for weighing on a microbalance. Filters are weighed to the nearest microgram (10^{-6} gram) at the lab, and then sent to clients for exposure. Exposed filters are returned to SLD, where they are again conditioned and weighed to the nearest microgram. The difference of exposed weight minus clean weight yields the net mass loading on the filter

3. DEFINITIONS

- 3.1 National Institute of Standards and Tests: (NIST) US Dept of Commerce Laboratory measurement standards laboratory.
- 3.2 Accuracy -The degree to which a measurement relates to its actual (true) value. For digital scales, expressed as a percent deviation of actual reading (%AR)
- 3.3 American Society for Testing and Materials: (ASTM) international standards program.
- 3.4 PM_{2.5}: Particulate Matter (PM) ≤ 2.5 microns in diameter.
- 3.5 PM₁₀: Particulate Matter (PM) ≤ 10.0 microns in diameter.
- 3.6 Gravimetric analysis: Analysis determined by the measurement of mass (weight).
- 3.7 Filter: 47-mm diameter Teflon. Each filter as supplied has a unique identifier (alphanumeric).
- 3.8 Primary mass reference standards: Certified ASTM class 1 or better mass standards (weights), 200, 300 & 500 mg. Verified annually by a certified technician.
- 3.9 Working mass reference standards: 200, 300 & 500 mg. mass standards (ASTM Class 2 or better) used for routine filter weighings. The working standards are calibrated against the primary mass standards every 6 months.
- 3.10 Laboratory Information Management System (LIMS): This is the database of record for SLD. All samples are logged into the facility and tracked through each step needed to properly analyze and report out on samples submitted.
 - 3.10.1 Pre-accessioning: This process is used to create samples in the LIMS system for the purpose of pre-sampling prior to sending filters out into the field.
- 3.11 Pre-sampling: Weighing of filter media before exposure (tare weight).
- 3.12 Post-sampling: Weighing of filter media after exposure (exposed).
- 3.13 Filter loading: the amount of particulates, in micrograms, entrained on the filter medium.
- 3.14 Filter lot: A single shipment of filters received from EPA or manufacturer. Identified by lot number.

- 3.15 Filter exposure lot blanks: 3 filters randomly selected from each filter exposure lot, used to assess the conditioning time necessary for the given lot.
- 3.16 Lab blank (LB): A conditioned, unsampled filter, used to assess contamination in the lab and microbalance environment. Filters should be weighed in the pre-sampling session and again in a post-sampling session. Enough filters should be weighed to represent 10% of filters in a batch per weighing session.
- 3.17 Field blank (FB): A conditioned, unsampled filter sent to the field, used to assess possible contamination during sampling. The field blank is placed in the sampler but not exposed. Field blanks are conditioned, stored, and weighed the same as sampled filters
- 3.18 Duplicate: The duplicate measurement (weighing) of a filter, used to assess the precision of the weighing and conditioning procedures.
- 3.19 Precision (also Repeatability): A measure of random variation among individual measurements of the same property under prescribed identical conditions. For microbalance measurements, precision is the measure of the ability to display the same result in repetitive weighings of the same mass under the same measurement conditions. ASTM: American Society of Testing and Materials.
- 3.20 Bias: The systematic or persistent distortion of a measurement process that causes errors in one direction. The lack of accuracy associated with a specific measurement.
- 3.21 Filter Integrity Check: Examination of each pre-sampled (unexposed) filter against a defined set of criteria before conditioning. Filters that do not pass the filter integrity check must not be used.
- 3.22 Qualifier: A 3-letter description giving further explanation of a particular filter. See table 15.2 for a list of qualifiers and their meanings.
- 3.23 Readability: (also Resolution, Scale Division, Scale Interval, Increment, Digit) – On electronic and digital scales, this is the smallest change in mass that corresponds to a change in displayed value. In other words, this is the amount that the scale will increment by as weight is added or removed.
- 3.24 Reproducibility: This is the scale's ability to show consistent results under changed conditions.

4. SAMPLE COLLECTION, PRESERVATION AND STORAGE

4.1 Pre-sampled (clean) filters

- 4.1.1 Filters are “pre-accessioned” in LIMS. Each filter is given a unique SLD number and request form that is tracked with the barcode label that is affixed to filter storage container and each request form is printed with the same information. At this point, each filter and its unique identifier is associated with a unique SLD number in LIMS and tracked with a barcode reading system.
- 4.1.2 All Supplied filters are conditioned, weighed, and checked for integrity before being sent to clients for exposure.
- 4.1.3 To ensure that contamination and/or static charge is not a problem, the analyst must wear static-free, non-powdered gloves and clean lab coats when handling filters. Long sleeve garments are discouraged (dust build up).
- 4.1.4 Filters shall ONLY be weighed in the designated, conditioned environment.

- 4.1.5 Clean filters are removed from the shipping material and retained in their original boxes (usually 50 filters per box). Boxes of clean filters are stored in the Air Quality Weight Room 2348A until filters are set out for conditioning. Refer to section 9.2 for clean filter conditioning procedure.
- 4.1.6 Upon completion of weighing, the filters are packaged and prepared as described in Section 9 of this SOP and are then available for pickup or being shipped to the client.
- 4.1.7 **Note:** Pre-sampled filters must be exposed (sampled) within 30 days from the date of weighing.

4.2 Exposed filters

- 4.2.1 Exposed filters upon being returned to SLD are brought into the Specimen and Receiving (SR) area of the Laboratory and accessioned through LIMS. Refer to section 9.5 for exposed filter check-in and handling.
- 4.2.2 The SR area of the Laboratory is responsible for checking and maintaining proper Chain of Custody. Each exposed filter's unique identifier is matched with paperwork and prepared for conditioning and weighing.

5. INTERFERENCES

- 5.1 Static charge will cause delays and inaccuracies in balance measurements. The analyst must take proper precautions to minimize static charge.
- 5.2 Insufficient conditioning of unexposed filters may result in erroneous filter loading calculations. Unexposed filters need sufficient time for the support ring to de-gas before pre-sample weighing and equilibrate with the laboratory environment.
- 5.3 Filter exposure in the presence of NO_x and SO₂ vapors (primarily from nitric and sulfuric acids, respectively) may cause the agglomeration of nitrate and/or sulfate containing particles on high-alkalinity filter media, resulting in a falsely high result.

6. APPARATUS AND EQUIPMENT

- 6.1 Microbalance: Capable of 1 µg (0.001 mg) readability and 0.0008 mg repeatability. (See Appendix A for currently used equipment.)
- 6.2 Conditioning & Weighing Room: Room 2348A and 2348B. The conditioning and weighing rooms must be maintained at a mean temperature of 20.0-23.0 °C, with <± 2.0 °C variation in the 24-hour period preceding filter weighing. The mean relative humidity in the same rooms must be maintained between 30.0%-40.0 % with <± 5.0% variation in the 24-hour period preceding filter weighing. The climate control equipment should be able to read both the room temperature and relative humidity in the room frequently and adjust such that these conditions are maintained. The room is equipped with Johnson Controls data logging that tracks the environmental parameters.
- 6.3 Hygrometer/temperature sensor: A separate hygrometer & temperature sensor [Dickenson THDX with chart recorder, and battery backup should be located near the

microbalance. Relative humidity must be measured to the nearest 1 percent, while temperature must be measured to the nearest 1 °C.

- 6.4 Computer with microbalance interfaced to LIMS.
- 6.5 Bar code label maker and scanner: interfaced to LIMS to make and read bar code labels for filter storage container.
- 6.6 Balance table: Stone or other heavy (stable) surface for microbalance.
- 6.7 Damping pads/slab: Isolate balance table from floor.
- 6.8 Primary and Working Mass standards: 200 mg, 300mg and 500 mg standards certified to ASTM or NIST class 1 or better.
- 6.9 ²¹⁰Polonium strips: Strips used to neutralize static electricity. Strips should contain no more than 500 Picocuries of radiation.
- 6.10 Anti-static brush: Small brush, used to clean the microbalance-weighing pan.
- 6.11 Filter: 47-mm diameter Teflon. With unique alphanumeric identifier. Available from US EPA through the national PM_{2.5} contract.
- 6.12 Filter cassette: Handling device attached to each filter ring, which holds the filter in place in the sampler. Two pieces (top and bottom half) to each cassette. Filter cassettes: Various, depending on filter manufacturer. Reusable.
- 6.13 Filter storage containers: Storage containers used to store the filter during conditioning. Each container must be labeled with the enclosed filter number on the lid. The dish should be large enough to accommodate the filter easily but with minimal extra room, to prevent filter movement inside the dish.
- 6.14 Cassette protective containers: This may be a Petri dish plus foam blocks (manual sampler) or sampling magazine holding several filter cassettes and solid spacers (automated sequential sampler).
- 6.15 Magazine Protective Container: Padded metal box used for additional protection, used to ship the filter plus cassette
- 6.16 Forceps: Smooth, non-serrated. A different pair is used to handle the filters (**filter**) and mass standards (**standard**).
- 6.17 ²¹⁰Po: Polonium 210, an alpha emitter used to neutralize static charge build-up.
- 6.18 Magazine Pump: Pneumatic tool to push filter cassettes through the magazine.
- 6.19 Filter cassette separator tool: Used to separate the top & bottom cassette halves for filter retrieval.
- 6.20 Shipping Coolers: Picnic coolers with leak proof ice substitute, for shipping filters.
- 6.21 Min-Max Thermometers: Thermometers for recording the minimum and maximum temperatures inside the shipping coolers.
- 6.22 Earth-ground flooring: used to drain away static charge.
- 6.23 Tacky mats: Adhesive mats, used to trap dust and other particulate contamination from analysts' shoes; placed outside of the balance room.
- 6.24 Kim Wipes: Lint free wipes used to remove debris and solution from apparatus.
- 6.25 Alcohol Wipes: Used to clean the inside of the filter magazines.
- 6.26 Anti-Static Solution: Spray-on type, applied to weighing areas to minimize static charge accumulation.
- 6.27 Alconox or similar detergent to clean filter cassettes.
- 6.28 Methanol: Used to clean forceps.

7. REAGENTS -NA

8. CALIBRATION

- 8.1 The microbalance calibration must be verified annually by a certified technician.
- 8.2 The microbalance calibration must be checked before each weighing session, using both the 300 and 500 mg. working mass standards.
- 8.3 Utilize any calibration programs that may be installed in the analytical balance as needed.

9. PROCEDURE

9.1 General

- 9.1.1 Wash hands thoroughly before entering the outer room (Rm. 2348).
- 9.1.2 Before entering the balance room, the analyst must walk across a tacky mat with both feet, to remove as much dust as possible from their feet.
- 9.1.3 Before entering the balance room, the analyst must discharge any static charge on their person to an earth ground by touching the ground with both hands for 2 seconds.
- 9.1.4 If contamination and/or static charge has been proven to be a concern, the analyst must wear non-static, powder-free gloves and a clean lab coat. Gloves and lab coats are put on in the outer room.
- 9.1.5 The analyst must verify via the balance room data recorders that the required conditions for temperature and relative humidity have been achieved over the previous 24 hours. See section 12.7 for requirements. If the conditions are outside the allowable range, weighing should not be done until the requirements are met. If the temperature and humidity cannot be controlled to requirements, then a notation must be entered into the batch under LIMS Batch Manager and be made available to the client
- 9.1.6 The weighing rooms (2348A and 2348B) are controlled environments. Access should be limited to people that have a need to work in the weight rooms.

9.2 Clean Filter Conditioning

- 9.2.1 All new filters must be checked for integrity, conditioned, and weighed before being sent to clients for exposure.
- 9.2.2 Filters meeting the integrity criteria are to be pre-logged into LabWare® LIMS.
 - 9.2.2.1 Click on **Sample Interface Icon**. A **Sample Login Window** will appear.
 - 9.2.2.2 Select **File>Open Template**. A **LIMS Browser Window** will appear
 - 9.2.2.3 Click on **Template ID: Select Air Quality Sample Pre-Log**. Click OK.
 - 9.2.2.4 In the **AQ Sample Pre-log Window** on the **Summary Tab** Select **Specimen Source** and from the Drop Down Menu **Air Filter (47mm)**
 - 9.2.2.5 Enter the Filter Lot # from the EPA supplied filter box.

- 9.2.2.6 In the upper-right hand corner of the **AQ Sample Pre-log Window** type in the appropriate amount of filters to be clean conditioned and Click the **Log Button**. Please confirm by hitting **Yes** when asked “Logging XX samples OK to continue”?
- 9.2.2.7 Select **File>Exit**.
- 9.2.2.8 Select **File>Folder Manager**
- 9.2.2.9 In the **Folder Manager Window** select **File>Open**.
- 9.2.2.10 When the **Folder Prompt Dialogue Window** appears, select the browse icon and then highlight the **AQ Clean Condition XX Folder**
- 9.2.2.11 When the **SAMPLE Folder: Air Quality – Clean Condition Window** appears select **File>Rebuild** . The samples created in Login Interface previous step should be present in the left column.
- 9.2.2.12 Select **NMDOH>Clean Condition**. In the **AQ Clean Condition Window** type in the first filter number and then highlight the remaining cells in the column.
- 9.2.2.13 Using **NMDOH>Increment Filter Down**.
- 9.2.2.14 When done **File>Save; and Exit**. This will enter the filter numbers into the batch.
- 9.2.2.15 Select **File>Save**.
- 9.2.2.16 Select **Folder>Print Sample Labels**.
- 9.2.2.17 Select **NMDOH>Clean Condition**.
- 9.2.2.18 In the **AQ Clean Condition Window** enter the date in the Clean Condition Date Column.
- 9.2.2.19 Select **Edit>Propagate** down to fill all filter samples .
- 9.2.2.20 **Select File >Save** and then **Exit**.
- 9.2.2.21 Select rebuild folder.
- 9.2.2.22 Select **File> Save** and then **Exit**.
- 9.2.2.23 The created labels are then affixed to the bottom of the petri dishes.
- 9.2.3 Remove all filters from their original boxes. Perform the filter integrity check (see section 12.1 and table 15.1). If all criteria in table 15.1 are not satisfied, the filter is rejected. Rejected filters are voided in LIMS. If a large number of filters from a given lot do not meet the defined criteria, the entire lot is returned to the vendor for replacement.
- 9.2.4 Each filter that successfully passes the filter integrity check is placed in a clean petri dish. Handle the filter only by the support ring using the **filter** forceps; do NOT handle the filter directly. Filters have a unique identifier (alphanumeric filter number) that is printed above the LIMS sample number on the printed labels (see 9.2.2.16) and affixed to the bottom half of the petri dish (filter container). Place all filters in the bottom half of the petri dish, and partially cover with the top. Record the current date in LIMS (9.2.2.18).
- 9.2.5 Three (3) filters are randomly selected from the initial filter exposure lot (3.12) of each filter lot (3.11) and designated as Exposure Lot Blanks. The 3 filters are conditioned for a minimum of 24 hours, and then weighed on consecutive days until such time that the 24-hour weight change is less than 15 µg. While conditioning, the petri dishes must be open. Remaining filters in this exposure lot

must not be weighed until this criterion is met. Record the Exposure Lot Blank filter numbers, dates of weighing, and weights in an Excel file.

- 9.2.6 The next group of clean filters set out to condition (filter exposure lot) following the initial exposure lot (9.2.5) must repeat the Exposure Lot Blank study. After clean filters have conditioned for at least the same period of time as determined by 9.2.5, subsequent weighings must agree within 15 µg.

9.2.6.1 If the Exposure Lot Blanks satisfy the criterion in 9.2.5, the amount of conditioning time has been established for the entire filter lot, and no new Exposure Lot Blanks need be weighed. All remaining clean filters in the given lot must condition for at least this amount of time.

9.2.6.2 If the Exposure Lot Blanks do not satisfy the criterion in 9.2.5, the blanks are conditioned for a longer period of time. Once the consecutive daily weighings agree within 15 µg, the clean filters in that specific Exposure Lot may be weighed. The Exposure Lot Blank study must again be conducted on the next group of clean filters set out to condition (filter exposure lot). The procedure is repeated until successive Exposure Lot Blank studies yield consistent results.

9.3 Pre-sampled (clean) filters

- 9.3.1 See section 9.2 for required filter conditioning.
- 9.3.2 Verify the required room conditions have been achieved (section 12.7); if the requirements cannot be achieved, the filters are flagged with the appropriate qualifiers.
- 9.3.3 Click on the Results Tab of the Batch window that you've just created. Enter the values for Humidity and Temperature Data in the lower left prompt in the window.
- 9.3.4 Select the appropriate clean filters for weighing, placing within easy reach of the balance. The following criteria must be satisfied:
- Filters have been conditioning for the appropriate time; the Exposure Lot Blanks (9.2.5) determine this.
 - Filters have successfully passed the filter integrity check. See table 15.1.
 - Filters have been pre-logged as described in section 9.2.2
- 9.3.5 Designate three filters as Lab Blanks (LB) every time pre-sampled (unexposed) filters are weighed, and label the appropriate petri dishes. Label as filter number followed by LB or FB (as appropriate). **Ex:** T8197000(LB).
- 9.3.6 For weighing more than 30 clean filters in any one session, designate one lab blank for each block of ten filters. **Ex:** 35 clean filters are to be weighed; designate 4 lab blanks.
- 9.3.7 Clean the microbalance weighing-chamber with a fine-bristled, anti-static brush.
- 9.3.8 Clean the surfaces near the microbalance with methanol-moistened Kim Wipes or anti-static cleaner and Kim-Wipes.
- 9.3.9 Clean both pairs of forceps (mass standards and filters) with methanol-moistened Kim Wipes. It is very important that the forceps be dry before handling standards.

Tare (zero) the balance by pushing the “re-zero” key before each weighing session.

Note: The microbalance will autozero between weighings, however, the balance should be re-zeroed when drift causes the zero reading (between filter weighings) to read other than 0.000 mg.

- 9.3.10 Open the balance software and check for connection.
- 9.3.11 Log into the LabWare LIMS. The analyst should have an account with the _TECH_AQ role and should log in under that role.
- 9.3.12 Click on **File >Batch Manager** (or use Batch Manager Icon): -A new window will appear. Click on **File >New** (or use New Batch Icon): Click on the **Template Browser** search icon and select the **AQ_47_Clean option**. Click OK and Save. This will create a new Batch
- 9.3.13 Select the Scan Icon and scan the barcode on the label printed out in section 9.2.2.16.
- 9.3.14 After scanning in the filter numbers select save.
- 9.3.15 Note: After every ten filters, you must add a duplicate and 300mg QC weighing into the batch.
- 9.3.16 Select **Options.Enter Results by Test**
- 9.3.17 You will see RS/232 Result Entry window.
- 9.3.18 Weigh lab blanks before other filters in any given session.
- 9.3.19 Pick up each filter, using the designated forceps for filters, by the support ring only. Pass every filter over the ^{210}Po strips for 15-30 seconds before placing in the weighing pan for measurement. Center each filter in the middle of the balance pan when weighing. Close the weighing chamber.
- 9.3.20 Press print on the scale. The weight will then be recorded and appear in the clean Weight cell when a stable reading is achieved.
- 9.3.21 After the measurement is transferred, open the weighing chamber and return each filter to its designated petri dish after weighing.

NB: For each filter, ensure that the filter number matches against the label on the petri dish.

- 9.3.22 One filter in each group of ten filters is weighed in duplicate. Weigh the filter, remove the filter from the weighing pan, and again weigh the filter. See section 12.12 for acceptance criterion.
- 9.3.23 Repeat until all filters have been weighed. Then Select **Save**, then **Exit**.
- 9.3.24 Select **NMDOH>Modify Samples**. This is where qualifiers are added. This is the first step of Shipping Out.
- 9.3.25 You will see an AQ Batch Sample Edit Window. This is where you will enter the Cassette # and Magazine; Sample type (SAM, LB, FB)
- 9.3.26 Entering Site ID: The Site ID is demographic data provided by the client and is linked to, tables in LIMS that populate other information fields associated with it.
 - 9.3.26.1 Site ID is entered by using a drop-down menu.
 - 9.3.26.1.1 Select the appropriate Site ID based upon the client’s request.

- 9.3.26.1.2 Once the appropriate Site ID is selected, the analyst should confirm that the correct location information populates.

NB: IF you notice that you have selected the wrong Site ID from the drop down menu. STOP.

Exit the batch and DO NOT SAVE.

Go back in and enter the correct Site ID.

NB: If the Site ID does not match up with the location provided by the client, Immediately STOP and notify your supervisor.

Then Ship Date

- 9.3.27 NOTE Never hit the **Save** option until all data is entered and verified by the analyst.
- 9.3.28
- 9.3.29 When complete hit **Save. Then Exit.**
- 9.3.30 Enter the Serial Numbers of the Working Standards and any qualifiers. Save Data before exiting
- 9.3.31 When the batch sheet requires, weigh the 300 and 500 mg working standards using the **standard** forceps.
- 9.3.31.1 Place the appropriate mass standard in the center of the pan. Close the weighing chamber door. Press print on the scale. The software will transfer the measurement to the LIMS automatically when the measurement is stable.
- 9.3.32 Each standard must agree with the verified mass $\pm 3 \mu\text{g}$. If not, reweigh the standard(s). If the mass still does not fall within the acceptable range, take appropriate corrective actions (see section 12.6).
- 9.3.33 Select NMDOH > Print paperwork to print out request forms for each filter.
- 9.3.34 The batch is now ready to be reviewed in LIMS by the AQ_Sup

9.4 Packaging Clean Filters for Shipment

- 9.4.1 Filters are shipped to NMED via UPS Ground; the City of Albuquerque (COA) picks up filters at SLD. Package filters such that clients receive them no later than the day previous to the day needed (check the appropriate client sample schedule). UPS usually takes one day.

- 9.4.2 The deadline for packages sent via UPS is 1:30 p.m. each day. Packaged filters must be taken to Specimen Receiving by this time. Check with Specimen Receiving personnel should you not be able to meet this deadline, as they may be able to delay UPS pickup. Also check with Specimen Receiving for UPS holiday schedules.
- 9.4.3 Retrieve the appropriate client shipping labels; these are in the balance room.
- 9.4.4 Secure the necessary number of Pre-sampled (clean) filters (see section 9.3) to load one magazine at a time.
- 9.4.5 Complete the shipping label. **Note:** Magazines are loaded bottom to top; complete the shipping label in the exact order that filters and spacers are packed.
- 9.4.6 For NMED, the bottom cassette (first into the magazine) is a solid spacer. For COA, the first is a sample (filter).
- 9.4.7 Check the fit of the top and bottom halves for each cassette before loading a filter. The fit **MUST** be tight. If not, try another cassette half. Note that the screen will decrease the tightness; if there is any doubt regarding the fit, load a screen and check the fit again.
- 9.4.8 Spacers have no designated top or bottom.
- 9.4.9 Filter screens must be loaded with the number facing down.
- 9.4.10 The top half of each cassette has a beveled edge. The beveled edge faces up when loaded into the magazine.
- 9.4.11 Load the magazine. Push each successive cassette into the magazine such that the top of the cassette is even with the top of the magazine.
- 9.4.12 Place an orange-colored cap over the top of the magazine when loading is completed.
- 9.4.13 Repeat steps 9.4.3-9.4.12 as needed.
- 9.4.14 Load the magazine into a metal shipping container as each one is completed, and tape both ends of the shipping label to the top (lid) of the metal shipping container. Repeat for the remaining magazines.
- 9.4.15 For NMED samples, proceed to step 9.4.16. For COA samples, go to step 9.4.21.
- 9.4.16 Package no more than four metal shipping containers per Styrofoam cooler. Group by submitter. Place the metal shipping container(s) on the cooler bottom, and pack liberally with ice-substitute blocks.
- 9.4.17 Include one thermometer into the cooler. The paperwork to accompany the filters should be placed into the cooler and then covered with the Styrofoam lid. **Note:** Most coolers have an outer cardboard protective carton.
- 9.4.18 Place a sticky note on the outer cardboard protective carton, indicating the submitter code, submitter city, and client name. This info is found on the list posted on the wall.
- 9.4.19 Repeat steps 9.4.16-9.4.18 for the remaining metal shipping containers.
- 9.4.20 Take the packages to Shipping and Receiving for shipping by 1:30 p.m. for NMED samples.
- 9.4.21 Take the COA shipping containers to Specimen Receiving. COA pickup is before close of business on Wednesday afternoon, unless otherwise requested by COA.

9.5 Exposed filter check-in

9.5.1 Filter receipt and check in by Specimen Receiving.

- 9.5.1.1 NMSLD Specimen Receiving personnel receive shipping/transport container(s); typically, this will be an insulated picnic cooler for NMED filters. The cooler is opened and the filter magazine protective container(s) (metal shipping box) and accompanying request form(s) are retrieved.
- 9.5.1.2 NMSLD Specimen Receiving personnel note the maximum temperature indicated on the min/max thermometer contained in the cooler and record on the request form to the nearest °C. For filter samples received not in a cooler, record the ambient temperature on the appropriate data sheet(s).
- 9.5.1.3 One form is required for each filter.
- 9.5.1.4 Upon receipt, collect the *Filter Chain of Custody Record(s)*. **Note:** The *Filter Chain of Custody Record(s)* must not be packaged inside the filter magazine.
- 9.5.1.5 **Note:** Filter magazines must only be opened by authorized AHM personnel.
- 9.5.1.6 NMSLD Specimen Receiving personnel return the metal shipping boxes back into their respective coolers and deliver to the AHM section facility. **Note:** NMSLD is a designated secure area; therefore, no internal custody transfers need be documented.

9.5.2 Filter receipt and check in by Air & Heavy Metals.

- 9.5.2.1 The filters are brought to AHM room 2366A still in the coolers and their protective containers (metal shipping boxes).
- 9.5.2.2 Retrieve the magazine from the metal shipping container. The magazines should not be wet from melting ice. If they are wet, flag as “questionable”.
- 9.5.2.3 Remove the shipping label from the top of the metal shipping container and tape the shipping label to the orange cap. Leave the magazine in room 2348 for 24 hours before opening for thermal equilibration.
- 9.5.2.4 After thermal equilibration, take the magazines into Room 2348A, remove all solid spacers and filter cassettes from the filter magazine, and inspect the inside of the magazine for particulate matter and/or debris. If particulate matter and/or debris is found, all filters contained in the magazine are flagged as questionable.
- 9.5.2.5 Carefully separate the 2 halves of the cassette container to remove the filter sample. Inspect for and note any debris or filter compromise in LIMS. Flag all filters that have obvious signs of damage to either the filter or filter cassette as questionable in the LIMS Lab field remarks.
 - 9.5.2.5.1 Damaged filters are voided and not weighed. Explain all voided filters in the LIMS field remarks.
- 9.5.2.6 Set the cassette halves and screens to wash.
 - 9.5.2.6.1 Cassettes are reusable and shall be cleaned between uses. Wash with Alconox in warm water; rinse thoroughly with tap water, followed by deionized water after washing. Let dry at room temperature completely.
- 9.5.2.7 Retrieve the appropriate petri dishes previously used for clean filter conditioning, and place the exposed filter in the dish, exposed side up.

Double check that the filter and LIMS numbers match up. Partially cover with the petri dish top half.

- 9.5.2.8 The filter in the open dish should be conditioned for a minimum of 24 hours before weighing.
- 9.5.2.9 Verify the user code, submitter code, priority, and sample location, site ID and analytical request fields are completed by the submitter. If not, the analyst completes these fields. Initial all changes to the request form. Do not add filter number unless there is only one filter per magazine (determine from shipping label).
- 9.5.2.10 Verify that each request form corresponds to the appropriate cassette and filter. Investigate and document all discrepancies.
- 9.5.2.11 Upon receiving the exposed filters back into SLD, Shipping and Receiving personnel record the filter temperatures and any field remarks into LIMS. Filters are delivered to the section as described above and forms are returned to the AHM section.
- 9.5.2.12 With respect to the 47mm PM_{2.5} filters If any are received at 4 °C they must be weighed within 30 calendar days from receipt. Filters received at > 4 °C, but < 25 °C must be weighed within 10 calendar days from receipt. Filters received at > 25 °C are weighed within 10 calendar days from receipt but are flagged as questionable. This rule does not pertain to 47mm PM₁₀ filters.

9.6 Exposed Filter Weighing

- 9.6.1 The analyst must wear static-free, non-powdered gloves when handling filters.
- 9.6.2 Use the same balance for exposed weighing as was used for the unexposed weighing.
- 9.6.3 Clean the microbalance weighing-chamber with a fine-bristled, anti-static brush.
- 9.6.4 Clean the surfaces near the microbalance with methanol-moistened Kim Wipes or anti-static cleaner and Kim-Wipes.
- 9.6.5 Clean both pairs of forceps (mass standards and filters) with methanol-moistened Kim Wipes. It is very important that the forceps be dry before handling standards or filters.
- 9.6.6 Tare (zero) the balance by pushing the “re-zero” key before each weighing session.
Note: The microbalance will autozero between weighings, however, the balance should be re-zeroed when drift causes the zero reading (between filter weighings) to read other than 0.000 mg.
- 9.6.7 Start the balance software and confirm connection.
- 9.6.8 Start LIMS software. Go to Batch Manager and create a new Exposed Batch.
- 9.6.9 Record the room temperature and relative humidity in LIMS Results Tab as described in section 9.3.3.
- 9.6.10 Weigh the 500 and 300 mg. working standards using the **standard** forceps.
 - 9.6.10.1 Open the weighing chamber and place the 500-mg mass standard in the center of the pan. Close the weighing chamber door. Press the print button on

the scale. LIMS software will transfer the measurement automatically when the measurement is stable.

- 9.6.10.2 Repeat using the 300-mg mass standard.
- 9.6.11 Each standard must agree with the verified mass $\pm 3 \mu\text{g}$. If not, reweigh the standard(s). If the mass still does not fall within the acceptable range, take appropriate corrective actions (see section 12.6).
- 9.6.12 Select an appropriate number of conditioned filters to weigh, placing within easy reach of the balance.
- 9.6.13 Exposed filters and cassettes must be inspected for signs of damage before weighing. Flag all filters that have obvious signs of damage to either the filter or filter cassette as questionable.
- 9.6.14 Weigh a Lab Blank (LB) filter first, then all exposed filters defined by the blank, including appropriate Field Blanks (FB). Pick up each filter, using the **exposed filter forceps** by the support ring only. Pick up each filter, using the designated forceps for filters, by the support ring only. Pass each filter over the ^{210}Po strips for 30–60 seconds before placing in the weighing pan for measurement. Center each filter in the middle of the balance pan when weighing.
- 9.6.15 Close the weighing chamber. Press the print button on the scale. The software will transfer the measurement when a stable reading is achieved (after the symbol ° disappears from the upper left corner of the balance display).
- 9.6.16 After the measurement is transferred, open the weighing chamber and return each filter to its designated petri dish after weighing, double checking filter numbers on the filters and petri dishes.
- 9.6.17 One filter in each group of ten filters is weighed in duplicate. Weigh the filter, remove the filter from the weighing pan, and again weigh the filter. See section 12.12 for acceptance criterion.
- 9.6.18 Reweigh the 300 mg. working standard after every duplicate filter, using the **standard** forceps. Each standard must agree with the verified mass $\pm 3 \mu\text{g}$.
- 9.6.19 Repeat steps 9.6.12 through 9.6.19 until all necessary filters are weighed.
- 9.6.20 After all filters are weighed, reweigh the 300 mg working standard twice and then the 500 mg. working standard. Handle the mass standards using the **standard** forceps. Resume the macro.
- 9.6.21 The batch is now ready to be reviewed in LIMS by the “AQ_Sup.”

10. CALCULATIONS AND REPORTING

10.1 The net filter loading is calculated by the following equation:

$$M_{2.5} = (M_f - M_i) \times 10^3$$

Where $M_{2.5}$ = total mass of particulates collected during the sampling period, in μg .
 M_f = final mass of the equilibrated filter after sample collection, in mg
 M_i = initial mass of the equilibrated filter before sample collection, in mg
 10^3 = units conversion ($10^3 \mu\text{g}/\text{mg}$)

- 10.2 Record filter weights in **milligrams** (mg).
- 10.3 Report the net difference (final weight – initial weight) in **micrograms** (µg).
- 10.4 Additional information for filters are noted as 3-digit qualifiers; see table 15.2.
- 10.5 Completed filter data is archived for a period of three (3) years following completion.

11. METHOD PERFORMANCE

- 11.1 The accuracy of the microbalance is assessed every 6 months, more often if indicated, using the certified Class 1 mass standards (200, 300 & 500 mg). The balance measurement must agree within ± 25 µg of the certified value.
- 11.2 The precision of the microbalance is assessed every 6 months, more often if indicated, using the certified Class 1 mass standards (200, 300 & 500 mg). The standard deviation of replicate measurements of each standard is compared to a pre-defined
- 11.3 Each working standard is verified against the appropriate certified class 1 primary mass standard every 6 months. The working standard must agree with the certified value within 25 µg.
 - 11.3.1 The acceptable range for the 200-mg working standard is 199.975 – 200.025 mg.
 - 11.3.2 The acceptable range for the 300-mg working standard is 299.975 – 300.025 mg.
 - 11.3.3 The acceptable range for the 500-mg working standard is 499.975 – 500.025
- 11.4 The precision of filter measurements is evaluated by replicate weighings of one filter out of every 10 filters weighed. Replicate weighings must agree within 15 µg.

12. QUALITY CONTROL

- 12.1 Filter Integrity Check: Before any filter can be weighed, either as a pre-sampled (unexposed) or post-sampled (exposed), the integrity of the filter and support ring must be examined. Refer to table 15.1 for parameters and criteria.
- 12.2 The calibration of the microbalance is checked yearly by a certified technician.
- 12.3 Class 1 primary mass standards are **certified** annually by a certified metrologist. These standards are used to verify the working standards.
- 12.4 Class 1 primary mass standards are **weighed** every 6 months, to assess balance accuracy and precision. Weigh each standard in duplicate and record in the appropriate file.
- 12.5 Working standards (200, 300 & 500 mg.) are verified against the Class 1 primary mass standards every 6 months. The measured value must be within 25 µg of the certified value. Record these values.
- 12.6 Working standards (300 & 500 mg.) are used to verify the balance calibration before every weighing session. The acceptable range is verified ± 3 µg. If the working standards are outside these limits, re-weigh the working standards. If the standards are still outside these limits, take corrective actions, including taring (zeroing) the balance, weighing the primary standards, passing the standards over the ^{210}Po strips, or other measures.

12.7 Weighing should only be done when the balance room conditions meet the following criteria:

The mean relative humidity should be between 30.0-40.0%, with control of not more than $\pm 5.0\%$ change in the 24 hours immediately prior to weighing.

The mean temperature should be between 20.0-23.0°C, with control of not more than $\pm 2.0^\circ\text{C}$ change in the 24 hours immediately prior to weighing.

Control of both temperature and humidity may be demonstrated by calculating the arithmetic mean (AM) and standard deviation (SD) of the values taken from the data logger for the twenty-four hours prior to weighing.

$$AM = \frac{1}{n} \sum_{i=1}^n a_i = \frac{1}{n} (a_1 + a_2 + \dots + a_n)$$

$$SD = \sqrt{\frac{1}{N} \sum_{i=1}^N (x - \mu)^2}$$

12.7.1 If these conditions cannot be achieved, the data must be flagged appropriately. Investigate and document possible causes and solutions.

12.8 Filter Exposure Lot Blank (Section 3.15): Three (3) filters are randomly selected from each filter lot and designated as Exposure Lot Blanks. The 3 filters are conditioned for a minimum of 24 hours, then weighed on consecutive days until such time that the 24-hour weight change is less than 15 μg . While conditioning, the petri dishes must be open. If the exposure lot blanks do not agree within $\pm 15 \mu\text{g}$, return the blanks for further conditioning. When three (3) consecutive daily weighings agree within $\pm 15 \mu\text{g}$, all filters of the same lot as the exposure lot blanks may be pre-sampled once they have conditioned for the same length of time as did the blanks.

12.9 Lab Blank (Section 3.16): Weigh a minimum of three (3) Lab Blank (LB) filters at each pre-sampling weighing session. One lab blank filter must be weighed at each post-sampling weighing session. Do NOT use a lab blank for more than one post-sampling weighing session. The acceptable weight difference (post-sampling minus pre-sampling) must be within $\pm 15 \mu\text{g}$.

12.9.1 If the difference is $> 15 \mu\text{g}$, contamination in the conditioning and/or weighing areas should be suspected. The analyst must take appropriate corrective actions,

including: Reweigh the working mass standards and verify they are within acceptable range; weigh a second lab blank. If a second lab blank also shows $> 15 \mu\text{g}$ difference, do not proceed with filter weighing, but advise the section supervisor. If a second lab blank also shows $< 15 \mu\text{g}$ difference, proceed with filter weighing, but investigate possible sources of contamination and take corrective actions to eliminate them.

12.10 Field Blank (Section 3.14): Weigh all Field Blanks (FB) submitted with the group(s) of filters to be weighed at each post-sampling (exposed filter) weighing session. The acceptable weight difference (post-sampling minus pre-sampling) must be within $\pm 30 \mu\text{g}$.

12.10.1 If the difference is $> 30 \mu\text{g}$, but the lab blanks are within acceptable range, the analyst should return the filters to the conditioning area, as the filters may have not had adequate time to condition.

12.10.2 After further conditioning, if the difference is $> 30 \mu\text{g}$, but the lab blanks are within acceptable range, contamination in the field/sampling process should be suspected. The sample filters defined by the specific field blank that is out of acceptable range should be flagged.

12.10.3 If the difference is $> 30 \mu\text{g}$, and the lab blanks are out of the acceptable range, contamination in the conditioning and/or weighing areas should be suspected. The analyst must take appropriate corrective actions.

12.11 Post-sampled (exposed) $\text{PM}_{2.5}$ filters should weigh approximately 110-160 mg.

Exposed filters outside this range should be investigated by the client or an independent party.

12.12 Replicate measurements of the filter selected for duplicate weighing (section 9.3.15 and 9.6.18) should agree within $2 \mu\text{g}$. If the difference is greater than $2 \mu\text{g}$, reweigh the filter. If the difference is still greater than $\pm 2 \mu\text{g}$, reweigh both working standards. If the standards are within the acceptable range (section 12.5), reweigh the last group of filters (since the last measurement of the 300-mg. working standard).

12.13 DI water is obtained from the SLD house DI water system and is filtered to 18 megaohms resistance prior to use.

12.14 The tacky mat outside the balance room shall be changed at least once each week, more often if indicated.

12.15 The Dickson Hygrometer/Thermometer is the environmental monitor of record for the filters processed. The circular data charts record continuous data for 1-week periods and the charts are kept on file for a period of 3 years.

13. SAFETY

13.1 ^{210}Po strips are alpha emitters and should not be touched directly.

13.2 Analysts must not be in the 2348A balance room when they have compromises to their skin (cuts, abrasions, etc.) that are exposed to the ^{210}Po strips. In all such cases, the analyst must cover the compromised skin with bandages, clothing, or gloves as appropriate.

- 13.3 Appropriate PPE should be worn in the balance rooms to minimize and protect against exposure from α -particle emissions from Po^{210} . Minimum PPE includes safety glasses, lab coat, and gloves.

14. REFERENCES

- 14.1 Code of Federal Regulations, Part 40 parts 53 and 58.
- 14.2 Quality Assurance Document 2.12. *Monitoring $\text{PM}_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods*. U.S. EPA April 1998.
- 14.3 Quality Assurance Guidance Document. *Model Quality Assurance Project Plan for the $\text{PM}_{2.5}$ Ambient Air Monitoring Program at State and Local Air Monitoring Stations (SLAMS)*. EPA-454/R-98-005. April 1998.
- 14.4 CAHN Technical Note. *Static Control for Balances by Jerry Weil*. Cahn Instruments, Inc.
- 14.5 *Quality Assurance Guidance Document 2.12 Monitoring $\text{PM}_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods* EPA 454/B-16-001 January 2016).
- 14.6 *NAAMC Contract Lab Training: 2016 National Ambient Air Monitoring Conference*; Greg Noah; US EPA QA/QPS; Stephanie McCarthy, US EPA Region 4

15. TABLES

15.1 Filter Integrity Check

Each pre-sampled (unexposed) filter must be inspected for, and pass the criteria described in the table below.

Filter Integrity Checklist	
Filter Defect.	Defect description
Pinhole	A small hole appearing as: a distinct and obvious bright point of light when examined over a light table or a dark spot when viewed over a dark surface.
Separation of ring	Any separation or lack of seal between the filter and filter border reinforcing the ring.
Chaff or flashing	Any extra material on the reinforcing ring or on the heat seal area that would prevent an airtight seal during sampling.
Loose Material	Any extra loose material or dirt particles on the filter.
Discoloration	Any obvious discoloration that might be evidence of contamination.
Filter nonuniformity	Any obvious nonuniformity in the appearance of the filter when viewed over a light or dark surface that might indicate gradations in porosity or density across the face of the filter.
Other	A filter with any imperfection not described above, such as irregular surfaces or other indications of poor manufacture.

15.2 Qualifiers

The following qualifiers are used to provide additional information regarding the conditioning and/or weighing processes.

Code	Definition	Description
ALT	Alternate Measurement	The subject parameter was determined using an alternate measurement method. Value is believed to be accurate but could be suspect.
AVG	Average Value	Average value-used to report a range of values.
CAN	Canceled	The analysis of this parameter was canceled and not performed.
FFB	Failed Field Blank	Field blank samples exceeded acceptance criteria limits.
FLB	Failed Laboratory Blank	Laboratory blank samples exceeded acceptance criteria limits.
FLD	Failed Laboratory Duplicate	Laboratory duplicate samples exceeded acceptance criteria limits.
FLH	Failed Laboratory Humidity	Laboratory humidity exceeded acceptance criteria limits.
FLT	Failed Laboratory Temperature	Laboratory temperature exceeded acceptance criteria limits.
FQC	Failed Quality Control	The analysis result is not reliable because quality control criteria were exceeded when the analysis was conducted. Numeric field, if present, is estimated value.
GSI	Good Shipping Integrity	Integrity of filter upon receipt by shipping/receiving looked good.
HTE	Holding Time Exceeded	Filter holding time exceeded acceptance criteria limits.
ISP	Improper Sample Preservation	Due to improper preservation of the sample, it was rendered not suitable for analysis.
INV	Invalid Sample	Due to a single or multiple flags or events, the sample was determined to be invalid.
LAC	Laboratory Accident	There was an accident in the laboratory that either destroyed the sample or rendered it not suitable for analysis.
OTH	Other	Miscellaneous event(s) occurred requiring further explanation.
REJ	Rejected	The analysis results have been rejected for an unspecified reason by the laboratory. For any results where a mean is being determined, this data was not utilized in the calculation of the mean.

APPENDIX A

List of equipment used in SLD Gravimetric Laboratory

Analytical Microbalance

Mettler XP6 microbalance (Serial Number B607093202).

Capacity 6.1 grams

Readability 1 μ g.

Repeatability 0.0008 mg

Linearity 0.004 mg

Hygrometer and temperature logger

Dickson THDX (Serial Number 8002212) #

Appendix B: Archiving of 47mm air filters.

This appendix describes the procedure for archiving filters used in the EPA ambient air program. Filters require storage under controlled conditions and should be available for reanalysis if needed. Filters that have been exposed, returned to SLD and conditioned for weighing to determine the net gravimetric difference need to be properly stored as described below.

1. Equipment:

- 1.1. SR walk in refrigerator (SLD room G392B) maintained at 0-4°C with Reese™ computer monitored temperature control. One storage shelf is reserved for AHM.
- 1.2. AHM Prep-lab storage area for ambient storage of 47 filters (SLD Room2366A)
- 1.3. Analyslide™ Petri-Dishes with storage boxes
- 1.4. 47mm Teflon Filters
- 1.5. Aluminum foil rolls, 12" in width
- 1.6. Plastic wrap rolls, 12" in width.
- 1.7. Electronic Filter Logbook

2. Procedure for Preparing Filters for Archival Storage

- 2.1. In preparation for storage, the filters should be placed in Analyslide™ Petri Dishes used to house the filters during conditioning, weighing, and handling in the laboratory. Each Petri Dish is labeled with the manufacturer's filter number as well as the SLD accession number, (with barcode) and allows for ease of tracking and retrieval during storage. Each filter is also recorded onto an electronic logbook (Excel spreadsheet) (See Figure 2). The logbook documents the storage time and dates and location so that filters can be stored, retrieved and disposed of according to EPA requirements.
- 2.2. When filter placement in the Petri Dishes is complete, the filters are then placed in storage boxes as described below.
- 2.3. The Analyslide™ Petri Dishes come in boxes of 25 and these boxes will be used for storage. Each box will have a label affixed that contains the following information:

CY	20XX
Box X	
Zm	<u>Cold Disp Date</u> Jan-Year
	<u>Ambient Storage Disp. Date</u> Jan-Year

Where:

CY 20XX is the Calendar Year that the filter was exposed.

Box X is a unique serial number assigned to each box. For each calendar year the Box x is reset to Box 1.

Zm is the particle fraction determined at the time of exposure. (2.5m or 10m.)

Cold Disp Date: Jan-Year. For 2.5m particulate fractions, this is the date after which filters may be removed from cold storage.

Ambient Storage Disp. Date Jan-Year. For 2.5m and 10m particulate fractions, this is the date after which filters may be discarded.

2.4. Logbook for tracking filters

2.4.1. The Filter Logbook will contain the following fields for each filter.

- 2.4.1.1. Year the sample was exposed. (Year)
- 2.4.1.2. SLD accession number assigned to each filter. (SLD#)
- 2.4.1.3. The manufacturer's filter number (Filter #)
- 2.4.1.4. Sampling Site (Site)
- 2.4.1.5. User Code used for billing purposes (User Code)
- 2.4.1.6. Box 1 (Box #)
- 2.4.1.7. Information on void status (Void)
- 2.4.1.8. Analyst (Analyst)
- 2.4.1.9. Position of the filter in the Analyslide™ Petri Dish box (Box Position)
- 2.4.1.10. Particle Size (Particle Size)

2.5 Filters from the 2.5m and 10m size particle fractions will be stored in separate boxes and not intermingled. Filters will be stored sequentially in their respective boxes based upon the SLD number assigned to them. An example of a logbook page is represented by Figure 2 below. The Filter Logbook will be kept electronically on the AHM drive @ F:\Air Filter Storage Archive

Year	SLD #	Filter #	Site	User code	Box #	Void	Analyst	Box position	Particle size
2013	2013022083	T2658588	6Q	55625	1	X	RSF	1	2.5
2013	2013022084	T2658589	6Q	55625	1		RSF	2	2.5
2013	2013022085	T2658590	6ZG	55625	1		RSF	3	2.5
2013	2013022086	T2658591	6ZG	55625	1		RSF	4	2.5
2013	2013022087	T2658592	6ZG	55625	1		RSF	5	2.5
2013	2013022088	T2658593	6ZG	55625	1		RSF	6	2.5
2013	2013022089	T2658594	6ZG	55625	1		RSF	7	2.5
2013	2013022090	T2658595	6ZG	55625	1		RSF	8	2.5

Figure 2. A sample of the Filter Logbook page that contains all the required fields.

2.6 PM2.5 and PM10 Filter Storage: All PM filters will require storage in a refrigerated environment. The storage temperature should be maintained 0-4°C. They are to be placed in the Analyslide™ Petri Dish box and then wrapped with a single layer of plastic wrap followed by a single layer of aluminum foil wrap. Each box will have a label affixed on the end and a label on the outer aluminum foil wrap. They will be stored

under refrigerated conditions in Shipping and Receiving Section Refrigerated Storage room G392B

3. Filter Storage Time Limits

- 3..1. PM2.5 and PM10 filters will be stored in cold storage during the calendar year in which they were exposed plus one additional calendar year. After that they may be stored at ambient temperature for an additional four years.

Revision 2.1 February 20, 2011

- Eliminated milligram, microgram, and millimeter definitions from definitions sections.
- Defined LIMS as the database system of record for AQ gravimetric analysis
- Defined the business procedures that are appropriate for carrying out LIMS operations.
- Moved description of filters and related equipment from definitions to equipment section.
- Moved references to specific equipment to Appendix A.
- Referenced rooms now currently in use in the new SLD building for AQ gravimetric analysis.
- Consolidated 47mm PM₁₀ into this document.

Revision 2.2 August 27th, 2013

- Added Appendix B which describes archiving procedure for 47mm filters.

Revision 3.0 March 26, 2018

- Added changes requested by EPA through NMED AQB.
 - Revise acceptance ranges for temperature, relative humidity weighing checks, field blank checks to reflect precision to decimal criteria recommended in EPA QAH App D. and change definition of Lab Control to be determined by mean and standard deviation of values in the previous 24-hour period per 40 CFR 58. Method 2.12 Section 10.4.1.3.
- Revised Appendix B to reflect EPA recommendation to follow 40 CFR 58.16(f) requirement to store all 47mm filters in cold storage for 1 year and ambient storage for an additional 4 years.
- Update EPA reference material to reflect most current EPA documentation and guidance.

QTRAK # _____

APPENDIX C

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU

Appendix C to 2020 Ambient Air Monitoring QAPP: Network Elements Spreadsheet

New Mexico Monitoring Network in 2019

Continuous Monitors & Non-Continuous Monitors

Is site proposed to be removed/moved within next 18 months?

Site AQS #	Site Name	Station Type	Site Address	Latitude	Longitude	Pollutants Measured	Analysis Method	Operating Schedule	Monitoring Objective	NAAQS Comparable ?	msa/csa/esa represented	Spatial Scale
35-045-1005	1H Substation	SLAMS	Shiprock Electrical Substation, Waterflow, NM 87421	36.7976	-108.5801	Ozone	U.V. Photometric	Continuous	General Background	Yes	Farmington MSA	Regional
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	General Background	Yes	Farmington MSA	Regional
		SLAMS				Sulfur Dioxide	Pulsed Fluorescence	Continuous	Source Oriented	Yes	Farmington MSA	Regional
		SPM				PM ₁₀	Continuous; BAM-1020	Continuous	General Background	Yes	Farmington MSA	Regional
35-045-0009	12B Bloomfield	SLAMS	2200 N 1st Street, Bloomfield, NM 87413	36.7421	-107.9774	Ozone	U.V. Photometric	Continuous	General Background	Yes	Farmington MSA	Neighborhood
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	General Background	Yes	Farmington MSA	Neighborhood
		SLAMS				Sulfur Dioxide	Pulsed Fluorescence	Continuous	Source Oriented	Yes	Farmington MSA	Neighborhood
35-045-0018	1N1 Navajo Lake	SLAMS	423A Highway 539, Navajo Dam, NM 87419	36.8097	-107.6514	Ozone	U.V. Photometric	Continuous	Regional Transport	Yes	Farmington MSA	Middle
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	Regional Transport	Yes	Farmington MSA	Middle
35-061-0008	21L Los Lunas	SLAMS	1000 W. Main St, Los Lunas, NM 87031	34.8147	-106.7410	Ozone	U.V. Photometric	Continuous	Population Exposure	Yes	Albuquerque MSA	Neighborhood
35-043-1001	22J Bernalillo	SLAMS	600 Oak Street, Bernalillo NM 87004	35.2998	-106.5470	Ozone	U.V. Photometric	Continuous	Population Exposure	Yes	Albuquerque MSA	Neighborhood
35-039-0026	3CRD Coyote Ranger District	SLAMS	21 New Mexico 96, Coyote, NM 87012	36.1877	-106.6984	Ozone	U.V. Photometric	Continuous	Regional Transport	Yes	Albuquerque Santa Fe Las Vegas CSA	Regional
35-049-0021	3SFA Santa Fe Airport	SLAMS	2001 Aviation Dr, Santa Fe, NM 87507	35.6198	-106.0797	Ozone	U.V. Photometric	Continuous	Population Exposure	Yes	Santa Fe MSA	Neighborhood
		SLAMS				PM _{2.5}	Continuous; BAM-1020	Continuous	Population Exposure	Yes	Santa Fe MSA	Neighborhood
35-055-0005	32D Taos	SLAMS	123 Camino de Santiago Fire Station, Taos, NM 87571	36.3833	-105.5849	PM _{2.5}	Continuous; BAM-1020	Continuous	Population Exposure	Yes	Taos MSA	Neighborhood
35-015-1005	52R Carlsbad	SLAMS	2811 Holland St., Carlsbad, NM 88220	32.3840	-104.2640	Ozone	U.V. Photometric	Continuous	General Background	Yes	Carlsbad-Artesia, CBSA/MSA	Urban
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	General Background	Yes	Carlsbad-Artesia, CBSA/MSA	Urban
35-025-0008	52S Hobbs Jefferson	SLAMS	2320 N. Jefferson St., Hobbs, NM 88240	32.7268	-103.1230	Ozone	U.V. Photometric	Continuous	Population Exposure	Yes	Hobbs CBSA/MSA	Neighborhood
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	Population Exposure	Yes	Hobbs CBSA/MSA	Neighborhood
		SLAMS				PM _{2.5}	Continuous; BAM-1020	Continuous	General Background	Yes	Hobbs CBSA/MSA	Neighborhood
35-013-0016	6CM Anthony	SLAMS	705 Church St., Anthony, NM 88021	32.0033	-106.5992	PM ₁₀	Sequential FRM	Every 6th Day	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM ₁₀	Co-located Continuous; BAM-1020	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM _{2.5}	Continuous; BAM-1020	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM _{2.5}	Co-located Sequential FRM	Every 3rd Day	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
35-013-0008	60 La Union	SLAMS	7048 McNurt, La Union, NM 88021	31.9187	-106.6330	Ozone	U.V. Photometric	Continuous	General Background	Yes	El Paso-Las Cruces CSA	Urban
35-013-0024	63M West Mesa	SLAMS	West Mesa Well #46, Las Cruces, NM 88005	32.2781	-106.8649	PM ₁₀	Continuous; BAM-1020	Continuous	Up Wind Background	Yes	El Paso-Las Cruces CSA	Urban
35-013-0019	62L Holman Road	SLAMS	Las Cruces Well #41, Las Cruces, NM 88012	32.4246	-106.6739	PM ₁₀	Continuous; BAM-1020	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Urban
35-013-0020	62K Chaparral	SLAMS	680 McCombs, Chaparral, NM 88081	32.0409	-106.4955	Ozone	U.V. Photometric	Continuous	General Background	Yes	Not in an MSA	Urban
		SLAMS				PM ₁₀	Continuous; BAM-1020	Continuous	Population Exposure	Yes	Not in an MSA	Neighborhood
35-013-0021	62M Desert View	SLAMS	5935A Valle Vista, Sunland Park, NM 88063	31.7961	-106.8839	Ozone	U.V. Photometric	Continuous	General Background	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM ₁₀	Continuous; BAM-1020	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM _{2.5}	Sequential FRM	Every 3rd Day	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
		SLAMS				PM _{2.5}	Co-located Sequential FRM	Every 3rd Day	Population Exposure	Yes	El Paso-Las Cruces CSA	Neighborhood
35-013-0022	62N Santa Teresa	SLAMS	104-2 Santa Teresa Int'l. Blvd., Santa Teresa, NM 88063	31.7881	-106.6826	Ozone	U.V. Photometric	Continuous	General Background	Yes	El Paso-Las Cruces CSA	Urban
		SLAMS				Nitrogen Dioxide	Chemiluminescence	Continuous	General Background	Yes	El Paso-Las Cruces CSA	Urban
		SLAMS				PM _{2.5}	Continuous; BAM-1020	Continuous	General Background	Yes	El Paso-Las Cruces CSA	Urban
35-013-0023	62Q Solano	SLAMS	750 N. Solano Drive, Las Cruces, NM 88001	32.3187	-106.7675	Ozone	U.V. Photometric	Continuous	Population Exposure	Yes	El Paso-Las Cruces CSA	Urban
35-013-0025	6Q Las Cruces	SLAMS	2301 Entrada del Sol, Las Cruces, NM 88001	32.3103	-106.7512	PM _{2.5}	Continuous; BAM-1020	Continuous	Regional Transport	Yes	El Paso-Las Cruces CSA	Neighborhood
35-029-0003	7E Deming Airport	SLAMS	3412 Raymond Reed Blvd., Deming, NM 88030	32.2538	-107.7227	PM ₁₀	Continuous; BAM-1020	Continuous	Population Exposure	Yes	Deming CBSA/MSA	Neighborhood

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APPENDIX D

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU

Ozone Validation Template

1) Requirement (O ₃)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
Monitor	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & <u>FRM/FEM method list</u>
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. 3.1.1 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 <u>Technical Note on AMTIC</u>
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) <u>QA Handbook Volume 2 Sec. 12.3</u> 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 <u>AMTIC</u> 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 <u>AMTIC Technical Memo</u>
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 Every 365 days and 1/ calendar year	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		Concentrations below LDL	1) 40 CFR Part 50 App D Sec. 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			

1) Requirement (O ₃)	2) Frequency	3) Acceptance Criteria	Information /Action
Certification/recertification to Standard Reference Photometer (Level 1)	Every 365 days and 1/calendar year	single point difference $< \pm 3.1\%$	1) 40 CFR Part 50 App D Sec. 5.4 2 and 3) <u>Transfer Standard Guidance EPA-454/B-10-001</u> Level 2 standard (formerly called primary standard) usually transported to EPA Regions SRP for comparison 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
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, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
(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	
Ozone Transfer standard (Level 3 and greater)			
Qualification	Upon receipt of transfer standard	$< \pm 4.1\%$ or $< \pm 4$ 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 $\leq 3.7\%$ 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 O ₃ season or every 182 days and 2/calendar year whichever less	New slope = ± 0.05 of previous and RSD of six slopes $\leq 3.7\%$ 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 AQ5)	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	$\geq 90\%$ (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	$\geq$ 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	$\geq$ 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
<i>Sample Probe, Inlet, Sampling train</i>	<i>All sites</i>	<i>Borosilicate glass (e.g., Pyrex®) or Teflon®</i>	3) 40 CFR Part 58 App E, Sec. 9 (c) 1) 40 CFR Part 58 App E, Sec. 9 (a) 2) Recommendation 3) 40 CFR Part 58 App E, 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
<i>Siting</i>	Every 365 days and 1/calendar year	<i>Meets siting criteria or waiver documented</i>	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
<i>Precision (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	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
<i>Bias (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	95% CL < $\pm 7.1\%$	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

NO₂, NO_x, NO Validation Template

1) Requirement (NO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- NO ₂			
<i>Sampler/Monitor</i>	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
<i>One Point QC Check Single analyzer</i>	<i>Every 14 days</i>	< ±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
<i>Converter Efficiency</i>	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
<i>Annual Performance Evaluation Single Analyzer</i>	<i>Every site every 365 days and 1/calendar year</i>	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
<i>Federal Audits (NPAP)</i>	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
<i>Verification/Calibration</i>	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 $\leq \pm 2.1\%$ or $\leq \pm 1.5$ ppb difference of best-fit straight line whichever is greater and Slope $1 \pm .05$	1) 40 CFR Part 50 App F 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
<i>Gaseous Standards</i>	All gas cylinders	<u>NIST Traceable</u> (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 <u>Green Book</u> 3) 40 CFR Part 50 App F Sec. 1.3.1. A technical memo may change the concentration requirement. Gas producer used must participate in EPA <u>Ambient Air Protocol Gas Verification Program</u> 40 CFR Part 58 App A Sec. 2.6.1
<i>Zero Air/ Zero Air Check</i>	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 $< \pm 2.1\%$	1, 2 and 3) Recommendation based on SO ₂ 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.			
<i>Noise</i>	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
<i>Lower detectable level</i>	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- NO₂			
<i>Standard Reporting Units</i>	<i>All data</i>	<i>ppb (final units in AQS)</i>	1, 2 and 3) 40 CFR Part 50 App S Sec. 2 (c)
<i>Rounding convention for data reported to AQ S</i>	<i>All routine concentration data</i>	<i>1 place after decimal with digits to right truncated</i>	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.
<i>Completeness</i>	<i>Annual Standard</i>	$\geq 75\%$ 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)
	<i>1-hour standard</i>	1) 3 consecutive calendar years of complete data 2) 4 quarters complete in each year 3) $\geq 75\%$ sampling days in quarter 4) $\geq 75\%$ 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

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1) Requirement (NO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
<i>Sample Residence Time Verification</i>	Every 365 days and 1/ calendar year	$\leq 20 \text{ Seconds}$	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 9 (c)
<i>Sample Probe, Inlet, Sampling train</i>	<i>All sites</i>	<i>Borosilicate glass (e.g., Pyrex®) or Teflon®</i>	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
<i>Siting</i>	Every 365 days and 1/ calendar year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, Secs 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
<i>Precision (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>90% CL CV < 15.1%</i>	1) <u>40 CFR Part 58 App A</u> 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
<i>Bias (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>95% CL < $\pm 15.1\%$</i>	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

SO₂ Validation Template

1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- SO₂			
<i>Sampler/Monitor</i>	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
<i>One Point QC Check Single analyzer</i>	<i>Every 14 days</i>	< ±10.1% (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. 2.3.1.2 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 < ± 10.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA- SO₂			
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 180 days and 2/calendar year	< ± 2.1° C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
<i>Annual Performance Evaluation Single Analyzer</i>	<i>Every site every 365 days and 1/calendar year</i>	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 Technical Memo
<i>Federal Audits (NPAP)</i>	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
<i>Verification/Calibration</i>	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	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 A-1 Sec. 4 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points)
<i>Gaseous Standards</i>	<i>All gas cylinders</i>	NIST Traceable (e.g., EPA Protocol Gas)	Slope criteria is a recommendation 1) 40 CFR Part 50 App A-1 Sec. 4.1.6.1 2) NA Green Book 3) 40 CFR Part 50 App F Sec. 1.3.1 Producers must participate in Ambient Air Protocol Gas

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1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
<i>Zero Air/ Zero Air Check</i>	Every 365 days and 1/ calendar year	Concentrations below LDL < 0.1 ppm aromatic hydrocarbons	Verification Program 40 CFR Part 58 App A Sec. 2.6.1 1) 40 CFR Part 50 App A-1 Sec. 4.1.6.2 2) Recommendation 3) Recommendation and 40 CFR Part 50 App A-1 Sec. 4.1.6.2
<i>Gas Dilution Systems</i>	Every 365 days and 1/ calendar year or after failure of 1 point QC check or performance evaluation	<i>Accuracy < ± 2.1 %</i>	1) 40 CFR Part 50 App A-1 Sec. 4.1.2 2) Recommendation 3) 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.			
<i>Noise</i>	Every 365 days and 1/ calendar year	≤ 0.001 ppm (standard range) ≤ 0.0005 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
<i>Lower detectable level</i>	Every 365 days and 1/ calendar year	≤ 0.002 ppm (standard range) ≤ 0.001 ppm (lower range)	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1

SYSTEMATIC CRITERIA- SO₂

<i>Standard Reporting Units</i>	<i>All data</i>	<i>ppb (final units in AQS)</i>	1, 2 and 3) 40 CFR Part 50 App T Sec. 2 (c)
<i>Rounding convention for design value calculation</i>	<i>All routine concentration data</i>	<i>1 place after decimal with digits to right truncated</i>	1, 2 and 3) 40 CFR Part 50 App T Sec. 2 (c) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
<i>Completeness</i>	<i>1 hour standard</i>	Hour – 75% of hour Day- 75% hourly Conc Quarter- 75% complete days Years- 4 complete quarters 5-min value reported only for valid hours	1, 2 and 3) 40 CFR Part 50 App T Sec. 3 (b), (c) More details in CFR on acceptable completeness. 5-min values or 5-min max value (40 CFR part 58.16(g)) only reported for the valid portion of the hour reported. If the hour is incomplete no 5-min or 5-min max reported.
<i>Sample Residence Time Verification</i>	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)
<i>Sample Probe, Inlet, Sampling train</i>	<i>All sites</i>	<i>Borosilicate glass (e.g., Pyrex®) or Teflon®</i>	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
<i>Siting</i>	Every 365 days and 1/ calendar year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, Sec. 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
<i>Precision (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>90% CL CV < 10.1%</i>	1) 40 CFR Part 58 App A Sec. 2.3.1.6 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2

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1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
Bias (using 1-point QC checks)	Calculated annually and as appropriate for design value estimates	95% CL < ± 10.1%	1) 40 CFR Part 58 App A Sec. 2.3.1.6 & 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 (PM _{2.5} LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Filter Based Local Conditions			
Field Activities			
Sampler/Monitor	NA	<i>Meets requirements listed in FRM/FEM/ARM designation</i>	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	<i>all filters</i>	<i>≤ 30 days before sampling</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.5
Sample Recovery	<i>all filters</i>	<i>≤ 7 days 9 hours from sample end date</i>	1, 2 and 3) 40 CFR Part 50, App. L 10.10
Sampling Period (including multiple power failures)	<i>all filters</i>	<i>1380-1500 minutes, or if value < 1380 and exceedance of NAAQS $\frac{\mu}{\mu}$ midnight to midnight local standard time</i>	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	<i>every 24 hours of op</i>	<i>average within 5% of 16.67 liters/minute</i>	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	<i>every 24 hours of op</i>	<i>CV ≤ 2%</i>	1, 2 and 3) 40 CFR Part 50, App L Sec. 7.4.3.2
One-point Flow Rate Verification	<i>every 30 days each separated by 14 days</i>	<i>≤ ± 4.1% of transfer standard < ± 5.1% of flow rate design value</i>	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	<i>After multi-point calibration or verification</i>	<i>< ± 2.1% of design flow rate</i>	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
Individual Flow Rates	<i>every 24 hours of op</i>	<i>no flow rate excursions > ±5% for > 5 min. $\frac{\mu}{\mu}$</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.1
Filter Temp Sensor	<i>every 24 hours of op</i>	<i>no excursions of > 5° C lasting longer than 30 min $\frac{\mu}{\mu}$</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.11.4
External Leak Check	<i>Before each flow rate verification/calibration and before and after PM_{2.5} separator maintenance</i>	<i>< 80.1 mL/min (see comment #1)</i>	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	<i>If failure of external leak check</i>	<i>< 80.1 mL/min</i>	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
<i>Post-sampling Weighing</i>	<i>all filters</i>	<i>Protected from exposure to temperatures above 25°C from sample retrieval to conditioning</i> <i>≤10 days from sample end date if shipped at ambient temp, or</i> <i>≤30 days if shipped below avg ambient (or 4° C or below for avg sampling temps < 4° C) from sample end date</i>	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
<i>Filter Visual Defect Check (unexposed)</i>	<i>all filters</i>	<i>Correct type & size and for pinholes, particles or imperfections</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 10.2
<i>Filter Conditioning Environment</i>			
<i>Equilibration</i>	<i>all filters</i>	<i>24 hours minimum</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.5
<i>Temp. Range</i>	<i>all filters</i>	<i>24-hr mean 20.0-23.0° C</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.1
<i>Temp. Control</i>	<i>all filters</i>	<i>< 2.1° C SD* over 24 hr.</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.2 SD use is a recommendation
<i>Humidity Range</i>	<i>all filters</i>	<i>24-hr mean 30.0% - 40.0% RH or Within ±5.0 % sampling RH but ≥ 20.0%RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.3
<i>Humidity Control</i>	<i>all filters</i>	<i>< 5.1 % SD* over 24 hr.</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.4 SD use is a recommendation
<i>Pre/post Sampling RH</i>	<i>all filters</i>	<i>difference in 24-hr means < ± 5.1% RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.3
<i>Balance</i>	<i>all filters</i>	<i>located in filter conditioning environment</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.2
<i>Microbalance Auto-Calibration</i>	<i>Prior to each weighing session</i>	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			
<i>One-point Temp Verification</i>	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
<i>Pressure Verification</i>	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
<i>Annual Multi-point Verifications/Calibrations</i>			
<i>Temperature multi-point Verification/Calibration</i>	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

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1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
<i>Pressure Verification/Calibration</i>	on installation, and on one-point verification failure	$\leq \pm 10.1$ 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
<i>Flow Rate Multi-point Verification/Calibration</i>	<i>Electromechanical maintenance or transport</i> or every 365 days and once a calendar year	$< \pm 2.1\%$ 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			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites by method designation</i>	CV $< 10.1\%$ of samples $\geq 3.0 \mu\text{g}/\text{m}^3$	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	$\leq \pm 2.1^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	$\leq \pm 10.1$ mm Hg	1, 2 and 3) Method 2.12 Sec. 11.2.3
<i>Semi Annual Flow Rate Audit</i>	<i>Twice a calendar year and between 5-7 months apart</i>	$< \pm 4.1\%$ of audit standard $< \pm 5.1\%$ 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) <u>Method 2.12</u> 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	$< \pm 15.1 \mu\text{g}$ 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	$< \pm 15.1 \mu\text{g}$ change between weighings	1, 2 and 3) Method 2.12 Sec. 10.5
Filter Integrity (exposed)	each filter	no visual defects	Used for preparing a subset of filters for equilibration 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	$< \pm 30.1 \mu\text{g}$ 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	$< \pm 15.1 \mu\text{g}$ 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	$< \pm 3.1 \mu\text{g}$ 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	$< \pm 15.1 \mu\text{g}$ change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8
Microbalance Audit	every 365 days and once a calendar year	$< \pm 0.003 \text{ mg}$ or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	$< \pm 2.1^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	$< \pm 2.1\%$	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	<i>At installation</i> 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	$< \pm 2.1^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	$< \pm 2.1\%$	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	$< \pm 2.1 \mu\text{g}$	1, 2 and 3) <u>Method 2.12</u> 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	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	<i>Annual Standard</i>	$\geq 75\%$ scheduled sampling days in each quarter	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
	<i>24- Hour Standard</i>	$\geq 75\%$ 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	<i>all filters</i>	$\mu\text{g}/\text{m}^3$ at ambient temp/pressure (PM _{2.5})	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Rounding convention for design value calculation	<i>all filters</i>	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
<i>Annual 3-yr average</i>	<i>all concentrations</i>	<i>nearest 0.1 µg/m³ (≥ 0.05 round up)</i>	1, 2 and 3) 40 CFR Part 50, App. N Sec. 3 and 4 Rounding convention for data reported to AQS is a recommendation
<i>24-hour, 3-year average</i>	<i>all concentrations</i>	<i>nearest 1 µg/m³ (≥ 0.5 round up)</i>	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			
<i>Lower DL</i>	<i>all filters</i>	$\leq 2 \mu\text{g}/\text{m}^3$	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.1
<i>Upper Conc. Limit</i>	<i>all filters</i>	$\geq 200 \mu\text{g}/\text{m}^3$	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.2
Precision			
Single analyzer (collocated monitors)	every 90 days	Coefficient of variation (CV) < 10.1% for values $\geq 3.0 \mu\text{g}/\text{m}^3$	1, 2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV < 10.1 % for values $\geq 3.0 \mu\text{g}/\text{m}^3$</i>	1, 2 and 3) 40 CFR Part 58, App A, Sec. 4.2.1 and 2.3.1.1
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites for PQAOs with > 5 sites</i>	$< \pm 10.1\%$ for values $\geq 3.0 \mu\text{g}/\text{m}^3$	1, 2 and 3) 40 CFR Part 58, App A, Sec. 3.2.4, 4.2.5 and 2.3.1.1
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against <u>NIST Traceable</u> standards			
<i>Flow Rate Transfer Std.</i>	every 365 days and once a calendar year	$< \pm 2.1\%$ of <u>NIST Traceable Std.</u>	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	$\pm 0.1^\circ \text{C}$ resolution, $\pm 0.5^\circ \text{C}$ accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Field Barometer	every 365 days and once a calendar year	$\pm 1 \text{ mm Hg}$ resolution, $\pm 5 \text{ mm Hg}$ accuracy	1, 2 and 3) Method 2.12 Sec. 4.2.2
Clock/timer Verification	Every 30 days	<i>1 min/mo</i>	1 and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App. L Sec. 7.4.12
Laboratory Activities			
<i>Microbalance Readability</i>	<i>At purchase</i>	<i>1 µg</i>	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

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Validation Templates from QA Handbook, Volume II (March 2017)
Relevant to NMED Monitors

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/amt/c/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 AQL, but not the NAAQS.

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Continuous, Local Conditions			
<i>Sampler/Monitor Designation</i>	NA	<i>Meets requirements listed in FRM/FEM/ARM designation</i> 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. <i>Firmware settings must be set for flowrate to operate and report at "local conditions" (i.e., not STP).</i>	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. <i>A 24-hour period is calculated in AQS if 18 or more valid hours are reported for a day L.</i>	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 separator as part of the method.
Average Flow Rate	<i>every 24 hours of operation; alternatively, each hour can be checked</i>	<i>average within 5% of 16.67 liters/minute at local conditions</i>	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	<i>every 24 hours of op</i>	<i>CV ≤ 2%</i>	1, 2 and 3) 40 CFR Part 50, App L Sec. 7.4.3.2
One-point Flow Rate Verification	<i>every 30 days each separated by 14 days</i>	<i>< ± 4.1% of transfer standard</i> <i>< ± 5.1% of flow rate design value</i>	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	<i>After multi-point calibration or verification</i>	<i>< ± 2.1% of design flow rate</i>	1,2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
External Leak Check	<i>Before each flow rate verification/calibration and before and after PM2.5 separator maintenance</i>	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. 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
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or</i> Every 365 days and 1/ calendar year	$\leq \pm 2.1\%$ 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			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites by method designation</i>	CV < 10.1% of samples $\geq 3 \mu\text{g}/\text{m}^3$	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	$\leq \pm 2.1^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	$\leq \pm 10.1 \text{ mm Hg}$	1, 2 and 3) Method 2.12 Sec. 11.2.3
<i>Semi Annual Flow Rate Audit</i>	<i>Twice a calendar year and 5-7 months apart</i>	$\leq \pm 4.1\%$ of audit standard $\leq \pm 5.1\%$ 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)	$< 2.1^\circ\text{C}$ 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	$\leq \pm 2.1^\circ\text{C}$	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) <u>Method 2.12</u> 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 $\leq \pm 5.1\%$	1, 2 and 3) TEOM SOP Sec. 10.1.2
Bypass leak check (TEOM)	every 30 days	$\pm 0.60 \text{ lpm}$	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 $\pm 1 \mu\text{g}/\text{m}^3$ (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 ($\leq 2.5\%$)	1, 2 TEOM SOP Sec. 10.3.6 3) 1405-DF operating guide. Verification software either passes or fails the verification. Acceptance criteria is $\leq 2.5\%$
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	$\leq 0.42 \text{ L/min}$	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 (PM _{2.5} 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 $\pm 1 \mu\text{g}/\text{m}^3$ (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. $< \pm 5.1\%$ 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 $< 2.4 \mu\text{g}/\text{m}^3$	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	$\geq 75\%$ 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	24-Hour Standard	$\geq 75\%$ scheduled sampling days in each quarter	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Rounding convention for data reported to AQS	all filters	$\mu\text{g}/\text{m}^3$ at ambient temp/pressure (PM _{2.5})	1. 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b)
Annual 3-yr average	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)
24-hour, 3-year average	all concentrations	nearest 0.1 $\mu\text{g}/\text{m}^3$ (≥ 0.05 round up) nearest 1 $\mu\text{g}/\text{m}^3$ (≥ 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 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	$< \pm 2.1\%$ 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	$\pm 0.1^\circ\text{C}$ resolution, $\pm 0.5^\circ\text{C}$ 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	<i>1 min/mo**</i>	1 and 2) Method 2.12 Sec. 4.2.1 3) <u>40 CFR Part 50, App.L</u> Sec. 7.4.12
Precision			
Single analyzer (collocated monitors)	every 90 days	Coefficient of variation (CV) $< 10.1\%$ for values $\geq 3.0 \mu\text{g}/\text{m}^3$	1,2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV $< 10.1\%$ for values $\geq 3.0 \mu\text{g}/\text{m}^3$</i>	1,2 and 3) 40 CFR Part 58, App A, Sec. 4.2.1 and 2.3.1.1
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites</i> <i>8 audits for PQAOs with > 5 sites</i>	<i>$< \pm 10.1\%$ for value $> 3 \mu\text{g}/\text{m}^3$</i>	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

Continuous PM10 STP Conditions Validation Template

NOTE: There are a number of continuous PM10 monitors that are designated as FEM. These monitors may have different measurement or sampling attributes that cannot be identified in this validation template. Monitoring organizations should review specific instrument operating manuals and augment the validation template with QC information specific to their EPA reference or equivalent method designation and instrument (<https://www3.epa.gov/ttn/amt/criteria.html>). In general, 40 CFR Part 58 App A and 40 CFR Part 50 App J requirements apply to Continuous PM10. Since a guidance document was never developed for continuous PM10, many of the requirements reflect a combination of manual and continuous PM2.5 requirements and are therefore considered recommendations.

1) Criteria (PM ₁₀ Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA - PM₁₀ Continuous			
<i>Sampler/Monitor</i>	N/A	<i>Meets requirements listed in FRM/FEM/ARM designation</i>	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
<i>Sampling Period</i>	all filters	1440 minutes ± 60 minutes midnight to midnight local standard time	1, 2 and 3) 40 CFR Part 50 App J Sec. 7.1.5
<i>Average Flow Rate</i>	every 24 hours of op	Average within $\pm 5.1\%$ of design	recommendation
<i>Verification/Calibration</i>			
<i>One-point Flow Rate Verification</i>	every 30 days each separated by 14 days	$\pm 7.1\%$ of transfer standard	1 and 2) 40 CFR Part 58, App A, Sec. 3.3 3) Method 2.10 Table 3-1
OPERATIONAL EVALUATIONS TABLE PM₁₀ Continuous			
<i>Verification/Calibration</i>			
<i>System Leak Check</i>	During precalculation check	Auditory inspection with faceplate blocked	1, 2 and 3) Method 2.11 Sec. 2.3.2
<i>FR Multi-point Verification/Calibration</i>	every 365 days and once a calendar year	3 of 4 cal points within $\pm 10.1\%$ of design	1) 40 CFR Part 50 App J Sec. 8.0 2 and 3) Method 2.10 Sec. 2.2.4
<i>Audits</i>			
<i>Semi Annual Flow Rate Audit</i>	Twice a calendar year and 5-7 months apart	$\pm 10.1\%$ of audit standard	1, 2) Part 58, App A, Sec. 3.3.3 3) Method 2.10 Sec. 7.1.5
<i>Monitor Maintenance</i>			
<i>Inlet/downtube Cleaning</i>	every 90 days and 4 times a calendar year	cleaned	1, 2 and 3) Method 2.10 Sec. 6.1.2
<i>Manufacturer-Recommended Maintenance</i>	per manufacturers' SOP	per manufacturers' SOP	
SYSTEMATIC CRITERIA - PM₁₀ Continuous			
<i>Siting</i>	Every 365 days and 1/ calendar year	Meets siting criteria or waiver documented	1) 40 CFR Part 58 App E, Sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sections 2-5
<i>Data Completeness</i>	24-hour quarterly	$\geq 75\%$	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b & c

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1) Criteria (PM ₁₀ Cont)	2) Frequency	3) Acceptable Range	Information /Action
Reporting Units	all filters	µg/m ³ at standard temperature and pressure (STP)	40 CFR Part 50 App K
Rounding convention for design value calculation			
24-hour, 3-year average	quarterly	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.
Verification/Calibration Standards	and 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.J Sec. 7.3 2) Method 2.11 Sec. 1.1.3 3) 40 CFR Part 50, App.J Sec. 7.3
Field Thermometer	every 365 days and once a calendar year	± 0.1° C resolution, ± 0.1° C accuracy	1, 2 and 3) Method 2.10 Sec. 1.1.2
Field Barometer	every 365 days and once a calendar year	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.10 Sec. 1.1.2
Clock/timer Verification	every 180 days and twice a calendar year	15 min/day	1) 40 CFR Part 50, App.J Sec. 7.1.5 2) Recommendation 3) 40 CFR Part 50, App.J Sec. 7.1.5

PM₁₀ Low Volume STP Filter-Based Local Conditions Validation Template

Monitoring organizations can use low-volume PM instruments for PM₁₀ monitoring. However, PM₁₀ 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 PM₁₀ 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}, PM₁₀-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 (PM ₁₀ Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM₁₀ Lo-Vol Filter Based STP			
Field Activities			
Sampler/Monitor	NA	<i>Meets requirements listed in FRM/FEM/ARM designation</i>	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Sample Recovery	<i>all filters</i>	<i>≤7 days 9 hours from sample end date</i>	1, 2 and 3) 40 CFR Part 50 App L Sec. 10.10
Pre-sampling	<i>all filters</i>	<i>≤ 30 days before sampling</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.5
Sampling Instrument			
Average Flow Rate	<i>every 24 hours of op</i>	<i>average within < 5.1% of 16.67 liters/minute</i>	1, 2 and 3) Part 50 App L Sec. 7.4.3.1
Variability in Flow Rate	<i>every 24 hours of op</i>	<i>CV < 2.1%</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.2
One-point Flow Rate Verification	<i>every 30 days each separated by 14 days</i>	<i>< ± 4.1% of transfer standard < ± 5.1% of flow rate design value</i>	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	<i>at one-point or multi-point verification/calibration</i>	<i>< ± 2.1% of design flow rate</i>	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
Individual Flow Rates	<i>every 24 hours of op</i>	<i>no flow rate excursions > ±5.1% for > 5 min. L/L</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.3.1
Filter Temp Sensor	<i>every 24 hours of op</i>	<i>no excursions of > 5° C lasting longer than 30 min L/L</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 7.4.11.4
External Leak Check	<i>Before each flow rate verification/calibration and before and after maintenance</i>	<i>< 80.1 mL/min (see comment #1)</i>	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	<i>every 5 sampling events</i>	<i>< 80.1 mL/min</i>	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
<i>Post-sampling Weighing</i>	<i>all filters</i>	<i>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</i>	1, 2 and 3) 40 CFR Part 50 App L Sec. 8.3.6
<i>Filter Visual Defect Check (unexposed)</i>	<i>all filters</i>	<i>Correct type & size and for pinholes, particles or imperfections</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 10.2
<i>Filter Conditioning Environment</i>			
<i>Equilibration</i>	<i>all filters</i>	<i>24 hours minimum</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.5
<i>Temp. Range</i>	<i>all filters</i>	<i>24-hr mean 20.0-23.0° C</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.1
<i>Temp. Control</i>	<i>all filters</i>	<i>< 2.1° C SD* over 24 hr</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.2 SD use is recommendation
<i>Humidity Range</i>	<i>all filters</i>	<i>24-hr mean 30.0% - 40.0% RH or <5.1% sampling RH but ≥ 20.0%RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.3
<i>Humidity Control</i>	<i>all filters</i>	<i>< 5.1% SD* over 24 hr.</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.2.4 SD use is recommendation
<i>Pre/post Sampling RH</i>	<i>all filters</i>	<i>difference in 24-hr means < ± 5.1% RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.3
<i>Balance</i>	<i>all filters</i>	<i>located in filter conditioning environment</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec. 8.3.2
OPERATIONAL EVALUATIONS TABLE PM₁₀ Lo-Vol Filter Based STP			
Field Activities			
<i>Sampling Instrument</i>			
<i>Routine Verifications</i>			
<i>One-point Temp Verification</i>	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
<i>Pressure Verification</i>	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			
<i>Temperature multi-point Verification/Calibration</i>	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
<i>Pressure Verification/Calibration</i>	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
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or</i> every 365 days and once a calendar year	$< \pm 2.1\%$ 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 manufacturer's op manual	per manufacturer's operating manual	1, 2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites</i>	CV < 10.1% of samples $\geq 3.0 \mu\text{g}/\text{m}^3$	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	$< \pm 2.1^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 11.2.2
Pressure Audit	every 180 days and at time of flow rate audit	$< \pm 10.1 \text{ mm Hg}$	1, 2 and 3) Method 2.12 Sec. 11.2.3
<i>Semi Annual Flow Rate Audit</i>	<i>Twice a calendar year and 5-7 months apart</i>	$< \pm 4.1\%$ of audit standard $< \pm 5.1\%$ 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 manufacturer's SOP	per manufacturer's SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	$< \pm 15.1 \mu\text{g}$ 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	$< \pm 15.1 \mu\text{g}$ change between weighings	1, 2 and 3) Method 2.12 Sec. 10.5
Filter Integrity (exposed)	each filter	no visual defects	Used for preparing a subset of filters for equilibration 1, 2 and 3) Method 2.12 Sec. 10.3 and 10.7
Lab QC Checks			
<i>Field Filter Blank</i>	10% or 1 per weighing session	$< \pm 30.1 \mu\text{g}$ 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
<i>Lab Filter Blank</i>	10% or 1 per weighing session	$< \pm 15.1 \mu\text{g}$ 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	$< \pm 3.1 \mu\text{g}$ 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	$< \pm 15.1 \mu\text{g}$ 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	$\leq \pm 0.003$ mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	$\leq \pm 2.1^{\circ}\text{C}$	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	$\leq \pm 2.1\%$	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	$\leq \pm 2.1^{\circ}\text{C}$	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	$\leq \pm 2.1\%$	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	$\leq \pm 2.1$ 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 - PM₁₀ 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	$\geq 75\%$ scheduled sampling days in each quarter	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b
Reporting Units	all filters	$\mu\text{g}/\text{m}^3$ 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 $10 \mu\text{g}/\text{m}^3$ (≥ 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	$\leq 2 \mu\text{g}/\text{m}^3$	1, 2 and 3) 40 CFR Part 50, App. L Sec. 3.1
Upper Conc. Limit	all filters	$\geq 200 \mu\text{g}/\text{m}^3$	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) $< 10.1\% \geq 3.0 \mu\text{g}/\text{m}^3$	1, 2 and 3) Recommendation
Single analyzer	1/ yr	$\text{CV} < 10.1\% \geq 3.0 \mu\text{g}/\text{m}^3$	1, 2 and 3) Recommendation
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of $\text{CV} < 10.1\% \geq 3 \mu\text{g}/\text{m}^3$	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
<i>Flow Rate Transfer Std.</i>	every 365 days and once a calendar year	$< \pm 2.1\%$ of <i>NIST Traceable Std.</i>	1) 40 CFR Part 50, App. I Sec. 9.1 & 9.2 2) Method 2.12 Sec 4.2.2 & 6.4.3 3) 40 CFR Part 50, App. I Sec. 9.1 & 9.2
Field Thermometer	every 365 days and once a calendar year	$\pm 0.1^{\circ}\text{C}$ resolution, $\pm 0.5^{\circ}\text{C}$ 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	<i>1 min/mo</i>	1 and 2) Method 2.12 Sec. 4.2.1 3) 40 CFR Part 50, App. I Sec. 7.4.12
Laboratory Activities			
<i>Microbalance Readability</i>	<i>at purchase</i>	<i>1 μg</i>	1, 2 and 3) 40 CFR Part 50, App. I Sec. 8.1 1) Method 2.12 Sec. 4.3.6
Microbalance Repeatability	at purchase	1 μg	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.			

QTRAK # _____

APPENDIX E

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU

United States Environmental Protection Agency

This Certifies that

Donna Intermont

*has satisfactorily completed a training program in
Quality Project & Program Management
at Sandia Pueblo, New Mexico on May 14-16, 2013*



A handwritten signature in black ink, appearing to read "Donald L. Johnson", is written over a horizontal line.

Donald L. Johnson, Instructor

A handwritten signature in black ink, appearing to read "Walter R. Helmick", is written over a horizontal line.

Walter R. Helmick, Instructor

A handwritten signature in black ink, appearing to read "Donald L. Johnson", is written over a horizontal line.

Donald L. Johnson

Regional Quality Assurance Manager

United States Environmental Protection Agency

This Certifies that

Mary Hilbert

*has satisfactorily completed a training program in
Orientation to Quality Assurance Management
at San Felipe Pueblo, New Mexico on September 27, 2010*



Donald L. Johnson
Donald L. Johnson, Instructor

Donald L. Johnson
Donald L. Johnson
Regional Quality Assurance Manager

United States Environmental Protection Agency

This Certifies that

Mary Hilbert

*has satisfactorily completed a training program in
Data Quality Objectives
at San Felipe Pueblo, New Mexico on September 28, 2010*



Walter R. Helmick, Instructor

Donald L. Johnson
Regional Quality Assurance Manager

United States Environmental Protection Agency

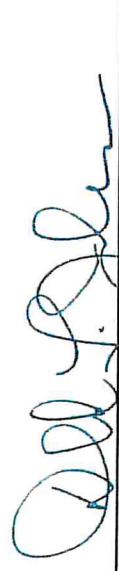
This Certifies that

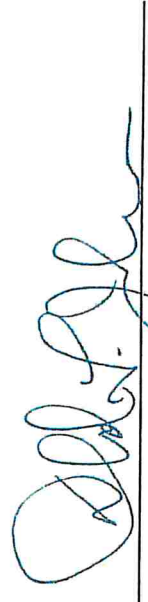
Mary Hilbert

*has satisfactorily completed a training program in
Quality Management Plan and Quality Assurance Project Plan
Seminar*

at San Felipe Pueblo, New Mexico on September 29-30, 2010




Donald L. Johnson, Instructor


Donald L. Johnson
Regional Quality Assurance Manager

QTRAK # _____

APPENDIX F

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

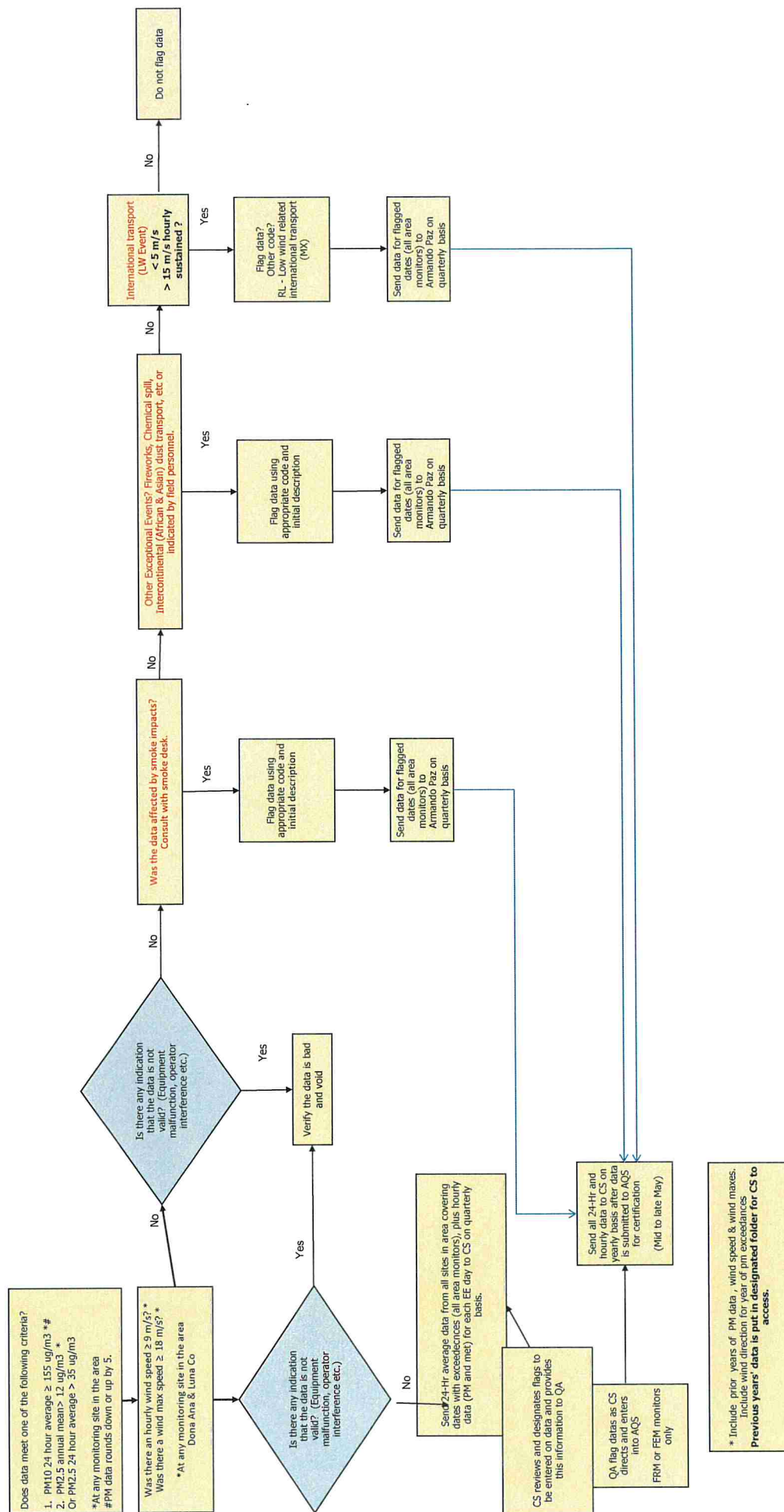
2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU

Appendix F to 2020 New Mexico Ambient Air Monitoring QAPP

Exceptional Events Flagging Process



QTRAK # _____

APPENDIX G

To

QUALITY ASSURANCE PROJECT PLAN
FOR AMBIENT AIR MONITORING

2020

NEW MEXICO ENVIRONMENT DEPARTMENT

AIR QUALITY BUREAU

Appendix G to 2020 New Mexico Ambient Air Monitoring QAPP

Table of Standard Operating Procedures included in the Air Quality Bureau's Standard Operating Procedure Manual for Ambient Air Monitoring and Quality Assurance

Control ID	Standard Operating Procedure	Revision Number	Effective Date	Section
AQB1-01	146i Calibration SOP	5	April 2019	Monitoring
AQB1-02	2025A/i Calibration - Maintenance SOP	1.7	February 2019	Monitoring
AQB1-03	42i Calibration using 146i	0	May 2019	Monitoring
AQB1-04	43i Calibration using 146i	0	May 2019	Monitoring
AQB1-05	49i Calibration SOP (using 49i-QPS)	0	May 2019	Monitoring
AQB1-06	BAM 1020 SOP	0	April 2019	Monitoring
AQB1-07	Campbell CR21X Met Data Download SOP	0	July 2018	Monitoring
AQB1-08	e-BAM SOP	0	October 2019	Monitoring
AQB1-09	Operators Daily Site Check SOP	1.1	November 2018	Monitoring
AQB2-01	Calibration of Dynamic Dilution Calibrator, Model T700	1	July 2019	Quality Assurance
AQB2-02	Reviewing Chain of Custody Forms	1	February 2019	Quality Assurance
AQB2-03	Corrective Action Report	4	February 2019	Quality Assurance
AQB2-04	Data Certification	2	May 2019	Quality Assurance
AQB2-05	Data Entry to AQS	0	January 2020	Quality Assurance
AQB2-06	Review & Validation of Data	0	April 2019	Quality Assurance
AQB2-07	Instrument and Equipment Labeling	0	November 2016	Quality Assurance
AQB2-08	Backfilling Data into Envista ARM	0	May 2019	Quality Assurance
AQB2-09	Meteorological Monitoring Parts Replacement - Adjustment	0	August 2017	Quality Assurance
AQB2-10	Monitoring Siting Criteria Audit	5	October 2019	Quality Assurance
AQB2-11	Operation of Alicat Flow Meters	0	May 2016	Quality Assurance
AQB2-12	Meteorological Audits	0	August 2016	Quality Assurance
AQB2-13	QA Field Accuracy Audit of Chemiluminescent 42i NO-NO ₂ -NO _x Analyzer	1	May 2019	Quality Assurance
AQB2-14	QA Field Accuracy Audit of Pulsed Fluorescence 43i SO ₂ Analyzer	0	January 2019	Quality Assurance
AQB2-15	QA Field Accuracy Audit of UV Photometric 49i Ozone Analyzers	1	May 2019	Quality Assurance
AQB2-16	QA Field Accuracy Auditing of Non-Continuous 2025i Partisol PM ₁₀ and PM _{2.5} Sequential Air Samplers	0	March 2018	Quality Assurance
AQB2-17	Qualification, Verification and Reverification of the QA 49iPS Ozone Transfer Standard	0	January 2019	Quality Assurance
AQB2-18	Standards for Conducting Ambient Air Monitoring Network Audits	0	January 2018	Quality Assurance
AQB2-19	Roles of Monitoring and Quality Assurance Sections in Documenting Exceptional Events	0	November 2018	Quality Assurance
AQB2-20	Calibrating Field Temperature Meters Using the Fluke 7109A Calibration Bath	0	May 2019	Quality Assurance
AQB2-21	Calibration of Alicat Flow Meters using Fluke Molbox1+	0	October 2019	Quality Assurance
AQB2-22	Calibration of Multi-Gas Calibrator, Model 146iQ	0	June 2019	Quality Assurance
AQB2-23	Quarterly Analysis of Daily Zero Data	0	October 2019	Quality Assurance
AQB2-24	Performing a QA Audit on the BAM 1020 Particulate Monitor	1	November 2019	Quality Assurance
AQB2-25	Qualification, Verification and Reverification of the QA 49iQPS Ozone Transfer Standard	0	Draft	Quality Assurance

