Quality Assurance Project Plan For Particulate Matter Pollutant Air Monitoring Program

February 2020

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Section A1 – Title and Approval Sheet

APPROVALS		
California Air Resources Board		
	Signature	**Date**
Catherine Dunwoody, Chief Monitoring and Laboratory Division		
Michael Benjamin, Chief Air Quality Planning and Science Division		
Manisha Singh, Chief Quality Management Branch		
Ravi Ramalingam, Chief Consumer Products and Air Quality Assessment Branch		
Kathy Gill, Chief Air Quality Surveillance Branch		
Michael Werst, Chief Northern Laboratory Branch		
Sylvia Vanderspek, Chief Air Quality Planning Branch		
United States Environmental Protection Agency		
Audrey Johnson, Manager Quality Assurance Office, Region 9	Audrey L Johnson Digitally signed by Audrey L Johnson Date: 2020.09.16 11:53:16 -07'00'	
Monitoring Organizations in the California Air Resources Board Primary Quality Assurance Organization Adopting this QAPP (including Addendum)		
Antelope Valley AQMD		
Eastern Kern APCD		
Great Basin UAPCD		
Imperial APCD		
Lake County AQMD		
Mendocino County AQMD		
Mojave Desert AQMD		
Monterey Bay ARD		

North Coast UAQMD		
Northern Sierra AQMD		
Northern Sonoma County APCD		
Placer County APCD		
Sacramento Metropolitan AQMD		
San Joaquin Valley APCD		
San Luis Obispo APCD		
Shasta County AQMD		
Siskiyou County APCD		
Tehama County APCD		
Yolo-Solano AQMD		

FOREWORD

This Quality Assurance Project Plan (QAPP) for the California Air Resources Board's (CARB) Particulate Matter Air Monitoring Program is a comprehensive document that describes in detail the necessary quality assurance, quality control, and all other technical activities implemented to ensure that program-specific work satisfies required performance criteria. This QAPP has been developed to be consistent and conform with all applicable laws and regulations, CARB's Quality Management Plan (QMP) and quality assurance policies, including the United States Environmental Protection Agency's (U.S. EPA) Chapter 5 of Manual CIO 2105-P-01-0 [formally Chapter 5 of U.S. EPA Order 5360 A1 (U.S. EPA 2000)]. This QAPP was developed using the U.S. EPA Quality Assurance regulations and guidance described in *EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans* and the accompanying document *EPA QA/G-5, Guidance for Quality Assurance Project Plans*. All pertinent elements of regulations and guidance are referenced in this QAPP.

Section A2 – Table of Contents and Acronyms

List of Acronyms

ADAM	Aerometric Data Analysis and Management
AIS	Audit Information System
AMN	Air Monitoring North
AMS	Air Monitoring South
ANP	Annual Network Plan
APCD	Air Pollution Control District
AQDA	Air Quality Data Action
AQMD	Air Quality Management District
AQMIS	Air Quality and Meteorological Information System
AQPB	Air Quality Planning Branch
AQPSD	Air Quality Planning and Science Division
AQS	Air Quality System
AQSB	Air Quality Surveillance Branch
ARM	Approved Regional Method
ASAP	As soon as possible
ASD	Administrative Services Division
BAAQMD	Bay Area Air Quality Management District
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAMN	Community Air Monitoring North Section
CAMS	Community Air Monitoring South Section
CAN	Corrective Action Notification
CARB	California Air Resources Board
CASTNET	Clean Air Status and Trends Network
CBSA	Core Based Statistical Area
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CL	Confidence Limit
CO	Carbon Monoxide
CPAQAB	Consumer Products and Air Quality Assessment Branch
CRM	Certified Reference Material
CSN	Chemical Speciation Network
CV	Coefficient of Variation
DAS	Data Acquisition System
DASC	Data Assessment Statistical Calculator
DGS	Department of General Services
DMS	Data Management System
DQA	Data Quality Assessment
DQO	Data Quality Objectives

FEM	Federal Equivalent Method
FRM	Federal Reference Method
FRSD	Full-scale Relative Standard Deviation
GFC	Gas Filter Correlation
ILS	Inorganic Laboratory Section
IR	Infrared
LIMS	Laboratory Information Management System
LSS	Laboratory Support Section
MLD	Monitoring and Laboratory Division
MO	Monitoring Organization
MQO	Measurement Quality Objectives
MSA	Metropolitan Statistical Area
N_2	Nitrogen
NAAQS	National Ambient Air Quality Standard
NCore	National Core Multipollutant Monitoring Network
NDIR	Non-Dispersive Infrared Method
NIST	National Institute of Standards and Technology
NLB	Northern Laboratory Branch
nm	Nanometer
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
NPAP	Nation Performance Audit Program
NPS	National Park Service
O_3	Ozone
OAQPS	Office of Air Quality Planning and Standards (U.S. EPA)
ODSS	Operations and Data Support Section
OIS	Office of Information Services
OMB	Office of Management and Budget
OTech	Office of Technology
PAMS	Photochemical Assessment Monitoring Stations
Pb	Lead
PE	Performance Evaluation
PM	Particulate Mater
PM10	Particulate Matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
PM2.5	Particulate Matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PMc	Particulate Matter with an aerodynamic diameter between a nominal 2.5 and 10 micrometers

ppm	Parts per Million
PQAO	Primary Quality Assurance Organization
PTFE	Polytetrafluoroethylene
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Section
QC	Quality Control
QCM	Quality Control Manual
QMB	Quality Management Branch
QMP	Quality Management Plan
QMS	Quality Management Section
R&R	Roles and Responsibilities
RSD	Relative Standard Deviation
SCAQMD	South Coast Air Quality Management District
SD	Standard Deviation
SDCAPCD	San Diego County Air Pollution Control District
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur Dioxide
SO_4	Sulfates
SOP	Standard Operating Procedure
SPM	Special Purpose Monitors
SRM	Standard Reference Material
TSA	Technical Systems Audit
U.S. EPA	United States Environmental Protection Agency
µg	Microgram
µm	Micrometer
UV	Ultraviolet

Section A3 – Distribution List

To ensure that CARB's quality assurance policies are appropriately distributed and inherent in all applicable ambient air quality data collection processes, the QAPP for the Particulate Matter Air Monitoring Program is distributed to the following:

- Persons listed in the APPROVALS section (A1).
- CARB's Monitoring and Laboratory Division (MLD) supervisory and line staff involved in any aspect of this Particulate Matter Pollutant Monitoring Program.
- All designated contacts in the monitoring organizations within CARB's Primary Quality Assurance Organization (PQAO).

Distribution is performed by sending an email notification via CARB's PQAO Contact List, placing this document in CARB's Quality Assurance Document Repository at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository, and maintaining hardcopies at CARB's Quality Management Branch Office. Training of staff within CARB's PQAO will include QAPP content and location of all available quality assurance documents.

Section A4 – Project/Task Organization

A4.1 – Introduction

The U.S. Environmental Protection Agency (U.S. EPA) designated the California Air Resources Board (CARB) as one of the seven Primary Quality Assurance Organizations (PQAO) responsible for monitoring ambient air pollution in California. U.S. EPA also designated the Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), San Diego County Air Pollution Control District (SDCAPCD), National Parks Service (NPS), Morongo Band of Mission Indians, and Pechanga Band of Luiseño Indians as their own PQAOs. A PQAO is responsible for managing its own air monitoring quality assurance programs and reporting ambient air quality, precision and accuracy data to the U.S. EPA Air Quality System (AQS) database.

CARB's PQAO consists of CARB and 32 local air monitoring organizations (MO) throughout California, of which 21 collect ambient air monitoring data. Within this PQAO, CARB operates approximately 20 air monitoring stations that include particulate matter (PM) samplers, while another approximately 100 monitoring stations with PM samplers are operated by local monitoring organizations.

California is divided geographically into 15 air basins, encompassing 58 counties. Some counties lie in more than one basin. Several different local air districts or monitoring organizations may operate monitoring stations in a given air basin. The geographical jurisdictions of local air monitoring organizations in California range from a portion of a county to several counties or an entire air basin.

The air monitoring data generated define the nature and severity of pollution in California, determine attainment status with California Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS), identify pollution trends, support agricultural burn forecasting, provide real-time air quality information, assess community exposure, and validate air quality models and emission inventories. CARB develops and adopts a State Implementation Plan (SIP) that delineates the strategy for bringing areas under its jurisdiction into compliance with federal clean air standards. To attain these goals, CARB employs an air monitoring network that includes monitoring of gaseous criteria and non-criteria pollutants, particulate matter pollutants, toxic air contaminants, pesticides, meteorological parameters, and greenhouse gases.

CARB management policy requires that sufficient quality assurance activities be conducted to demonstrate that all data collected by, and on behalf of, CARB are scientifically and legally valid for the purposes for which they are intended.

The purpose of this Particulate Matter Air Monitoring Program Quality Assurance Project Plan (QAPP) is to document management policy and those activities and procedures necessary for accomplishing specified program objectives. This QAPP shall comply with all applicable laws and regulations, CARB's Quality Management Plan (QMP), and quality assurance policies and procedures at the time of adoption and/or most recent review to ensure the quality of data reported meets all program objectives. CARB will utilize separate QAPP documents for gaseous pollutants, meteorological parameters, and non-criteria toxic pollutants.

All particulate matter air monitoring measurement activities performed by staff within CARB, by participating monitoring organizations in CARB's PQAO, or performed on behalf of CARB shall comply with the quality assurance policies and procedures specified in this QAPP. Each monitoring organization within CARB's PQAO has responsibility for ensuring that operation of the air monitoring network is conducted in accordance with approved procedures and data collected is of sufficient quantity and quality to meet intended objectives. CARB's goal is to work cooperatively and collaboratively with monitoring organizations within its PQAO to consistently produce high quality air monitoring data.

The quality assurance system and procedures set forth in this document apply to CARB and all monitoring organizations within its PQAO, unless alternative quality management documents and procedures are approved by CARB and U.S. EPA. All substantive deviations to this QAPP must be documented in an Addendum. The deviation documentation must describe a district-specific process that differs from, but meets the same quality and regulatory criteria, as a CARB process. The Addendums must be submitted to CARB for review and approval. The Addendum process is described in CARB's Document Repository at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository. A monitoring organization within CARB's PQAO may choose to utilize an alternative QAPP. The alternative QAPP must be submitted to CARB for review and written approval prior to implementation.

This QAPP adheres to U.S. EPA QAPP requirements set forth in the document *Guidance for Quality Assurance Project Plans*, U.S. EPA QA/G-5, December 2002. This document is divided into the element groups summarized in Table A.1 – QAPP Elements.

Table A.1 – QAPP Elements

	Group A - Project Management		Group B - Data Generation and Acquisition		Group C – Data Validation and Verification
A1	Title and Approval Sheet	**B1**	Sampling Process Design	**C1**	Data Review, Verification, and Validation
A2	Table of Contents	**B2**	Monitoring Methods	**C2**	Verification and Validation Methods
A3	Distribution List	**B3**	Sample Handling and Custody		
A4	Project/Task Organization	**B4**	Analytical Methods		**Group D – Assessment, Oversight, and Usability**
A5	Project Definition and Background	**B5**	Quality Control	**D1**	Assessments and Response Actions
A6	Program Description	**B6**	Instrument/Equipment Calibration and Frequency	**D2**	Reports to Management
A7	Quality Objectives and Criteria For Measurement Data	**B7**	Instrument/Equipment Testing, Inspection, and Maintenance	**D3**	Reconciliation with User Requirements
A8	Special Training/ Certifications	**B8**	Inspection/Acceptance of Supplies and Consumables		
A9	Documents and Records	**B9**	Data Management		
		B10	Non-Direct Measurements		

A4.2 – Project/Task Organization

CARB's organizational structure is described in CARB's Quality Management Plan for Ambient Air Monitoring (QMP), Section 1.5 and Appendices D - F, and monitoring organizations within CARB's PQAO are listed in Appendix A. The most recently dated version of the Particulate Matter Air Monitoring Program QAPP or the QMP will include the most up to date organization structure. These documents will be revised every five years. The Particulate Matter Air Monitoring Program is the responsibility of the Monitoring and Laboratory Division (MLD) and the Air Quality Planning and Science Division (AQPSD) within CARB. The roles and responsibilities of these divisions are

outlined in the QMP and Roles and Responsibilities Documents: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/roles-responsibility-agreements.

Below is a description of the responsibilities of CARB divisions and sections which are involved in the Particulate Matter Air Monitoring Plan. Please see Appendix A.2 of this document for a CARB organization chart of these applicable groups.

Within MLD, the Air Quality Surveillance Branch (AQSB) conducts most of CARB's continuous and filter-based particulate matter samplers at ambient air monitoring stations throughout California. All permanent stations are assigned with qualified station operators who are responsible for station operation, quality assurance/quality control (QA/QC) activities, data management, preventive maintenance, and minor repairs of sampling equipment. In addition, AQSB staff is responsible for the verification and validation and upload to AQS of ambient air monitoring data. These actions are performed by the following sections:

The Air Monitoring South Section (AMS), Air Monitoring North Section (AMN), and Operations and Data Support Section (ODSS) support CARB's quality control program for the regulatory monitoring network by performing measurements and providing data to help define the nature, extent, and trend of the air pollution problem. The AMS and AMN sections are responsible for coordinating the operation, installation, and maintenance of air monitoring instrumentation as well as performing various data management activities. This includes the calibration of field instrumentation at both CARB and District air monitoring stations located throughout California. ODSS supports CARB's ambient air monitoring programs by providing various support services, such as evaluations, acceptance tests, repairs, modifications, etc. In addition, the section administers the branch's data management systems and is responsible for both real-time and data for record reporting to CARB's ambient air data clients. These sections also provide technical support to CARB PQAO local monitoring organizations.

The two sections of the Community Air Monitoring Branch (CAM) that are involved with the Particulate Matter Air Monitoring Program are the Community Air Monitoring North (CAMN) and Community Air Monitoring South (CAMS) sections. These sections conduct special purpose monitoring to support the regulatory network or special projects using temporary and mobile air monitoring stations and equipment.

The two sections of the Northern Laboratory Branch (NLB) that are involved with the Particulate Matter Air Monitoring Program are the Inorganic Laboratory and Laboratory Support Sections.

The Inorganic Laboratory Section (ILS) is responsible for laboratory services of ambient air analyses related to the Particulate Matter Air Monitoring Program, including pre-

and post-sampling gravimetric analysis of particulate filter media. The section is also responsible for sample QA/QC activities, laboratory data verification and validation, and overseeing preventive maintenance and minor repairs of laboratory equipment.

The Laboratory Support Section (LSS) supports CARB's ambient air monitoring programs by providing various support services, such as sample handling and management, health and safety, and QA/QC activities. In addition, the section administers the branch's Laboratory Information Management System (LIMS) and is responsible for upload to AQS of laboratory data.

The two sections of the Quality Management Branch (QMB) that are involved with the Particulate Matter Air Monitoring Program are the Quality Assurance and Quality Management Sections.

The Quality Assurance Section (QAS) has primary responsibility for conducting performance audits of the field monitoring instrumentation used in support of California's ambient air monitoring network. Audits of special monitoring programs may also be conducted to ensure that data quality meets the purpose and objectives of the monitoring program. QAS is responsible for issuing Air Quality Data Action (AQDA) requests and initiating appropriate corrective action responses for issues discovered during performance audits. QAS also provides certification and verification services for flow and gaseous calibration standards. Additionally, QAS and the Quality Management Section (QMS) work together to conduct Technical Systems Audits (TSA) and to provide training to CARB and districts throughout California.

QMS has the responsibility of acting as liaison between CARB and monitoring organizations within CARB's PQAO. Additional responsibilities include coordination and communication of QA/QC information; development and management of the air monitoring training program; and review and assessment of air monitoring programs. These activities are conducted to ensure compliance with state and federal requirements pertaining to sample collection and analysis, and validation and reporting of ambient air monitoring data. QMS also assists QMB's Chief with preparation and review of quality management documents to ensure that consistent practices are performed within CARB's PQAO.

The Air Quality Planning and Science Division (AQPSD) also has a significant role in the Particulate Matter Air Monitoring Program. AQPSD evaluates the air monitoring network to ensure that it meets federal monitoring requirements, creates the Annual Network Plan and five year network assessment, uploads ambient data for 10 air districts, certifies regulatory data annually for those 10 air districts and MLD, reports data for exceptional events, and develops and maintains the State's Air Quality and Meteorological Information System (AQMIS) and Aerometric Data Analysis and Management (ADAM) air quality databases. This work is conducted within the Air Quality Analysis Section (AQAS) and the Air Quality and Statistical Studies Section

(AQSSS) in the Consumer Products and Air Quality Assessment Branch (CPAQAB), and the Central Valley Air Quality Planning Section (CVAQPS) within the Air Quality Planning Branch (AQPB).

The Air Quality Analysis Section (AQAS) is responsible for conducting a number of complex air quality investigations. Another major area of responsibility includes conducting data evaluations to support federal designations, classifications, and nonattainment. Staff also prepare portions of the State Implementation Plans, including Weight of Evidence assessments for ozone. Other duties include preparing federally mandated monitoring network plans and network assessment plans and working with air districts, U.S EPA, and MLD to implement network plans for revised federal standards, including the ongoing evaluation of monitor siting issues.

The Air Quality and Statistical Studies Section (AQSSS) also conducts complex air quality investigations. Staff supports development of the State Implementation Plans and has the primary responsibility within the Branch for the evaluation of air toxics data. This Section is responsible for developing, programing, and maintaining CARB's air quality databases, ADAM and AQMIS, and transferring data from U.S. EPA's database AQS to ADAM. ADAM houses CARB's data for record that underlies critical air quality programs.

The Central Valley Air Quality Planning Section (CVAQPS) is responsible for all PM air quality planning issues related to the San Joaquin Valley as well as certain other areas of the State. The section is lead in the preparation of PM2.5 State Implementation Plans (SIP), PM10 SIPs, the California Regional Haze Plan, and PM-related technical analyses and policy papers. CVAQPS is also responsible for PM data analysis related to air quality planning, including the development of PM-related technical work used to demonstrate attainment of the NAAQS. The Section routinely reviews particulate matter exceedances of air quality standards resulting from natural events for the purpose of evaluating the applicability of U.S. EPA's Exceptional Events Rule and its impact on air quality planning. CVAQPS works with divisions throughout CARB, as well as with local air districts, U.S. EPA, and various stakeholder groups.

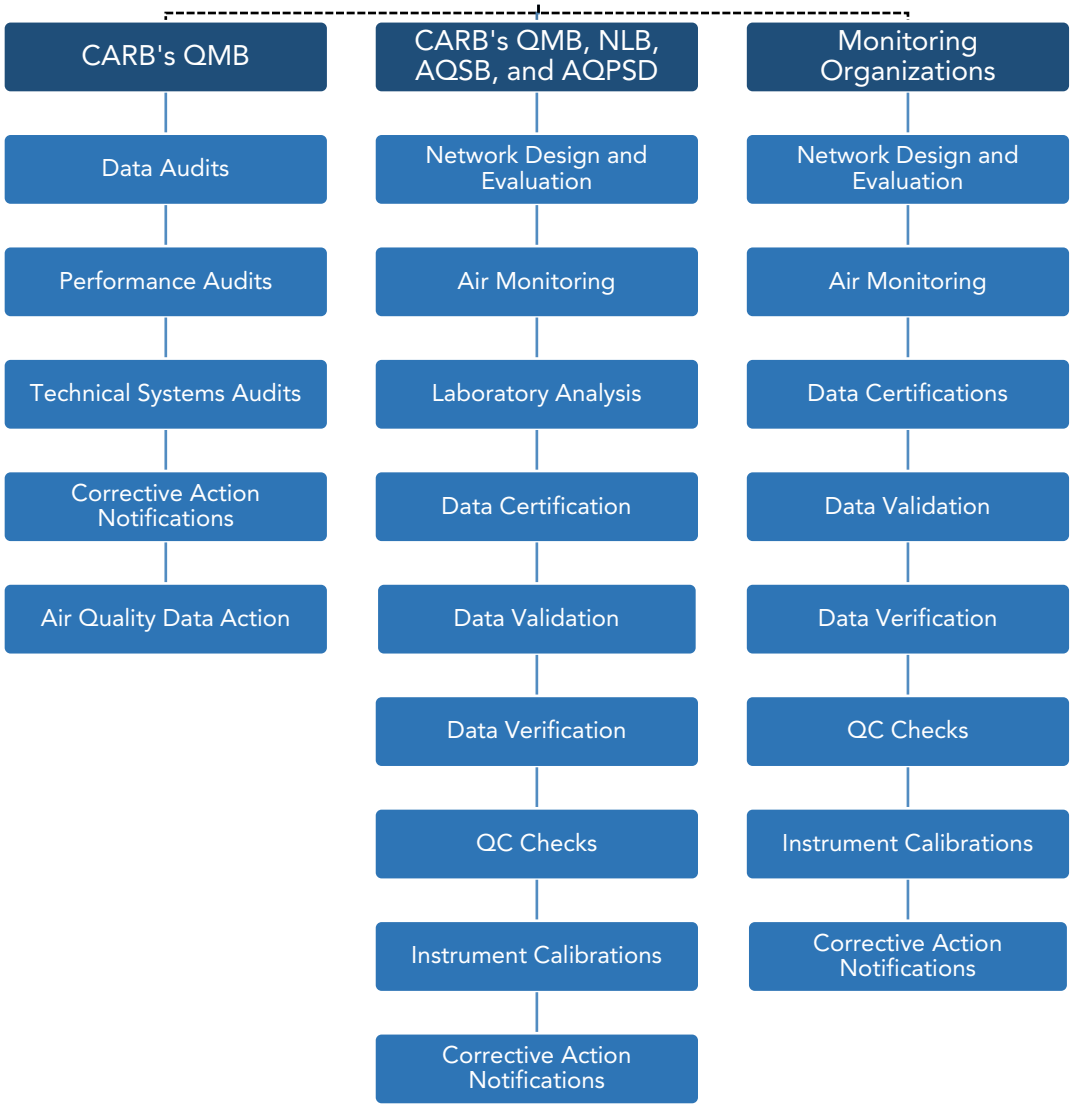
CARB PQAO and MO staff work closely with U.S. EPA's Office of Air Quality Planning and Standards (OAQPS). OAQPS is the organization charged under the authority of the Clean Air Act to protect and enhance the quality of the nation's air resources. Among other responsibilities, OAQPS provides technical and quality assurance information, evaluates quality system performance through Technical Systems Audits (TSA), and reviews and approves PQAO QAPPs.

On an ongoing basis, some laboratory services for the PM monitoring program are provided by partnering agencies SDAPCD and BAAQMD. These agencies are required to be capable of achieving project measurement quality objectives and data quality objectives to ensure continuity of data quality throughout the CARB PQAO.

Should a failure of CARB laboratory equipment occur such that PM analysis cannot be performed, CARB has contingency agreements with PM laboratories at BAAQMD, SCAQMD, and SDAPCD to provide PM monitoring laboratory services where available. CARB also provides back-up laboratory services to these PQAO partnering agencies, wherever feasible, should a failure of their systems occur. MOs who utilize laboratory services of partnering agencies should include this information or agreements in applicable SOPs or addendums.

Figure A.1 below is a function summary for the CARB PQAO. Please note that dotted lines indicate oversight.

Figure A.1 – CARB and Monitoring Organization Function Summary



The responsibilities for the local monitoring organizations may be covered by the monitoring organization or collaboratively with CARB. Specific responsibilities are outlined in the Roles and Responsibilities (R&R) document developed between CARB and each monitoring organization. These documents are available on the CARB Document Repository at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/roles-responsibility-agreements. The CARB Roles and Responsibilities document is provided as an example of the information covered in the R&R documents along with the R&R Template in Appendix A.1. In instances where U.S. EPA feels Roles and Responsibilities require U.S. EPA to communicate directly with districts, CARB should be provided notification of these communications.

A4.3 – Responsibilities

Table A.2 shows the general responsibilities and lines of communication for staff involved in the Particulate Matter Pollutant Monitoring Program. More detailed description of specific responsibilities for various positions are identified in related SOPs. MO managers and staff should handle the listed responsibilities in a similar manner.

Table A.2 – Position Responsibilities

Position	Responsibilities	Reports To
Monitoring and Laboratory Division, Chief	Responsible for the successful accomplishment of project objectives.	Executive Staff
Quality Management Branch, Chief	Responsible for the quality assurance program for CARB's PQAO; responsible for timely review, implementation, distribution, and assessment of quality management documents and systems throughout the CARB PQAO.	Division Chief
Quality Assurance Section, Manager	Responsible for scheduling and conducting the annual and semi-annual performance evaluations of all PM monitors in the CARB PQAO, and audits of PM laboratories. Provide certification services for standards related to PM monitoring.	Branch Chief
Quality Management Section, Manager	Coordination of liaison activities between CARB and PQAO districts; review and distribution of quality management documents and revisions for CARB and districts; coordination of PQAO air monitoring training; coordination of QMP and QAPPs; participation in TSA activities; evaluation of ambient air quality data within the PQAO.	Branch Chief
QMB Staff	Responsible for following QAPP and SOP requirements while conducting performance evaluations, certification services, liaison activities, training, and evaluating PQAO air quality data.	Section Manager

Position	Responsibilities	Reports To
Air Quality Surveillance Branch, Chief	Responsible for overseeing air monitoring activities and the verification and validation of continuous air monitoring data and associated quality assurance data related to continuous air monitoring.	Division Chief
Air Monitoring North Section, Manager	Responsible for overseeing Air Monitoring North Section air monitoring activities, verification and validation of air monitoring data. Data submittal packet to Branch Chief.	Branch Chief
Air Monitoring South Section, Manager	Responsible for overseeing section air monitoring activities, verification and validation of air monitoring data. Data submittal packet to Branch Chief. Also acts as the coordinator of CARB's Border Air Monitoring Program.	Branch Chief
Community Air Monitoring North and South Sections, Manager	Responsible for PM monitor operation, calibrations, and QC equipment calibrations of community air monitoring projects. Data submittal packet to Branch Chief.	Branch Chief
Operations & Data Support Section, Manager	Responsible for administering the Branch's ambient air quality data management and data acquisition systems. Develops, designs, tests, and performs evaluation of air quality monitoring technology, sampling methods, systems, and instrumentation.	Branch Chief
AQSB Staff	Responsible for following QAPP and SOP requirements while operating air monitoring equipment, maintaining sampling stations, and repairing and calibrating instruments; QA/QC activities; data management; verification and validation of air monitoring data.	Section Manager
Northern Laboratory Branch, Chief	Responsible for overseeing laboratory activities; verification and validation of laboratory data and associated QA/QC, including laboratory corrective actions; maintaining LIMS database; uploading of laboratory data to AQS for CARB and air districts in CARB's PQAO.	Division Chief
Inorganic Laboratory Section, Manager	Responsible for overseeing Inorganic Laboratory Section laboratory activities, QA/QC activities, verification and validation of laboratory PM data, and laboratory corrective actions. Data submittal packet to Branch Chief.	Branch Chief
Laboratory Support Section, Manager	Responsible for overseeing laboratory data management, QA/QC activities, health and safety, sample handling and custody, AQS laboratory data uploads.	Branch Chief
NLB Staff	Responsible for following QAPP, SOP, and laboratory QCM requirements while performing laboratory analyses; maintaining and calibrating laboratory equipment; QA/QC activities, including laboratory corrective actions; data management; verification and validation of laboratory data.	Section Manager

Position	Responsibilities	Reports To
Air Quality Planning and Science Division (AQPSD), Chief	Responsible for overseeing network design, maintaining CARB's air quality databases, uploading of data to AQS for 10 air districts, and certification of data generated by CARB and 10 air districts in CARB's PQAO.	Executive Staff
Consumer Products and Air Quality Assessment Branch, Chief	Responsible for air monitoring network evaluations in conjunction with MLD to ensure PQAO meets federal requirements; data certification contingent upon receipt of required documentation from MLD and 10 districts, and submittal of required network assessments and annual network plan to U.S. EPA.	Division Chief
Air Quality & Statistical Studies Section, Manager	Responsible for overseeing evaluation of air toxics data, and maintaining ADAM and AQMIS databases.	Branch Chief
Air Quality Analysis Section, Manager	Responsible for preparation of network plan, network assessment, final data certification package, and upload of ambient air data to AQS for 10 air districts for whom CARB has data upload responsibilities.	Branch Chief
Air Quality Planning Branch, Chief	Responsible for overseeing PM area designations and boundaries under the federal air quality standards for particulate matter, PM-related technical analyses, policy papers, technical work, and exceedances of air quality standards from exceptional events.	Division Chief
Central Valley Air Quality Planning Section, Manager	Responsible for PM air quality planning issues and preparation of PM SIPs, PM data analysis, and demonstration of NAAQS attainment. Reviews particulate matter exceedances of air quality standards.	Branch Chief
AQPSD Staff	Responsible for following QAPP and SOP requirements; preparation and implementation of monitoring network and assessment plans; State air quality database development, programming, and maintenance.	Section Manager

U.S. EPA Region 9 reviews and approves ANPs, QMPs, and QAPPs developed by CARB, and evaluates data submission in AQS. CARB and U.S. EPA also conduct performance evaluations and technical systems audits, which are described in Section D1 and QMP Section 9.

Partnering agencies providing laboratory services are responsible for maintaining QAPPs and SOPs to ensure laboratory analyses meet project requirements. Agencies are expected to use approved methods and follow all project quality control and quality assurance requirements. Should issues arise with data quality for CARB or district laboratory samples, agencies are expected to notify the district and/or CARB and provide information on potential data quality concerns. Partnering agencies are

expected to meet the gravimetric analysis requirements for NAAQS-comparable regulatory data. However, as the partnering agencies are not within the PQAO, laboratory data are sent back to the collecting agency for review, data validation, and certification.

Section A5 – Project Definition and Background

Between the years 1900 and 1970, the emission of air pollutants increased significantly throughout the nation. In 1970, Congress passed the Clean Air Act (CAA), which required states to assess their attainment in comparison to the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants.

The CAA and its amendments provide the framework by which all participating organizations are to protect air quality. The CAA requires U.S. EPA to revise or update federal air quality standards based on reviews of the latest scientific information about known and potential human health effects associated with concentrations of criteria pollutants typically found in the ambient air [Code of Federal Regulations (CFR), Title 40, Part 50]. In fulfilling these obligations, U.S. EPA reviews the air quality criteria and NAAQS for criteria pollutants and the epidemiological range of serious health effects. California's air monitoring network design meets or exceeds the minimum federal requirements, with the goal of attaining and maintaining compliance with NAAQS. The data generated is utilized to define the nature and severity of pollution in California, determine attainment status with state standards, identify pollution trends, support agricultural burn forecasting, and develop air models and emission inventories.

CARB has the primary responsibility of overseeing quality assurance activities for all monitoring organizations within its PQAO. This is accomplished through a comprehensive quality assurance program that includes systematic planning, implementation, assessment, and on-going evaluation activities. These quality assurance activities are discussed in more detail throughout this document. Roles and responsibilities for conducting these activities are defined collaboratively between CARB and local air monitoring organizations. These Roles and Responsibilities agreements can be found in CARB's Quality Management Document Repository: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository.

Annually, CARB evaluates ambient air quality data with a centralized review of the data quality within CARB's PQAO with respect to criteria defined by measurement quality objectives (MQO). MQO's reviewed include data capture (amount of ambient data reported), precision (the degree of mutual agreement among individual measurements of the same property), bias/accuracy (the degree of agreement between an observed value and an accepted known or reference value), and the amount of precision and bias/accuracy data collected and reported. For detailed information on this annual evaluation, please see CARB's Data Quality Reports on CARB's Quality Assurance webpage: https://ww2.arb.ca.gov/resources/documents/data-quality-reports-primary-quality-assurance-organizations.

Particulate matter is a general term used to describe a broad class of substances that exist as liquid or solid particles over a wide range of sizes. In order to meet federal and state criteria pollutant monitoring requirements, CARB measures the following particulate matter size fractions; those with a nominal size less than or equal to 10 micrometers (PM10), those with a nominal size less than or equal to 2.5 micrometers (PM2.5), and those with a nominal size less than or equal to 10 micrometers, but greater than 2.5 micrometers (PMc). CARB will utilize separate QAPP documents for gaseous pollutants, meteorological parameters, and non-criteria toxic pollutants.

The differing sizes of particulate matter reflect unique characteristics and sources of particulate matter. PM10 is a mixture of various substances. Some particles are emitted directly into the atmosphere, while other particles result from gases that are transformed into particles through physical and chemical processes in the atmosphere. A variety of emission sources and meteorological conditions contribute to ambient PM10. These particulates can come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads from vehicle traffic.

PM2.5 particulate matter, called "fine" particulate, is primarily a result of combustion products emitted into the atmosphere as well as those particles that are formed in the atmosphere from gaseous pollutants as a result of atmospheric chemistry. Generally, the fine particulate poses a greater health risk because these particles can deposit deep in the lung and contain chemicals that are particularly harmful to health. In addition to health impacts, these particles can reside in the atmosphere for long periods of time and are the main contributors to reduced visibility. Fine particles are generally emitted from activities such as industrial and residential combustion and from vehicle exhaust.

Particulate size is directly linked to potential for negative health effects. Exposure to particulate matter can affect the lungs and heart as well as irritate the eyes, nose, and throat. Health problems associated with particulate matter exposure include:

- Premature death in people with lung disease
- Non-fatal heart attacks
- Irregular heartbeat
- Aggravated asthma
- Decreased lung function
- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing

The people most at risk for health effects related to particulate matter exposure are older adults, children, and people already suffering from heart or lung diseases.

A5.1 – Federal and State Standards

Current regulation defines criteria pollutants as particulate matter (PM10 and PM2.5), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb). Ambient air quality standards for O_3, CO, NO_2, SO_2, PM10 and PM2.5, and Pb have been set by both the State of California and the federal government. CARB has also set standards for Sulfates (SO_4), Hydrogen Sulfide (H_2S), Vinyl Chloride, and visibility. The focus of this QAPP is the particulate matter pollutants. Separate QAPPs will cover the other criteria pollutants as well as meteorological and non-criteria toxics pollutants.

The state and federal ambient air quality standards for each of the criteria pollutants and their effects on health are summarized in Table A.3.

Table A.3 – State and Federal Ambient Air Quality Standards for Criteria Pollutants

Ambient Air Quality Standards						
Pollutant	**Averaging Time**	**California Standards [1]**		**National Standards [2]**		
		Concentration [3]	**Method [4]**	**Primary [3,5]**	**Secondary [3,6]**	**Method [7]**
Ozone (O_3) [8]	1 Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m³)		0.070 ppm (137 µg/m³)		
Respirable Particulate Matter (PM10) [9]	24 Hour	50 µg/m³	Gravimetric or Beta Attenuation	150 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m³		—		
Fine Particulate Matter (PM2.5) [9]	24 Hour	—	—	35 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m³	Gravimetric or Beta Attenuation	12.0 µg/m³	15 µg/m³	
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m³)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m³)	—	Non-Dispersive Infrared Photometry (NDIR)
	8 Hour	9.0 ppm (10 mg/m³)		9 ppm (10 mg/m³)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m³)		—	—	
Nitrogen Dioxide (NO_2) [10]	1 Hour	0.18 ppm (339 µg/m³)	Gas Phase Chemiluminescence	100 ppb (188 µg/m³)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m³)		0.053 ppm (100 µg/m³)	Same as Primary Standard	
Sulfur Dioxide (SO_2) [11]	1 Hour	0.25 ppm (655 µg/m³)	Ultraviolet Fluorescence	75 ppb (196 µg/m³)	—	Ultraviolet Flouresconce; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 µg/m³)	
	24 Hour	0.04 ppm (105 µg/m³)		0.14 ppm (for certain areas) [11]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas) [11]	—	
Lead [12,13]	30 Day Average	1.5 µg/m³	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m³ (for certain areas) [12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m³		
Visibility Reducing Particles [14]	8 Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	**No National Standards**		
Sulfates	24 Hour	25 µg/m³	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m³)	Ultraviolet Fluorescence			
Vinyl Chloride [12]	24 Hour	0.01 ppm (26 µg/m³)	Gas Chromatography			

Footnotes for Table A.3:

1) California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.
2) National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.
3) Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 °C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25 °C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4) Any equivalent measurement method which can be shown to the satisfaction of CARB to give equivalent results at or near the level of the air quality standard may be used.
5) National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
6) National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
7) Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.
8) On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.
9) On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.
10) To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.
11) On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.
12) CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
13) The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
14) In 1989, CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively

A5.2 – Monitoring Station and Network Categories

The Code of Federal Regulations (CFR), Title 40, Part 58 describes the minimum number of monitors for each pollutant, the type of monitors, the methodology for locating the monitors, the quality assurance needed for the monitors, and the schedule for reporting data to U.S. EPA. Ambient air monitoring data from approved methodologies historically have been and will continue to be the basis for any decisions regarding the attainment or non-attainment of the NAAQS in California.

Most monitors established and operated in California are operated as part of the State and Local Air Monitoring Station (SLAMS) network. SLAMS monitors are designed for NAAQS comparison and to meet State Implementation Plan (SIP) requirements. In addition, these stations support compliance with California Ambient Air Quality Standards, provide air pollution data to the public, support compliance with air quality standards and emissions strategy development, and support air pollution research studies. SLAMS monitors meet specific siting and quality assurance criteria defined in federal regulations.

Special Purpose Monitoring (SPM) monitors can provide information needed by monitoring organizations to support SIPs or other air program activities and to supplement the fixed monitoring network. SPMs are typically not permanent sites which are operated for not more than 24 months. They must meet all QA, siting, and methodology requirements for SLAMS monitoring if used for SIP purposes. If an SPM operates for more than 24 months and meets all applicable federal requirements, it is eligible for comparison to the relevant NAAQS, subject to the conditions of §58.30, unless the air monitoring agency demonstrates that the data came from a particular period during which the requirements of 40 CFR Part 58, Appendices A, C, or E were not met.

The National Core Monitoring Network (NCore) is a multi-pollutant network that integrates several advanced measurement systems for particles, pollutant gases, and meteorology. As national air pollution levels decrease, NCore sites include more sensitive instrumentation. The particulate matter pollutants are included in the NCore parameter list. The objective of the NCore site locations is to help characterize regional and urban patterns of air pollution. Particulate matter instruments used for NCore are expected to adhere to the requirements of this QAPP document, with the exception of monitors for PM2.5 Speciation and Lead. These requirements will be addressed in the non-criteria toxic pollutant QAPP.

SLAMS and SPM sampling programs which generate data for record in the CARB PQAO are expected to adhere to the requirements of this QAPP document. For particulate matter air sampling outside of these programs or networks, a unique air monitoring plan should be created for each project. An example of such an air monitoring plan is attached in Appendix A.3.

A5.3 – State and Federal Air Quality Standard Status

Monitoring organizations within CARB's PQAO are judged for attainment with air quality standards at the federal level (NAAQS) and state level (CAAQS). There are several terms used when discussing the designations in which the definitions vary:

Federal Designations:

States and tribes submit recommendations to the U.S. EPA as to whether or not an area is attaining the national ambient air quality standards for a criteria pollutant. The states and tribes base these recommendations on air quality data collected from monitors at locations in urban and rural settings as well as other information characterizing air quality such as modeling. After working with the states and tribes and considering the information from air quality monitors and/or models, U.S. EPA will "designate" an area as attainment or nonattainment for the standard.

If the air quality in a geographic area meets or is cleaner than the national standard, it is called an attainment area (designated "unclassifiable/attainment"); areas that don't meet the national standard are called nonattainment areas. In some cases, U.S. EPA is not able to determine an area's status after evaluating the available information. Those areas are designated "unclassifiable." More specific information on federal designation requirements will be included later in the document.

California State Designations:

Area Designations:

For State Area Designations, there are three basic designation categories, and one sub-category.

- Nonattainment is the category for an area that has one or more CAAQS violations (see definition below) within the last three years.
    - Nonattainment-Transitional is a subcategory of nonattainment. For particulate matter pollutants, there must be two or fewer violations (see definition below) in the previous calendar year.
- Attainment is the category given to an area with no violations in the last three years.
- Unclassified is the category given to an area with insufficient data.

Exceedance versus Violation:

- Exceedance is a concentration higher than the State standard. Some exceedances may be excluded if determined to be caused by an exceptional event, such as a wildfire or a dust storm. Not all exceedances are violations.

- Violation is a concentration higher than the State standard which is not determined to be caused by an exceptional event.

Geographic Extent of Designations:

The size of the designated area may vary depending on the pollutant, the location of contributing emission sources, the meteorology, and the topographic features. CARB may designate areas smaller than an air basin or county, if CARB finds that a smaller area has distinctly different air quality. Air Basin is the area designated for PM10 and PM2.5.

A5.4 – Current Designation Info

California has numerous areas that exceed the PM10 and PM2.5 NAAQS. See Appendix A.4 for the most recent Federal and State Designation Maps that show attainment status by area.

For more information about current designation info, please visit the following sites:

- U.S. EPA federal designation info: https://www.epa.gov/green-book;
- California designation info: https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/state-area-designations.

Section A6 – Program Description

California's ambient air monitoring network includes over 250 sites and more than 700 monitors, making it one of the most extensive in the world. Many regions in California are characterized by complex terrain, variable meteorological conditions, and diverse emission sources. A large monitoring network is critical for assessing the State's progress in meeting clean air objectives, understanding spatial and temporal variation in air pollutants, and evaluating pollutant exposure. Monitors are operated by CARB, local air districts, and other entities, including the National Park Service (NPS), private contractors, and tribal authorities. Tribal monitors, NPS, and industry monitors are not covered by this QAPP.

CARB's ambient air monitoring network is designed so that each monitor meets one or more of the three monitoring objectives, as defined in Appendix D of 40 CFR Part 58:

1. Provide air pollution data to the general public in a timely manner.
2. Support compliance with air quality standards and develop emission strategies.
3. Support air pollution research.

In addition to the three monitoring objectives, each monitor must be sited so that it is capable of informing the public and air quality managers about different aspects of air quality, including high concentration, population exposure, etc. This is referred to as a site type and U.S. EPA requires that each monitor has an identified site type in the AQS database as one of the following:

Table A.4 – U.S. EPA Site Types

Extreme Downwind	General Background	Highest Concentration
Max Precursor Emissions Impact	Maximum Ozone Concentration	Population Exposure
Quality Assurance	Regional Transport	Source Oriented
Upwind Background	Welfare Related Impacts	Other

Federal regulations note that the spatial scale of representativeness of a monitor should be consistent with the stated site type. The spatial scale of representativeness is a measure of the physical dimensions of the air mass through which pollutant concentrations are expected to be relatively homogeneous. The scales of representativeness that are most relevant to ambient air monitoring are defined below:

- Microscale: Measured concentrations are expected to be similar for an area ranging from several meters up to about 100 meters.
- Middle scale: Measured concentrations are expected to be similar for areas up to several city blocks in size with dimensions ranging from about 100 meters to

0.5 kilometer.

- Neighborhood scale: Measured concentrations are expected to be similar within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range.
- Urban scale: Measured concentrations are expected to be similar within an area of city-like dimensions, on the order of 4 to 50 kilometers.
- Regional scale: Measured concentrations are expected to be similar within a rural area of reasonably homogeneous geography without large sources, and extend from tens to hundreds of kilometers.
- National and global scales: These measurement scales represent concentrations characterizing the nation and the globe as a whole.

The scale(s) of representativeness that is generally most appropriate for each of the most common federal site types are shown in Table A.5, which is based on Table D-1 in Appendix D of 40 CFR Part 58.

Table A.5 – U.S. EPA Site Types and Spatial Scales

Site type	Appropriate siting scales
Highest concentration	Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants)
Population exposure	Neighborhood, urban
Source oriented	Micro, middle, neighborhood
General background & regional transport	Urban, regional
Welfare-related impacts	Urban, regional

Each year, CARB submits an Annual Network Plan (ANP) to U.S. EPA Region 9 for review and approval of the current configuration of the air monitoring network. Air districts are queried to ensure that those that are not drafting their own network plan are included. Certain local air districts within CARB's PQAO prepare their own ANP. These local air districts are Great Basin, Monterey, North Coast, Sacramento Metropolitan, San Joaquin, San Luis Obispo, and Santa Barbara. Districts that prepare their own plans are expected to submit a copy concurrently to CARB and U.S. EPA. The network plan includes a list of monitoring sites covered by the plan, pollutants monitored, spatial scale, and the monitoring objective. The most current CARB ANP is located at: https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report.

The ANP includes detailed information about monitors using Federal Reference Methods (FRM), Federal Equivalent Methods (FEM), or Approved Regional Methods (ARM) that are included in the State and Local Air Monitoring Station (SLAMS) network, National Core (NCore) Multipollutant Network, Chemical Speciation Network

(CSN) or at Special Purpose Monitoring (SPM) stations, and Photochemical Assessment Monitoring Stations (PAMS). Monitoring for gaseous criteria pollutants, toxic air contaminants, meteorological parameters, non-criteria federal pollutants, and PAMS pollutants are not covered in the QAPP.

CARB's PQAO network is required to meet or exceed the federal monitoring requirements for particulate matter pollutants. The minimum number of monitors for each pollutant is based on Core Based Statistical Areas (CBSA) reported by the U.S. Office of Management and Budget. Minimum monitoring requirements for PM2.5 must include at least one site with the highest pollutant concentration. CBSAs are used to determine the Metropolitan Statistical Area (MSA) populations as described in 40 CFR Part 58 Appendix D. The actual number of monitors may vary by year; network changes are updated through CARB's Annual Network Plan (ANP). The minimum number of monitors required is assessed each year through the ANP and every five years through the network assessment and submitted to U.S. EPA Region 9.

For criteria pollutants, U.S. EPA has established minimum monitoring requirements that are specified in federal regulations (Appendix D of Title 40, Part 58 of the CFR). Generally, requirements are based on the population from the most recent census data, and other factors, depending on the pollutant. The other factors can include the severity of the air quality problem, as specified by the design value, emissions, or traffic counts. More information detailing the status of the CARB PQAO meeting federal minimum reporting requirements can be found in the Annual Network Plan document.

For CBSAs that include multiple districts, fulfillment of minimum monitoring requirements is dependent upon coordination between air monitoring staff, particularly when changes to the monitoring network are considered. The Roles and Responsibilities documents developed by CARB specify that districts and CARB must communicate with each other when changes to the network are being considered. When proposed changes are communicated, staff from both agencies will work closely to evaluate impacts on minimum monitoring requirements and develop pathways that ensure federal requirements are met.

In addition to minimum monitoring requirements, federal regulations also specify that monitoring networks may need additional monitors to address the needs of (1) State Implementation Plans, (2) complexity of terrain, (3) meteorology, (4) geographic size of region, (5) adjacent monitors, (6) pollutant formation mechanisms, (7) distribution of emissions and (8) quality control requirements that include collocation. CARB is responsible for ensuring that the CARB PQAO network meets all federal requirements and addresses critical regulatory needs.

In addition to meeting federal monitoring requirements, monitors are also required to support critical California programs. These include, but are not limited to:

implementation of state air quality standards, agricultural burn programs, community exposure, evaluating progress towards attainment of federal standards, and support of special projects.

Appendix A.5 contains a map identifying the monitoring organizations included in the CARB PQAO. Appendix A.6 shows the location of the spatial distribution of the fixed monitoring sites (2019).

Section A7 – Quality Objectives and Criteria for Measurement Data

Data Quality Objectives

Data quality objectives (DQO) and acceptability criteria are critical for clarifying the purpose of the study, defining the information to collect, determining the appropriate conditions, and specifying the tolerable limits of potential decision errors. The DQO process is a strategic planning approach used to prepare for data collection activity. The objective of this process is to achieve data of known and appropriate quality to support decision-making. The process helps to ensure that the type, quantity, and quality of environmental monitoring data will be sufficient for their intended use, while ensuring no unnecessary, redundant, or insignificantly precise data are collected.

In developing DQOs, there are certain measurement quality objective (MQO) indicators that are important to determining uncertainty and reducing errors. These indicators are listed in Table A.6:

Table A.6 – Measurement Quality Objective Indicators

Indicator	Definition
Precision	A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions.
Bias	The systematic or persistent distortion of a measurement process which causes error in one direction.
Accuracy	A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.
Representativeness	A qualitative term that expresses "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." (ANSI/ASQC 1995)
Comparability	A qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made.
Completeness	A measure of the amount of valid data needed to be obtained from a measurement system.
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.

Table A.6 references *U.S. EPA Guidance for Quality Assurance Project Plans*, U.S. EPA QA/G5; Section 2.1.7

CARB has adopted the specific measurement quality objectives presented in EPA's 'Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Monitoring Program, Appendix D, Revision 1 (03/2017)' listed in Appendix A.7.

Although adherence to regulations are required, strict adherence to the validation templates is not required. They are meant to be a guide based upon current knowledge and best practices and may be a starting point for the Monitoring Organization's (MO) specific validation template. MOs should discuss deviations from the validation tables with their respective U.S. EPA Regions to ensure the deviation under consideration is not considered significant. For objective checks which are found to be outside of the acceptance criteria, a weight of evidence evaluation will be performed as outlined in 40 CFR, Part 58, Appendix A. Per section 1.2.3, 'Failure to conduct or pass a required check or procedure, or a series of required checks or procedures, does not itself invalidate data for regulatory decision making. Rather, PQAOs and the U.S. EPA shall use the checks and procedures required in this appendix in combination with other data information, reports, and similar documentation that demonstrate overall compliance with Part 58.'

The following Table A.7 details CARB exceptions to the specific measurement quality objectives for the particulate matter pollutants listed in Appendix A.7.

Table A.7 – CARB Exceptions to Measurement Quality Objectives in Appendix A.7

PM2.5 and PM10 Continuous (BAM only)		
Requirement	**Frequency**	**Acceptance Criteria**
Zero Test*	At installation and annually thereafter	Standard deviation of the 48 - 72-hour test data < 2.4 µg/m^3
Downtube cleaning**	Annually	Cleaned

**Historically, the zero test duration was 72 hours. This requirement is in the FEM approved BAM-1020 instrument manual, Revision W, and can help minimize potential loss of data.*
***This requirement is set as recommended in the FEM approved BAM-1020 instrument manual, Revision W, as unnecessary cleaning may do more harm than good. Cleaning the downtube requires that it be removed from the instrument, which requires manipulating the watertight flange on the roof of the station. In order to maintain the integrity of the flange and therefore the instrumentation, it should be manipulated as little as possible. For downtube cleaning of PM10 instruments in dusty areas, more frequent downtube cleaning and/or inspections should be implemented based on site conditions.*

The formal DQO process consists of seven steps for the development of an experimental design that meets criteria specified by stakeholders in the decision, as described in U.S. EPA QA/G-4, *Guidance on Systematic Planning Using the Data Quality Objective Process* (U.S. EPA, 2006), and in Section 3 of the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II* (U.S. EPA, 2017). The seven steps are:

1. State the problem
2. Identify the goal
3. Identify information inputs
4. Define boundaries
5. Develop the analytical approach
6. Specify performance or acceptance criteria
7. Develop the plan for obtaining data

State the Problem

Criteria particulate matter pollutants impact human health and the environment. The Clean Air Act (CAA) requires that the U.S. EPA establish NAAQS at ambient levels that protect public health. The CAA further requires that these standards be reviewed every five years to ensure that they remain health protective. The data generated are used to define the nature and severity of the pollution in California; determine which areas of California are in attainment or non-attainment of federal or State standards; identify pollution trends in the State; support agricultural burn forecasting; and develop air models, emissions inventories, and State Implementations Plans. Criteria particulate matter pollutant data are also used to provide health advisory information to the public and inform the public in the event of an emergency. These data are posted in near real time for public review using the Air Quality and Meteorological Information System (AQMIS) and AirNow.

AQMIS link: https://www.arb.ca.gov/aqmis2/aqmis2.php

AirNow link: https://www.airnow.gov/

MO's attainment status for each particulate matter pollutant is determined by comparing ongoing monitoring results with the applicable NAAQS, as specified in 40 CFR Part 50. U.S. EPA uses a formal process specified in the Clean Air Act to designate the areas of the State as attainment, nonattainment, or unclassifiable for criteria pollutants. Part of this process includes reviewing the recommendations made by CARB and the monitoring data. The attainment determination may impact activities related to the regulation of the particular pollutant.

Identify the Goal

The primary goal for monitoring criteria particulate matter pollutants is to provide a basis to determine the attainment status of the MO for the applicable NAAQS. Monitoring should provide data of appropriate quantity and quality to determine the attainment status of the MO with the applicable NAAQS, particularly for criteria pollutants for which portions of the State are not in attainment. Other uses include declaring an air pollution health advisory, alert, warning or emergency; trends analysis;

implementing air pollution abatement actions; and in support of State Implementation Plans.

Identify the Information Inputs

Inputs related to attainment status of NAAQS and regulatory decisions include, but are not limited to:

1. Annual Monitoring Network Plan that demonstrates the monitoring network meets the requirements of 40 CFR Part 58
2. Three years of annual mean and 98th percentile of three year PM2.5 values for each PM2.5 monitoring site
3. Three years of annual mean PM10 values for each PM10 monitoring site
4. Pollutant model requirements and objectives
5. Pollutant distribution changes
6. Pollution history and trends
7. Meteorology
8. Topography
9. Budget and Staffing
10. Maintenance Plan and State Implementation Plan Requirements
11. Community Feedback

Define Boundaries

The study boundary is defined as the area under the jurisdiction of CARB PQAO, which encompasses the entire state of California with the exception of those areas covered under the South Coast, Bay Area, and San Diego PQAOs. At times, CARB may perform SPM sampling within other California PQAOs. Prior to such SPM sampling, CARB will coordinate the sampling with the affected PQAO. Sampling for criteria pollutants will take place continuously in order to meet long term attainment assessment requirements.

Develop the Analytical Approach

Attainment status is determined if the Decision Input for a specific pollutant is under the acceptable level in the NAAQS (see section A5). If an area in the PQAO is designated as attainment for one of the NAAQS, CARB is required to prepare and submit a maintenance plan to U.S. EPA that demonstrates how the monitoring organization will remain in attainment with the specified NAAQS.

If the monitoring data for particulate matter criteria pollutants compared to NAAQS show that the area is non-attainment, U.S. EPA will designate the area as non-attainment for that NAAQS. If an area in the PQAO is designated as non-attainment for one of the NAAQS, CARB is required to prepare and submit a course of action in a State Implementation Plan (SIP) submitted to the U.S. EPA that demonstrates how the

responsible monitoring organization will attain the specified NAAQS within a required timeframe.

Consistent with the goals of assessing precision and accuracy of the instruments/samplers, the maintenance plan also assesses the amount of ambient air quality data produced by the instruments or samplers. Depending on the sampling frequency of each respective instrument or sampler, data capture is compiled as a percentage of the ambient data collected over the total amount of data possible. A minimum of 75% completeness value per calendar quarter provides sufficient data for NAAQS determination. If data are less than 75% complete for a specific NAAQS, or if the area does not have a monitor, U.S. EPA will designate the area in the PQAO as unclassifiable, and the responsible monitoring organization would be required to collect more data. This will trigger an action to determine the cause and address any findings to improve completion percentages.

Non-NAAQS related actionable results may include:

- Alerting the public when levels of pollutants impact regional air quality
  - Advisories (*based on imminent or occurring conditions*)
  - Smoke advisories
  - Windblown dust advisories
  - Windblown ash advisories
  - Air Alerts: Public air pollution alerts based upon measured real-time AQI thresholds over 100 (*Unhealthy for Sensitive Groups or above*)
- Air Quality Forecasts (*forecasts rely on current and historical air monitoring data*)
  - Criteria pollutant concentration and AQI forecasts
  - Residential wood burning restrictions
  - Open burning restrictions (*agricultural and prescribed burning*)
- Public outreach mechanisms (*forecasts, advisories, and current air quality conditions*):
  - Maps and web data
  - U.S. EPA AirNow web maps and data
  - Cellular phone applications
  - Email, social media and FAX-based forecasts and alerts (AirAlerts, Twitter, etc.)
  - Media outreach
  - School flag program
- Identifying potential sources of pollutants
  - Source apportionment
  - Emissions inventory reconciliation

Specify Performance or Acceptance Criteria

In order to minimize the possibility of erroneous conclusions, uncertainty must be assessed and taken into account, so CARB and U.S. EPA have established performance or acceptance criteria for air quality data and tolerable limits. The primary reference for this information is U.S. EPA 40 CFR Part 58 Appendix A. For automated and manual PM methods, the PQAO acceptable limits based on representative sampling are defined as less than 10.1 percent for upper confidence limit of a standard deviation of differences between collocated samplers for total precision and less than plus or minus 10.1 percent for total bias. In addition, bias is addressed via periodic flow rate verifications and semi-annual flow rate audits, both subjected to specific criteria that ensure data produced are of high quality. A full description of acceptance criteria can be found in U.S. EPA's QA Handbook Volume II, Appendix D.

For non-NAAQS objectives that are on shorter timescales for reporting, such as forecasting and alerts, tolerances are based on balancing data reporting time frames and control checks that can be performed within that time frame. Therefore, the uncertainty is defined by a subset of QC checks presented in Section B5 that can be conducted in real time. This data is considered preliminary. There are many automatic QC checks as well as threshold concentrations that alert staff to check the instrumentation to ensure proper operation. These thresholds are based on station location and parameter. Additional measures include comparison to historical air data for season and location. If data seem to be out of line with historical measurements and current expectations, further investigation may be warranted. Additional QC objectives may be used on an as-needed basis for special data applications. Appendix A.8 includes real-time QC Criteria for the AirNow site.

Develop the Plan for Obtaining Data

The primary design objective of a criteria monitoring network is to meet the requirements of 40 CFR Part 58 Appendix C. Design may also consider impending decisions, such as design value sites on pollutants that have an ambient concentration near the NAAQS. CARB's PQAO optimizes quality control and quality assurance criteria as outlined in the Quality Assurance Handbook Volume II, Appendix D (March 2017). This is discussed in more detail in Section B1.

Design considerations such as pollutant attainment status, projected pollutant attainment designation, proximity of the ambient concentrations to the NAAQS, instrument reliability, and special studies objectives may necessitate a greater level of data quality practices over and above the requirements for criteria pollutant measurements.

Other air monitoring objectives not related to criteria pollutants require different DQOs and are beyond the scope of this document. If the program objectives are not covered by any existing federal programs, a special monitoring project QAPP may be developed.

Section A8 – Special Training/Certifications

CARB recognizes that adequate training of all staff involved in any aspect of its air monitoring program is a critical component of maintaining continuity and an effective and efficient quality assurance program. Training activities are tracked and training needs are assessed on a continual basis by each section manager. Training is encouraged and provided as needed or required to ensure staff maintain adequate skills and knowledge to successfully perform assigned duties and comply with all applicable quality assurance requirements. CARB's PQAO general training practices are documented in CARB's QMP.

CARB's PQAO implements the appropriate training of all staff involved in the particulate matter pollutant monitoring program, including field operators and support personnel, QA personnel, temporary and contract personnel, and supervisory and management personnel. This ensures that staff has sufficient knowledge to perform assigned duties under the Particulate Matter Pollutant Monitoring Plan Program, including the ability to satisfy program and agency QA requirements. Districts shall adopt training guidelines similar to those described below or develop their own training plan and record-keeping process that is approved by CARB.

In accordance to the CARB/District Roles and Responsibilities documents, applicable CARB and district employees shall, at a minimum, participate in the following training provided by CARB and/or U.S. EPA:

- Ambient air monitoring training
- Data verification and validation training

In addition, applicable CARB and district employees are strongly encouraged to attend trainings by U.S. EPA and vendors of air sampling equipment.

A8.1 – Personnel Qualifications

All employees, including managers, must satisfy class specifications for all positions, including those performing quality assurance or environmental measurement functions. Class specifications and duty statements identify job duties and the minimum education, experience, knowledge, skills, and abilities required to perform job duties for each specific position. Classification specifications are reviewed periodically for relevance to applicable ambient air monitoring requirements, including current technology, instrumentation, and methodologies. A competitive interview process is required for all prospective staff to ensure that the most qualified candidates are considered by the hiring manager or authority.

A8.2 – New Employee Orientation and Training

New staff receives on-the-job training from senior program staff and management. A duty statement is developed for each position and a plan for achieving performance objectives is included in an employee development plan. An individual training plan is developed for each trainee based on the skills that need to be acquired or enhanced and to become familiar with CARB procedures. The plan includes training events and timelines for completion. Training is tracked and evaluated by the trainee's manager, and is reviewed at a minimum annually during performance reviews. CARB has developed a training plan for field personnel and to assist districts in developing their own training plans: https://ww2.arb.ca.gov/resources/documents/field-operator-and-calibrator-training-plan-example.

Each new staff member will read all Standard Operating Procedures (SOP) applicable to the position for which they have been hired. In addition to job specific training, new employees of CARB and monitoring organizations within CARB's PQAO are encouraged to participate in the Air Academy Training Program and other trainings applicable for the job duties to be performed. The Air Academy program includes a series of on-line training modules covering major elements of CARB's programs and functions, and the fundamentals of air pollution. Upon completion of the on-line portion of the program, employees may meet with management or other staff to discuss any aspect of the training program in more detail.

The trainee's manager will perform regular evaluations by way of the completion of courses and tasks on the training plan with demonstrations of proficiency. Additional training may be required if proficiency is not demonstrated. Evaluating and documenting trainee performance improves communication and guides the trainee toward enhancing his or her skills. During the training period the manager will formally observe, evaluate, and document the trainee's performance to determine progress towards training goals and to offer suggestions to improve the trainee's skills. These reviews should be documented in the trainee's probationary reports. After completion of the training program, the manager will review and discuss training needs with air monitoring personnel on an ongoing basis, but at a minimum yearly during performance reviews. New training plans will be generated as needed.

For laboratory staff, performance for specific procedures or methods is verified by measurement against a defined performance standard. These assessment tools may include:

- Written evaluation (e.g. training checklist)
- Observation of procedure or method
- Testing blind QC samples
- Testing known or previously analyzed samples

Laboratory staff will be retrained, and the retraining verified, whenever significant changes occur in policies, values, goals, procedures, methods, processes, instrumentation, or when staff have not performed the method on a routine basis and as determined by management.

CARB's Training Section provides a variety of training and consultative services to CARB and Cal/EPA staff. The Training Section is responsible for developing training policy; maintaining training resources and materials; assisting management teams in the development and review of their annual training plan and needs; assisting employees in the identification of appropriate courses; and preparing training plans and reports. Additional information and training courses are available to other interested parties on CARB's website at: https://ssl.arb.ca.gov/training/courselist.php.

A8.3 – CARB Section-Specific Training Requirements

The following section details training requirements specific to the Particulate Matter Pollutant Air Monitoring Program for CARB sections, if applicable. CARB's organization chart is included in Appendix A.2.

Air Quality Analysis Section Training

New staff shall receive training from other staff in the Section. Training focuses on critical requirements needed to perform analysis tasks. This includes training in how to download data from CARB's air quality databases (ADAM and AQMIS). In addition, staff are provided with a link to past PQAO trainings and instructed to watch training on relevant subjects, including, but not limited to: (1) network design, including Annual Network Plans; using other databases including AQS and AirNow; and addressing data anomalies. When a new employee begins, the Manager outlines the required training and timeframe for completion. Ongoing training for all staff include attending PQAO training (when funds are available), participating in U.S. EPA webinars and other training opportunities and understanding network design requirements by reviewing relevant federal and state regulations.

Quality Assurance Section Training

New QAS hires receive on-the-job training from senior program staff and management. The training begins with an overall introduction to the program, such as: federal and State requirements for quality assurance activities, quality assurance manuals, test methods, and SOPs. The new staff members receive the QA Training Program and become familiar with laboratory and field performance audits and related audit procedures. Additionally, they will become familiar with the Audit Information System (AIS) program, audit criteria, and both field and laboratory equipment.

Each new staff member is typically evaluated by the QA Manager for up to one year after initial hire to demonstrate progress with performing the required tasks. These tasks increase in difficulty over time and include, but are not limited to:

- Assisting in audit start-up, conduction and end procedures
- Conducting an Ozone, PM10, and Meteorological performance audit
- Conducting a full performance audit, including all particulate matter and gaseous pollutants

Additionally, certain duties are delegated to specific individuals within QAS. Training for these duties will normally be hands on with another senior auditor. These duties include:

- Standards Laboratory Certifications
- Technical Systems Audits
- Air Quality Data Actions and Corrective Action Notifications
- Precision and Accuracy uploads
- Van/Equipment Maintenance
- Standards Files Update
- AIS Maintenance

Quality Management Section Training

New staff in the Quality Management Section (QMS) receive training by the section manager for up to one year after initial hire to demonstrate progress with performing the required tasks. An introductory training includes a combination of literature review and on-the-job training prior to performing liaison responsibilities. The training begins with an overall introduction to the State and federal requirements for quality assurance, which includes applicable CFR, U.S. EPA Handbooks, CCR, on-line Air Academy and PQAO training, and other relevant documents and training. Training also includes a review of CARB policies and procedures for quality management, including the QMP, QAPPs, SOPs, technical bulletins, and the Roles and Responsibilities documents and requirements of the PQAO. An introduction to the air quality and corrective action databases operated by U.S. EPA (AQS) and CARB (CAN, AQDA, AIS, AQMIS, ADAM), and an introduction to the quality control requirements for ambient air monitoring are also covered. Following the introductory training, QMS staff receive more specific training on the organization, operations, and equipment utilized by CARB and local air monitoring organizations within the CARB PQAO.

Operations and Data Support Section Training

In addition to training outlined in section A8.2, new staff to the Operations and Data Support Section (ODSS) receive additional training including, but not limited to, the following:

- Air Quality Data Management System Training
- CARBLogger Training
- Vendor offered instrument training (i.e. Teledyne/API)

Inorganic Laboratory Section Training

Prior to performing any method or analysis, new staff must be trained by senior staff with applicable expert knowledge. Staff are trained to understand each program's requirements per any applicable State and federal regulations and guidance. Training includes how to safely and properly operate the equipment needed to perform a method, the quality assurance components, sample handling procedures, and LIMS functionality pertaining to the program. Staff should provide an initial demonstration of capability prior to performing this method on real-world samples (i.e. data for record). Training must be documented by the trainer in the form of an employee training checklist and maintained by the laboratory supervisor of the section.

Laboratory Support Section Training

New staff shall receive training from other staff in the section, overseen by the section supervisor. All new staff are monitored by qualified staff until approved by the supervisor to perform given tasks autonomously. Training focuses on critical requirements needed to perform sample handling and management, health and safety, quality control and quality assurance, and data management tasks. New staff review CARB policies and procedures, applicable federal and State program standards, LIMS functionality and administration, sample management and custody requirements, and data processing protocols.

A8.4 – Ongoing Training and Continuing Education

Each new staff member will be evaluated periodically after initial hire by the appropriate section manager. Additionally, CARB encourages staff and district employee's participation in available and relevant training provided by outside agencies such as equipment manufacturers and U.S. EPA.

CARB recognizes that continuing education and training are critical components of maintaining continuity and an effective and efficient quality assurance program. Training needs are assessed on a continual basis by section managers, and at a minimum annually during performance reviews. Training is offered as needed or required to maintain and improve the skills and knowledge of staff. All training is tracked and documented in individual personnel files by managers or their designee. Staff may be required to submit a memorandum to their supervisor or manager outlining training received or may be required to present a summary of training received at meetings, conventions, or symposia proceedings to relevant staff.

Laboratory staff will be retrained, and the training verified, whenever significant changes occur in policies, values, goals, procedures, methods, processes, instrumentation, or when staff have not performed the method on a routine basis and as determined by management.

The Administrative Services Division (ASD) created a Training Plan and Guide to assist employees in assessing their training needs. The Training Plan and Guide identifies training opportunities, along with some specific course recommendations for job classifications at CARB. The Training Section in ASD is dedicated to providing CARB staff training that meets CARB's mandate for educational development, enhancing employee skills, providing opportunities for upward mobility, improving productivity, and the quality of work output.

A8.5 – Air Monitoring Training Modules

CARB's PQAO, in conjunction with U.S. EPA and monitoring organizations throughout California, have developed training modules for CARB, local air monitoring staff, and management at all levels. The modules are designed to emphasize the fundamentals of key elements of ambient air monitoring including: (1) station set up and operation; (2) quality assurance and data management; and (3) operation, maintenance, and troubleshooting of commonly used ambient air monitoring instruments.

The training program is comprised of three distinct modules, and will be offered at different times and locations in California. Training will be conducted by subject-matter experts from CARB, U.S. EPA, air monitoring districts, and instrument manufacturers.

These trainings will be recorded and the presentations posted to the CARB QA webpage at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/pqao-training-resources.

Training materials and associated references (i.e., regulatory requirements, guidance documents, QA Manual, AQSB SOPs, etc.) will be provided to all attendees. Training material for all three modules will be available on CARB's PQAO website. Approximately every two years CARB will conduct a PQAO refresher training event. This event will include critical elements from PQAO modules 1-3 as well as new relevant and timely topics related to ambient air monitoring.

Section A9 – Documents and Records

CARB and monitoring organizations within its PQAO generate and maintain a variety of quality management related documents and records. Documents include QMPs, QAPPs, SOPs, quality control forms, technical bulletins, acceptance test procedures, audit and assessment reports, AQDA requests, CANs, and network plans. Data records include ambient air monitoring data and laboratory analysis results, sample reports, strip charts, and maintenance records.

Effective document management includes a system for generating, updating, maintaining, and disseminating quality management related documents and records. Documents for CARB and monitoring organizations within its PQAO are available at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository. The baseline procedures described below are those followed by CARB and monitoring organizations within its PQAO for quality management related documents and records, unless otherwise described in an approved addendum.

A9.1 – Responsibility for Documents and Records

The responsibility for identifying, preparing, and managing quality management documents and records lies with management of the group responsible for creation of the document or record. The responsible party shall work with QMB to incorporate a new document, revision or addendum to an existing document (i.e., QAPP, SOP, etc.) into the document control system. Previous versions of documents should be archived if no longer in use.

Only authorized personnel are granted access to edit or modify documents. Records and file access privileges are based on staff duties and needs, and are assigned and approved by management. Updates are made to staff access as staff changes occur. Changes to approved documents must be made by authorized individuals only, and management's approval may be required.

QMB is responsible for maintaining a database of all current CARB quality management related documents as well as a list of those documents in use by monitoring organizations within CARB's PQAO. The monitoring organizations are responsible for informing CARB of the status of documents being prepared and maintaining original copies of the current and archived documents.

AQSB is responsible for maintaining a database of quality control documents related to the operation and maintenance of the ambient air monitoring program (SOPs, field maintenance forms, technical bulletins, acceptance test procedures, ambient air quality data, etc.). These documents are accessible through CARB's Quality Assurance website, at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance. In

conjunction with the Office of Information Services (OIS), AQSB is also responsible for maintaining a copy of the ambient and QC data generated by the air monitoring network.

NLB is responsible for maintaining a database of quality control documents related to laboratory procedures. These documents are accessible through CARB's website at: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air. Finalized and approved data may be amended in LIMS per management approval. After the request is approved, laboratory staff and management must follow the data review and approval process. If changes to finalized data are made, the client must be notified and sent a revised report. In conjunction with the Office of Information Services (OIS), NLB is also responsible for maintaining a copy of the laboratory and QC data housed in the LIMS database.

A9.2 – CARB Document Retention Policy

Records and documents created or received by CARB are retained for a period of time as specified in CARB's Records Management Program and the Department of General Service's (DGS) Records Retention Schedule. However, the most stringent retention criteria are always applied. Additional information on California State records retention and destruction policies and requirements can be found here: https://www.sos.ca.gov/archives/records-management-and-appraisal/.

As a general rule, CARB retains documents and records for a period of three years before transferring them to DGS for long term archiving. However, laboratory records are not maintained by DGS, but archived securely onsite at the laboratory for a period of five years, plus the current year.

Site operators should maintain copies or electronic access to copies of their station's monthly maintenance datasheets for the current and previous calendar year. They should also maintain copies of all calibration and audit reports for the previous three calendar years. These materials, along with the current station logbooks, should be available and maintained at the air monitoring station.

A9.3 – CARB Document Tracking

The documentation format utilized by CARB for tracking and controlling quality management documents is described below. The system incorporates a standardized indexing format and provides for revisions without reissuing the entire document.

Each document is formatted to include a 4-line indexing format that includes the following information:

Line 1 – Branch or Division and Document Number
Line 2 – Title or Description of Document

Line 3 – Document Revision Number and Revision Date
Line 4 – Page X of Y

An example of an indexing label is as follows:

AQSB SOP 408
TE-6070V SSI PM10 VFC Sampler
Second Edition, December 2014
Page 1 of 50

Sections within a document can be added, modified, or deleted in one of two ways. When a document is modified, the revision number and revision date are changed on the Title Page, Table of Contents, and in the indexing label at the top of each page. The Title Page will include SOP number, title, approval date, and version. Monitoring organizations within CARB's PQAO may adopt this procedure or develop their own standardized procedure for tracking quality management documents.

Alternatively, an addendum can be written for more minor exceptions or updates to a document and submitted to CARB's Quality Management Branch for review and approval. Monitoring organizations can utilize CARB's addendum process to describe district specific modifications to the quality management documents. These modifications must meet all quality and regulatory requirements. These addendums will be retained with the parent document under the district section of the CARB Document Repository.

A9.4 – Document Distribution

CARB's MLD is responsible for maintaining electronic files of CARB's quality management documents (i.e., QMP, QAPPs, SOPs, etc.). The documents are accessible on the Quality Assurance webpage, which is available to CARB personnel, PQAO contacts within each monitoring organization, and the general public. The contents of the webpage are reviewed on an annual basis, and notification of updates or additions are sent via CARB's PQAO Contact List, available at: https://arb.ca.gov/aaqm/qa/pqao/pqao-pocv4.pdf. CARB management and designated PQAO contacts are responsible for dissemination of information to the appropriate personnel within their monitoring organization. The quality management document repository database is updated routinely, as needed.

A9.5 – Considerations for Electronic Records

There are advantages to using electronic records, such as logbooks, at monitoring stations. Some of these advantages include ease of information sharing, data search capabilities, automated calculations and scheduling of activities, and reduction in manual entry. If using such software, special consideration must be paid to data

security, similar to those listed in QAPP section B. Additionally, the software must have features to create a time stamp of edits which identifies the editor. MOs using such software must describe their operation and security features in a QAPP addendum.

A9.6 – Archiving of CARB Documents and Records

Archiving of quality management documents and records is the responsibility of the section, program, or monitoring organization generating the document or record. Documents that are created and shared by multiple sections, such as the QMP, are maintained and archived by QMB. The section responsible for the document should maintain it in a digital and/or hardcopy format. A current version of the document or record shall be maintained in a designated electronic directory. Versions no longer in use are archived. Documents and records related to CARB's air monitoring program are maintained and accessible in accordance with CARB and U.S. EPA record retention policies. Quality management documents are archived in digital format unless hardcopy originals are legally required to be kept by the program QAPP. Records and data that are originally captured in digital format should be archived in digital format, unless a hardcopy of the original record or data is also required to be archived by the program QAPP. Records and data that are originally captured in a hardcopy format should be archived in a hardcopy format. An archived document incorporates the word "Archive" in the title and it is transferred to an "Archived Document" directory.

Section managers or monitoring organizations have the responsibility to maintain updated documents and to archive those that are no longer in use. In order to properly manage current and archived documents, two document directories shall be maintained. The "current document" directory is accessible to all staff. Current documents are defined as those currently in use by management and staff for programs in progress or approved for implementation. The "archived document" directory is for all versions of documents that were previously in use. These documents and records provide a timeline indicating when a specific version of a document was in effect. Archived documents should remain available to all CARB personnel and designated PQAO contacts. Hardcopy documents and records are archived on-site at CARB facilities for the current and previous year before being transferred to a CARB main office or an off-site secure storage facility contracted by CARB. CARB main office and off-site secure storage facilities are accessible only to authorized staff. Laboratory records are securely stored in either a locked room or cabinet within CARB's main office accessible only to authorized laboratory staff. Monitoring organization documents should be archived according to the organization's document management procedures.

Table A.8 lists CARB's QA/QC record keeping, general laboratory, and air monitoring station record keeping requirements. CARB implements a Data Management System (DMS) for processing data streams from the continuous instruments, and a Laboratory

Information Management System. CARB has implemented the LabVantage 8.3.0 LIMS Data System for data centralization and sample tracking.

Table A.8 – Data Record Formats, Locations, and Designated Record Custodians

Document Name	Brief Description	Format	Storage Location	Record Custodian
Training Files	Records substantiating the training and proficiency of staff relevant to this program	Electronic	Varies by CARB section method	Trainee's manager
QAPP	Master version of QAPP, including pending revisions	Electronic	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality	QMS Staff
Air Monitoring SOPs	Current version of SOPs	Electronic	https://ww2.arb.ca.gov/index.php/resources/documents/standard-operating-procedures-ambient-air-monitoring	AQSB Staff
Performance Evaluations and Audits	Results of internal and external assessments	Electronic	QAS Audit Information System: http://inside.arb.ca.gov/wg/mld/ais/login_2.php	QAS Staff
Corrective Action Reports	Results or identified QA problems and their resolution	Electronic	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/data-corrective-action-process	QMS Staff
Station Notebooks	Logs station activity	Hardcopy	Air monitoring sites	AQSB Staff
Instrument User's Manual and/or Manufacturer's Instructions	Information for setting up, using, and troubleshooting the continuous PM monitors	Hardcopy; Electronically via man-ufacturer's websites for updates	Air monitoring sites; Online	AQSB Staff, Manufacturer
Calibration Certificates and Records	Includes certificates for flow standards and other standards used for calibration	Hardcopy	Air monitoring sites; accompanying instruments	AQSB Staff
QC Records	Results of instrument blanks, calibrations, standard recoveries, and replicate precision	Hardcopy	Air monitoring sites; MLD Headquarters	AQSB Staff

Document Name	Brief Description	Format	Storage Location	Record Custodian
Raw Data Records	Results of instrument analyses (including supporting data that are not uploaded to the database)	Electronic	Stored by DMS	ODSS and OIS Staff
Annual Network Plan (for portions of the CARB PQAO)	Federally required report to meet requirements of 40 CFR 58.10	Electronic	https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report	AQPSD Staff
PM2.5 Monitoring Waiver	Annual Waiver request for 1-IN-6 day monitoring at five sites.	Electronic	Available in Annual Network Plan: https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report	AQPSD Staff
5 Year Network Assessment (for portions of CARB PQAO)	Assessment of potential network changes in upcoming 5 years	Electronic	Internal network drive (HQCSAQPSD\branch\ aqpb) T:\Network assessment (5 year)	AQPSD Staff
State Implementa-tion Plans	Plans required under the Federal Clean Air Act	Electronic	https://www.arb.ca.gov/planning/sip/sip.htm	AQPSD Staff
Laboratory Notebooks	Includes the following types of notebooks and bound data sheets: - analysts' notebooks - instrument maintenance logs - reagent preparation logs - materials acceptance tests	Electronic; Hardcopy	Laboratory or archive area.	ILS Staff
Laboratory Calibration Certificates and Records	Includes certificates of NIST traceability and similar records	Hardcopy	Near location of calibrated instrument. Laboratory or archive area.	ILS Staff
Laboratory Control Charts of Equipment	QC information displayed in sequence to help diagnose problems with analytical instruments. Usually includes acceptance limits that are periodically computed.	Electronic; Hardcopy	QC Limits are placed into NLB's LIMS. Laboratory or archive area.	ILS Staff

Document Name	Brief Description	Format	Storage Location	Record Custodian
Laboratory SOPs	Current copies of SOPs relevant to the analyses performed in a particular laboratory	Electronic; Hardcopy	https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air, and on internal network drive. Laboratory or archive area.	ILS and LSS Staff
Laboratory Quality Control Manual	A current copy of the QCM. Laboratory Managers ensure each Analyst has access to a current copy.	Electronic; Hardcopy	https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf, and on internal network drive. Laboratory or archive area.	LSS Staff
Analytical Results Database	Results for each chemical analysis with identifying information	Electronic; Hardcopy	NLB's LIMS LabVantage 8.3.0 and on the instrument controller. Laboratory or archive area.	LSS, ILS, and OIS Staff
Analytical QC Database	Includes all QC information for each weighing session including standard weights, duplicates, field blanks, and laboratory blanks.	Electronic; Hardcopy	NLB's LIMS LabVantage 8.3.0 and on the instrument controller. Laboratory or archive area.	LSS, ILS, and OIS Staff

A9.7 – Procedures for Correction of CARB Documents and Records

Corrections to hand-written and electronic data must be completed only by authorized staff. Corrections are made with approval from relevant section managers, database administrators, or designated record custodians, where applicable. The data correction process must maintain the integrity of the original data. Hand-written corrections must be made with ink pen as follows: cross out invalid information with a single line, and initial and date changes. Electronic data correction must be documented, and documentation should at a minimum include:

- Correction(s) made
- Date data amended
- Individual making correction(s)
- Rationale for the correction(s)
- Approvals (if applicable)
- Corrective actions (if applicable)

Guidance and further details on the data correction process can be found in CARB SOP 610, Data Review and Validation, CARB SOP 606, Data Management System, and the MLD NLB Laboratory Quality Control Manual. These documents can be found in the CARB Quality Assurance Manual Volumes II and III on the Quality Assurance webpage at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-

assurance-manual. Additional details are also discussed in QAPP Sections C2.1.2 and Section C2.2.3.

Section B1 – Sampling Process Design

The following section describes the process that goes into designing the air monitoring network and the considerations that must be given to locating sites that measure one or more pollutants and/or meteorological parameters. Many regions in California are characterized by complex terrain, variable meteorological conditions, and diverse emission sources. A large monitoring network is critical for assessing the State's progress in meeting clean air objectives, understanding spatial and temporal variation in air pollutants, and evaluating pollutant exposure. Monitoring is a joint responsibility. Monitors are operated by CARB, local air districts, NPS, private contractors, and tribal authorities. Particulate matter criteria monitoring stations operated by CARB may be to supplement stations operated by the monitoring agency, or to meet the monitoring requirements for a district that does not operate the stations themselves.

The primary goals of the CARB PQAO monitoring network are to provide air quality information to the public, support compliance with ambient air quality standards and emissions strategy development, and to support air pollution research, as specified in Appendix D to 40 CFR Part 58. These federal regulations further state that in order to meet these goals, the monitoring network must be able to provide information on peak pollution levels, typical levels in populated areas, air pollution transported into and outside of a city or region, and air pollution levels near specific sources.

In order to meet all of the goals, stations must be sited to meet one or more of numerous monitoring objectives, have a defined site type, and must be sited at the appropriate spatial scale. The goal of locating monitors is to correctly match the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the air pollutant to be measured, the site type, and the monitoring objective.

To select air monitoring station locations according to the site type criteria, it is necessary to have detailed information on the location of emission sources, geographical variability of ambient pollutant concentrations, meteorological conditions and population density. Site types relate to how sites/stations represent air quality over a geographical area. Spatial scales range from as little as several meters to the global scale. Thus, selection of the sites/stations will be based upon the best available evidence and on the experience of the decision team. Site considerations: Economics, security, logistics, atmospheric considerations, topography, pollutant considerations and the availability of appropriate locations.

Detailed information on the current CARB PQAO air monitoring network design can be found in CARB's ANP or other districts' ANPs. The 2020 CARB ANP covers the monitoring networks of 25 districts within the CARB PQAO. Seven districts in the CARB PQAO prepare their own ANPs and submit them directly to U.S. EPA. These

local air districts are Great Basin, Monterey, North Coast, Sacramento Metropolitan, San Joaquin, San Luis Obispo, and Santa Barbara. These district ANPs include monitoring sites operated by the districts and by CARB, if any, within the jurisdiction of those districts. In addition, districts must coordinate all site changes with CARB and/or U.S. EPA (i.e., openings, closures, relocations) before they occur and obtain prior approval of the change before executing it, barring exceptional circumstances. Ambient air is monitored for criteria pollutants at each of the monitoring sites noted in the ANP, however not all of the sites operate filter-based or continuous monitors for particulate matter pollutants.

Appendix A of the CARB ANP also lists the location of many of the monitors, including the CBSA in which the monitors are located. The remaining monitors are listed in the other districts' ANPs. CBSAs are defined by the United States Office of Management and Budget (OMB) and provide a consistent set of geographical areas for federal agencies to use in collecting, tabulating, and publishing statistical data. Two types of areas are included as CBSAs: Metropolitan Statistical Areas and Micropolitan Statistical Areas, which differ by population threshold. A Metropolitan Statistical Area has an urban core with a population of 50,000 or more, whereas a Micropolitan Statistical Area has an urban core with a population of at least 10,000, but less than 50,000. Several counties in California are sparsely populated and do not meet the classification requirements for incorporation into a CBSA.

U.S. EPA specifies the minimum number of monitors required for each pollutant based on the OMB statistical areas and other factors. For some standards, minimum monitoring is based on the severity of the air quality, as specified by the design value and the population of the CBSA. Other standards rely on other factors in addition to population, such as motor vehicle counts or emissions levels. The ANP summarizes federal minimum monitoring requirements for criteria pollutants. For some pollutants, for example PM2.5, tied to the minimum monitoring requirements is the need to establish a site where the highest concentrations are expected to occur. As noted in Appendix D of 40 CFR Part 58, 'The total number of monitoring sites that will serve the variety of data needs will be substantially higher than these minimum requirements provide. The optimal size of a particular network involves trade-offs among data needs and available resources.'

In California, due to the severity of air quality problems and the needs of implementing critical State and federal programs, the number of monitors exceeds the federal minimum monitoring requirements. When determining the appropriate number of sites, factors considered include, but are not limited to:

- Highest concentrations expected to occur in the area covered by the network
- Population exposure
- The impact of significant sources or source categories on air quality
- General background concentration levels

- Regional pollutant transport
- Information on air quality to the public
- Support of development of required federal and State air quality plans

In addition, CARB collaborates with each monitoring agency in the CARB PQAO to define respective roles and responsibilities with regard to California's ambient monitoring network and to identify any critical local monitoring needs.

For CBSAs that include multiple districts, fulfillment of minimum monitoring requirements is dependent upon coordination between air monitoring agencies, particularly when changes to the monitoring network are considered. The Roles and Responsibilities documents developed by CARB specify that districts and CARB must communicate with each other when changes to the network are being considered. When proposed changes are communicated between districts and CARB, staff from both agencies as well as U.S. EPA will work closely to evaluate impacts on minimum monitoring requirements and develop pathways that ensure federal requirements are met. The Roles and Responsibilities documents are available on CARB's website at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/roles-responsibility-agreements.

For continuous analyzers, consecutive hourly averages must be collected except during:

1. periods of routine maintenance plus other instrument or site issues; or
2. periods of instrument calibration, quality control checks, or performance evaluation.

For discrete analyzers, filter based samples must be collected on scheduled sampling days except during:

1. periods of routine maintenance plus other instrument, filter media, or site issues;
2. periods of instrument calibration, quality control checks, or performance evaluation;
3. Replacement "make-up" sampling days as stipulated in 40 CFR Part 50, Appendix N.

More specific information about CARB's PQAO network is in the Annual Network Plan, located at: https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report.

B1.1 – General Station Design Requirements

The design at CARB particulate matter air monitoring stations incorporates the following:

- Standardized and U.S. EPA approved air monitoring equipment, including reference (FRM) or equivalent (FEM) monitoring equipment;
- All equipment sited in accordance with the requirements in 40 CFR Part 58 Appendix E. A summary of these siting requirements can be found in the CARB Quality Assurance Manual at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-manual;
- Standardized sampling components;
- Data acquisition systems.

A typical monitoring station for particulate matter parameters will include the following components:

- Environmental controlled shelter, trailer, or other suitable location (i.e. office type room). Automated instrumentation shall be housed in temperature controlled and monitored shelters where required by 40 CFR.
- Secure rooftop platform or suitable raised platform
- FRM and/or FEM monitors
- Certified flow rate transfer standards for performing flow rate verification and leak test checks
- Data acquisition system (DAS)

Section B2 – Monitoring Methods

This section identifies monitoring instrument SOPs for particulate matter monitors operated by CARB monitoring personnel. SOPs list needed equipment, identify support facilities, and describe operation, maintenance, and repair of equipment. They also provide details regarding duties/responsibilities for field operators and QC needed to satisfy monitoring requirements. The quality control information included in the SOPs is developed in accordance with measurement quality objectives in U.S. EPA Handbook Volume II and 40 CFR Part 58, as applicable. SOPs written by MOs are expected to meet these requirements at a minimum. If an MO does not have an approved SOP, MOs should adopt CARB's SOPs or consult the document repository to adopt SOPs from other MOs which have been approved by CARB. These SOPs can be adopted as written or with a CARB approved addendum.

The sampling methods used in this document meet the qualifications of either the Federal Reference Methods (FRM) or Federal Equivalent Methods (FEM). FRM is a sampling and analysis method for an ambient air pollutant that is specified as a reference method according to 40 CFR Part 50, or a method that has been designated as a reference method in accordance with 40 CFR Part 53. For PM, the reference methods are based on manual techniques using filters prepared and weighed under specified laboratory conditions. FEM is a measurement method that was demonstrated by rigorous field testing in accordance with 40 CFR Part 53 to produce equivalent results to the reference method. These designations are made by U.S. EPA. Once a method has been designated by U.S. EPA to be equivalent to the reference method, the data produced is usually regarded and utilized similar to data produced by an FRM.

At a minimum, monitoring methods used by CARB must be either reference or equivalent methods as designated by U.S. EPA. California further defines monitoring methods for use. Ambient air monitoring methods for California are outlined in QA Manual Volume IV and outlined in the list of California Approved Samplers (CAS). The CAS list is maintained by MLD with input from AQPSD and PQAO Districts as to what monitoring methods are suitable for monitoring in California. These data partners also provide input to address method changes, and communicate with each other when changes to the network are being considered. When proposed changes are communicated between districts and CARB, staff from both agencies as well as U.S. EPA will work closely to evaluate impacts and develop pathways that ensure federal requirements are met.

Current and legacy Standard Operating Procedures (SOP) for particulate matter pollutant instruments are available online at the MLD Quality Assurance Manual webpage, as outlined in Table B.1. SOPs for the preparation and gravimetric analysis of filter-based samples are included on the Laboratory Standard Operating Procedures for Ambient Air webpage, as highlighted in Table B.1. CARB and the MOs are

currently in the process of creating and updating SOPs to include all procedures related to work in the particulate matter air pollutant monitoring program. CARB's goal is to update its SOPs at least once every five years, and to review the SOPs annually to determine if they reflect current practices.

Table B.1 – Examples of Monitoring and Laboratory SOPs and Technical Documents.

Particulate Matter	**Location of SOP Documents**
Monitoring Instruments	https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring
CARB Laboratory Analysis	https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air

Instrument SOPs contain technical instructions for station operators. In the event of a deviation from the procedures or other issues, operators will initiate the corrective action process by completing the Corrective Action Notification form. More info on the corrective action process is in QAPP section D1. CARB SOPs for data acquisition, review, and validation are listed on section B9. Laboratory SOP deviations are approved by laboratory management and documented. If the deviation is on a more permanent basis, then an SOP addendum is generated and approved by QMB.

Section B3 – Sample Handling and Custody

Particulate matter sampled using discrete sampling methods utilize sample filters which must be handled and transported to a laboratory for analysis. The sample handling and custody requirements for these discrete methods are discussed in sections B3.1 and B3.2 below. Continuous sampling instruments test and record sample results in real time and require no additional sample handling or custody.

B3.1 – Filter Hold Time and Temperature Requirements

Federal regulations stipulate specific time frames and environmental conditions for FRM PM2.5 sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated either by field operators or laboratory staff. In addition to these requirements, field operators must practice the usual care to prevent or minimize contamination of the sample filter media and filter cassettes.

Sampled PM2.5 and PM10 Lo-Vol filters must be removed from the sampler within 177 hours (7 days, 9 hours) of the end of sampling and placed in cold storage as soon as practical. Sampled filters must be kept at a temperature of less than 4 °C during storage and shipping which allows the laboratory up to 30 days from the end of sampling for analysis. If this temperature is exceeded but kept at no greater than 25 °C, and the average ambient sampling temperature is greater than 25 °C, the laboratory has up to 30 days to analyze. Additionally, if the temperature is exceeded but kept at no greater than 25 °C, and the average ambient sampling temperature is less than 25 °C, the laboratory has up to 10 days to analyze. The storage environment must have its temperature constantly monitored and recorded. Sampled filters and CARB 24-Hour Sample Report-Field Data Sheets will be shipped in an insulated shipping container containing sufficient Blue Ice or other leak proof ice substitute media to assure that sample filters arrive at the laboratory at a temperature no greater than 25 °C or preferably 4 °C. Other methods may also be employed if they comply with these requirements.

Shipping containers will contain a min/max thermometer, temperature data logger, irreversible temperature indicators (WarmMark, 5 °C and 25 °C, or similar) or other suitable means to determine whether temperature requirements of the sample filters have been exceeded during transit. This requirement also applies when sampled filters are being transported from remote or satellite sites to central or main locations.

Sampled filters will be shipped to the laboratory weekly on Monday, Tuesday, Wednesday or any other day that avoids Saturday or Sunday arrivals as well as assures as short as possible transit time. Sampled filters may also be dropped off directly to laboratory support personnel Monday-Friday, to further ensure as short as possible transit time.

Federal regulations also stipulate time frames for FRM PM10 sample filters. Samples should be weighed as soon as possible to minimize volatile particle mass loss. Samples should be received in the laboratory less than 30 days after sampling. If these time frames are not met, sample filters may be flagged or invalidated by field staff or the receiving laboratory. In addition to these requirements, operators should practice the usual care and follow standard operating procedures to prevent or minimize contamination of the sample filters and provided filter storage media. Sampled filters are shipped to the receiving laboratory at ambient temperatures.

Analyzed PM2.5 filters are archived for one year in cold storage, then may be stored at room temperature. All PM filter-based samples must be kept for five years, plus the current year.

B3.2 – Chain of Custody Requirements

A chain of custody (COC) must accompany each sample. A COC or record of custody is an accurate written record that tracks possession, transfer, handling, and location of samples from sample media preparation to sample collection, including sample receipt, and analysis. The COC is an important function of sample control and an integral part of sample receipt.

All samples shall be accompanied by a properly completed COC. If not, laboratory staff may not accept samples depending on the program. If samples are accepted, they will be stored appropriately in the specified sample receiving area but may not be processed until a completed COC is received.

Laboratory staff generates a COC for each filter before sampling, and each subsequent change of sample custody is documented. Laboratory staff shall sign and date the COC indicating the laboratory has received the sample and is now responsible for sample control and custody. All completed, signed, and dated COCs shall be stored and archived appropriately according to program needs or requirements and CARB document retention policies.

B3.3 – Security

<u>Monitoring Site Security</u>

Monitoring stations are secure sites which are kept locked when CARB personnel are not present. Locked fencing is additionally used where possible. Only authorized CARB representatives have access to the site keys. Personnel activity at CARB sites are documented in the station logbooks.

MOs are expected to have similar site security standards to CARB. Computer access and security is discussed in detail in section B9. If MOs use any additional data

transmittal equipment, the details and security of these devices must be included in a QAPP addendum document.

Monitoring site break-in occurrences are logged by the site operator. In addition, California Highway Patrol or local law enforcement is notified and requested to complete a report on such an incident.

Laboratory Security

The Monitoring and Laboratory Division is a secure site and access to the laboratory is available via key card for authorized personnel only. Laboratory personnel are required to wear identification at all times. Visitors are required to sign in and out, wear visitor identification, and be accompanied by authorized laboratory personnel. Any variation from this procedure is documented by administrative staff.

MLD site building entrances are monitored with cameras and onsite security personnel. Buildings are also protected by a security system that alerts police to potential break-ins. Unauthorized access or break-ins are reported to police and all incidences are documented. PM laboratories (balance rooms) are kept locked when laboratory staff are not present. Only authorized laboratory staff have access to keys.

Laboratory data is stored on computers and in the Laboratory Information Management System (LIMS). Access to LIMS is managed by the LIMS administrator(s). Data access privileges, based on staff duties and needs, are approved by laboratory management. Computer and LIMS access and security is discussed in detail in section B9.

B3.4 – Sample Archival

After each post-weight session, PM2.5 and PM10 Lo-Vol samples are archived in the designated refrigerators, where they are kept cold for at least one year. After their one-year retention in cold storage, samples are moved to the designated room temperature archive storage, away from light and dust, for the remainder of the required archive period. Samples are kept for five years, plus the current year. PM10 filter samples, their respective COC forms, and any program related reports are archived for five years plus the current year according to records retention policy.

B4 – Analytical Methods

The pollutants covered in the Particulate Matter Pollutant Air Monitoring Program QAPP are analyzed using both discrete and continuous PM samplers. Discrete methods require laboratory gravimetric analysis to be performed on sample filters.

FRM criteria pollutant monitoring for PM10, PM2.5, and PMc requires discrete sampling methods. Discrete sampling instruments operate by drawing air at a set flow rate over a 24-hour time period through appropriate sized filters, depending on the method. Upon delivery to the analysis laboratory, the filters are stored under controlled temperature and humidity for at least 24 hours for equilibration. Discrete sample masses are determined by gravimetric analysis in which the pre- and post-sampling filter net mass differences are compared. The mass concentration of particulate matter in the ambient air is computed as the total mass of collected particles in the desired particle size range divided by the volume of air sampled, as determined in standard or actual conditions, and is expressed in micrograms per cubic meter of air ($\mu g/m^3$).

CARB provides lab analysis of these discrete samples in the Sacramento MLD location. The laboratory standard operating procedures (SOP) are documents which describe the steps necessary to conduct a measurement and the critical parameters to be evaluated during the analysis. SOPs set out detailed steps that implement the general guidance of the CARB Laboratory Quality Control Manual document. SOPs are written such that a chemist or laboratory technician with experience in the particular analytical technique can follow the procedure and obtain the same result as another similarly trained chemist.

The SOPs are specific to CARB laboratories because they describe the actual instrumentation and equipment used. Mention of specific equipment and products do not constitute endorsement or recommendation for use by CARB. Monitoring organizations within CARB's PQAO are expected to follow laboratory procedures similar to CARB that meet all criteria outlined in this QAPP.

The SOPs related to CARB laboratory analyses are listed in the following table:

Table B.2 – CARB Analytical Method SOPs

SOP	Title
SOP MLD055 Revision 2.0	Standard Operating Procedure for Determination of PM2.5 Mass and PM Coarse Mass by Gravimetric Analysis; August 2018: https://www.arb.ca.gov/aaqm/sop/mld055.pdf
SOP MLD016 Revision 7.0	Standard Operating Procedure for Determination of PM10 Mass by Gravimetric Analysis; April 2018: https://www.arb.ca.gov/aaqm/sop/mld016.pdf

Some districts within CARB's PQAO may also utilize PM laboratories of other PQAOs in California. These currently include PM laboratories at BAAQMD and SDAPCD. CARB expects that any laboratory utilized outside of its PQAO for the purpose of regulatory PM monitoring as outlined in this QAPP follow similar laboratory procedures that meet regulatory criteria described herein. PQAO partnering agency's quality management documents are maintained and updated by the partnering agency, with direction and approval from U.S. EPA. Additional information can be found on the associated agency's webpages at: http://www.baaqmd.gov/ (BAAQMD) and https://www.sdapcd.org/ (SDAPCD).

Below is a brief description of the principal of operation for the primary FEM monitor types operated in CARB and the PQAO network. More information on the principals of operation can be found in the operation manual for each instrument. Please note these descriptions are not necessarily inclusive of all monitors used in the CARB PQAO. It is CARB's expectation that if agencies within the PQAO intend to begin operating equipment other than those noted below, they will discuss the monitors with CARB. In addition, they will be responsible for preparing a QAPP addendum discussing the monitor operation and SOPs, as applicable.

FEM criteria pollutant monitoring for PM10 and PM2.5 allows for continuous sampling methods. Continuous particulate matter instruments report sampling data in real time. Two of the most commonly used FEM samplers include the Beta Attenuation Mass (BAM) or Tapered Element Oscillating Microbalance (TEOM) technology.

Beta attenuation mass (BAM) monitors use beta ray attenuation to calculate collected particle mass concentrations in units of $\mu g/m^3$. A 14C element (60 µCi +/- 15 µC) emits a constant source of low-energy electrons, also known as beta particles. The beta rays are attenuated as they collide with particles collected on a filter tape. The decrease in signal detected by the instrument scintillation counter is inversely proportional to the mass loading on the filter tape. As BAM monitors are mass analyzers, any component that is suspended on the filter tape and attenuates beta rays will subsequently affect the average mass value for that hour. Moisture in the ambient air can affect both monitor performance and hourly average mass values. All BAM samplers utilized by CARB are equipped with a "smart heater" to minimize moisture interferences.

TEOM instruments continuously monitor particulate matter levels by capturing particulate on a sample filter attached to a vibrating inertial mass transducer. Using the rate of mass accumulation on the filter and the flowrate through the sample (main) flow controller, the TEOM's microprocessor calculates the mass concentration. Inadequate control of the sample air temperature and RH are known sources of interference. Great care should be taken to maintain a stable temperature and RH in the instrument shelter and best practices dictate the use of additional insulation, such as pipe insulation, on all exposed tubing.

Additional information on interferences and how they are addressed can be found in the associated SOP on the QM Document Repository: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository.

FEM samplers incorporating other technologies may be used by agencies within the CARB PQAO. Agencies using different samplers should describe these in an addendum to the QAPP and prepare an SOP describing the sampler's use and operation. These quality management documents should be submitted to CARB for review and approval.

Section B5 – Quality Control

Quality Control (QC) is composed of a set of internal tasks performed routinely that ensures representative, high quality, and defensible ambient air quality data. QC tasks address all aspects of monitoring and reporting. Examples include automated and manual calibration checks, instrument diagnostics, preventative maintenance, data review, and documentation.

Section B5.1 – Field QC

For particulate matter pollutant instruments, flow rate checks are performed by monitoring organizations to confirm that reliable, accurate, critical flow rates and total flow are obtained. These QC checks should ideally be performed using certified equipment and standards separate from those used for the multi-point calibration, wherever possible. These checks are recorded in a maintenance check sheet or instrument log to assist in the data validation process. QC checks are not used to make any adjustments to analyzers. Doing so will invalidate the multi-point calibration of the instrument.

If any QC checks are found to be outside of the acceptance criteria, a weight of evidence evaluation will be performed as outlined in 40 CFR, Part 58, App. A. Per section 1.2.3, 'Failure to conduct or pass a required check or procedure, or a series of required checks or procedures, does not itself invalidate data for regulatory decision making. Rather, PQAOs and the EPA shall use the checks and procedures required in this appendix in combination with other data information, reports, and similar documentation that demonstrate overall compliance with Part 58.' In addition, ambient data are not invalidated solely based on QC check results. The data analysts must use all available information in deciding how to validate the data set in question. Additional information regarding validation of data sets for a particular pollutant and instrument can be found in the instrument or laboratory SOPs listed in Table B.1 and in the data validation SOPs listed in Section B9.

Routine QC checks are performed using calibration equipment and standards separate from those used for the multi-point calibrations, if possible. Station operators, data reviewers, and air monitoring management monitor the results of these checks and will take action if the results fall outside of acceptable limits.

The below tables B.3 and B.4 detail QC limits for particulate matter sampling. Table B.3 includes QC limits for filter-based sampling and table B.4 includes QC limits for continuous monitoring.

Table B.3 – Filter-Based PM Field QC Criteria

Acceptance Criteria	Frequency	PM2.5 / PM10 Lo-Vol
Pre-sampling Hold time	All filters	≤ 30 days from pre-weight date
Sample Recovery	All filters	≤ 7 days, 9 hours (177 hours) from sample date end
Sampling Period	All filters	1380-1500 minutes, or if value < 1380 and exceedance of NAAQS midnight to midnight local standard time
Average Flow Rate	Every 24 hours of operation	Average within 5% of 16.67 liters/minute
Variability in Flow Rate	Every 24 hours of operation	CV ≤ 2%
One-point Flow Rate Verification	Every 30 days each separated by 14 days	< ± 4.1% of transfer standard; < ± 5.1% of flow rate design value
Individual Flow Rates	Every 24 hours of operation	No flow rate excursions > ± 5% for > 5 min
Acceptance Criteria	**Frequency**	**PM10 Hi-Vol**
Sample Recovery	All filters	ASAP
Sampling Period	All filters	1440 minutes ± 60 minutes; midnight to midnight ± 30 minutes local standard time
Average Flow Rate	Every 24 hours of operation	~1.13 m^3/min (varies with instrument)
One-point Flow Rate Verification	Every 90 days and 4 times a calendar year	< ± 7.1% of transfer standard and < ± 10.1% from design

Table B.4 – Continuous PM Field QC Criteria

Acceptance Criteria	Frequency	PM2.5
Data Reporting Period	Report every hour	24 hour period is calculated in AQS if 18 or more valid hours are reported for a day

Acceptance Criteria	Frequency	PM2.5
Average Flow rate	Every 24 hours of operation; Alternatively each hour can be checked	Average within 5% of 16.67 liters/minute at local conditions
One-point Flow Rate Verification	Every 30 days each separated by 14 days	< ± 4.1% of transfer standard; < ± 5.1% of flow rate design value
Check of Membrane Span Foil (BAM only)	Daily	Avg. < ± 5.1% of ABS
Acceptance Criteria	**Frequency**	**PM10**
Data Reporting Period	Report every hour	24 hour period is calculated in AQS if 18 or more valid hours are reported for a day
Average Flow rate	Every 24 hours of operation	Average within < ± 5.1% of design
One-point Flow Rate Verification	Every 30 days each separated by 14 days	< ± 7.1% of transfer standard

B5.2 – Laboratory QC

Particulate matter filters are pre- and post-weighed in an environmentally controlled laboratory referred to as a balance room. Per 40 CFR Part 50, Appendix L, the balance room's relative humidity must be maintained at a mean value range over 24 hours of 30-40% and standard deviation of < 5.1% and the air temperature must be maintained at a mean value range of 20.0-23.0 °C and standard deviation of < 2.1 °C for conditioning of PM2.5 filter media. Per 40 CFR Part 50 Appendix J, the balance room's relative humidity must be maintained at a mean value range over 24 hours of 20-45% and standard deviation of < 5.1% and the air temperature must be maintained at a mean value range of 15.0-30.0 °C and standard deviation of < 3.1% for conditioning of PM10 filter media. If the balance room is out of range for temperature or humidity, no weighing can occur until the room is back in range for 24 hours.

Before any PM2.5 or PM10 filter is weighed, it must be checked for defects. This is done by an examination of the filter in accordance with rejection and acceptance criteria detailed in the applicable laboratory analysis SOP listed in Table B.2. Pre-weight filters are discarded if any unacceptable defects are identified. Sampled filters are not discarded.

Table B.5 below details laboratory QC limits for filter-based particulate matter sampling.

Table B.5 – Laboratory QC items

PM2.5 & PM10 Lo-Vol		
	Frequency	**Acceptable Range**
Critical Laboratory QC Checks		
Filter Conditioning Environment		
Equilibration	All filters	24 hours minimum
Temp. Range	All filters	24-hour mean 20.0-23.0 °C
Temp. Control	All filters	< 2.1 °C SD over 24 hr.
Humidity Range	All filters	24-hr mean 30.0%- 40.0% RH
Humidity Control	All filters	< 5.1% SD over 24 hr.
Pre/Post Sampling RH	All filters	Difference in 24-hr means < ± 5.1% RH
Balance	All filters	Located in filter conditioning environment
Microbalance Auto Calibration	Prior to each weighing session	Manufacturer's specifications
Operational Laboratory QC Checks		
Lot Blanks	9 filters per lot	< ± 15.1 µg change between weighings
Exposure Lot Blanks (Stability Blanks)	4 filters per lot	< ± 15.1 µg from its determined average weight from lot blank study
Filter Integrity	Each filter	No visual defects
Field Filter Blank	10% or 1 per weighing session	< ± 30.1 µg change between weighings
Trip Filter Blanks	10% or 1 per weighing session	< ± 15.1 µg change between weighings
Laboratory Filter Blanks	10% or 1 per weighing session	< ± 15.1 µg change between weighings
Balance Check (working standards)	Beginning, every 10th sample, end	< ± 3.1 µg from certified value
Routine Duplicate Weighing	10% or 1 per weighing session	< ± 15.1 µg change between weighings
Microbalance Audit	Every 365 days and once per calendar year	< ± 0.003 mg or manufacturers specs, whichever is tighter

PM2.5 & PM10 Lo-Vol		
	Frequency	**Acceptable Range**
Laboratory Temp Check	Every 90 days	< ± 2.1 °C
Laboratory Humidity Check	Every 90 days	< ± 2.1%
PM10 Hi Vol		
Critical Laboratory QC Checks		
Equilibration	All filters	24 hours minimum
Temp Range	All filters	Calculated 24-hour average within 15 – 30 °C
Temp. Control	All filters	Calculated 24-hour SD within ± 3 °C.
Humidity Range	All filters	Calculated 24-hour average within 30 – 40% RH
Humidity Control	All filters	Calculated SD within ± 5% RH.
Balance	All filters	Located in filter conditioning environment
Operational Laboratory QC Checks		
Balance Calibration Check (Control)	Before any pre- or post-weighing begins	4 g (1 g and 3 g weights combined) within ± 0.0005 g
Balance Standard Weight Checks	Beginning of pre- or –post sample weighing, after every 9th sample duplicate, ending of sample weighing	Beginning 3 g then 5 g, weights separately; after every duplicate 9th sample, alternate 3 g and 5 g weights separately; end with 3 g and 5 g, weights separately; each weight must be within ± 0.0005 g.
Routine Duplicate Weighing	10% or minimum of 1 per weighing session	< ± 2.8 mg change from original value for pre-sampled filters < ± 5.0 mg change from original value for post-sampled filters
Field Filter Blank	1 per site per calendar quarter	< ± 5 mg change between pre- and post-weights
Laboratory Temperature Sensor Checks	Once per calendar year	< ± 2.0 °C
Laboratory Humidity Sensor Checks	Once per calendar year	< ± 2.0%

SD = Standard Deviation

B5.3 – Precision and Bias

Precision for most particulate matter samplers is assessed via collocated sampling whereby two identical or equivalent samplers are operated side-by-side. Collocated sampling is required for all PM samplers, except continuous PM10. Bias for PM samplers is assessed by using the routine flow rate verifications performed by site operators. Total PM2.5 bias for a PQAO is also assessed through the Performance Evaluation Program run by EPA. Precision and bias are assessed and calculated by CARB's QMB, and reported annually in the Data Quality Report. See section D2 for more details.

Appendix A of 40 CFR 58 includes requirements for collocation of samplers to ensure that measurements of particulate matter are of comparable quality throughout monitoring networks located in each PQAO. Federal regulations require that 15 percent of the FEM and FRM monitors in the network of primary PM2.5 monitors must have a collocated monitor. Collocated FRM monitors must have the same method of measurement. For each site with collocated PM2.5 FEM monitors, half of the collocated monitors must have the same method of measurement and half must be FRM monitors. If there are an odd number of required collocated monitors, then the additional monitor must be an FRM monitor. PM2.5 FRM collocated monitors operate on a 1-in-12 sampling frequency, following U.S. EPA sampling schedule calendar for the given year. This information can be found on U.S. EPA's website here: https://www3.epa.gov/ttnamti1/calendar.html.

Federal regulations require that 15 percent of PM10 sites using manual FRMs in a PQAO have collocated monitors. Collocated monitors must use the same method of measurement as the primary FRM monitor. Per U.S. EPA's guidance, the required number of collocation sites is determined by counting all of the PM10 FRM monitors, regardless of method code.

Table B.6 – Precision

Continuous and Filter-Based PM2.5/Filter-Based PM10	
Single Analyzer (Collocated monitors)	CV < 10.1% of samples ≥ 3.0 µg/m^3 for PM2.5 OR 15.0 µg/m^3 for PM10
PQAO Level	90% CL of CV < 10.1 % for values ≥ 3.0 µg/m^3 (PM2.5) or 15.0 µg/m^3 (PM10)

CV- Coefficient of variation; CL-Confidence Limit

Table B.7 – Bias

PM10 Continuous	
Bias from monthly flow rate verifications	< ± 7.1% of transfer standard
PM2.5 Continuous and Filter-Based	
Bias from PEP Audit Program	< ± 10.1% for values ≥ 3.0 µg/m^3

Performance of the instruments is further validated or assessed via the annual performance evaluation program for particulate matter pollutants. Details of this program are discussed in QAPP section D1.

A check of instrument diagnostic data, concentration data, QC check values, and error messages will be performed daily or during each site visit. Additional information on these routine service checks can be found in the individual instrument SOPs, listed in QAPP section B2.

When method acceptance limits are exceeded, station operators will begin the process of evaluating the situation and developing an appropriate corrective action, including an instrument verification and calibration process. This process is discussed in QAPP section B7.

The implementation of a comprehensive corrective action system throughout CARB's PQAO is an essential component for maintaining data quality and facilitating continuous process improvement. Upon review of audit results that show air monitoring equipment operating outside CARB's control limits or federal requirements, QMB will initiate an AQDA request. An AQDA is a request for an investigation of the validity of ambient air quality data for a certain period of time.

In addition to the AQDA process, QMB implemented the Corrective Action Notification (CAN) process. The CAN process documents issues that impact, or potentially impact, data quality, completeness, storage, or reporting. The goal of the CAN process is to investigate, correct, and reduce the recurrence of these issues. As such, the CAN process will identify issues not addressed by AQDAs, improves data quality, and helps ensure compliance with state, federal, and local requirements. MOs must use the CARB CAN process or submit a QAPP addendum which identifies their own corrective action process for approval.

Section B6 – Instrument/Equipment Calibration and Frequency

Calibration is defined as the comparison of a measurement standard, instrument, or item with a standard or instrument of higher level accuracy to detect and quantify inaccuracies. A calibration is used to report or eliminate those inaccuracies by adjustment.

Prior to implementation of any ambient air monitoring activities, particulate matter pollutant monitoring instruments are required to be calibrated by checking flow rates against certified flow measurement standards. Once an instrument's calibration relationship is established, periodic calibrations at reasonable frequencies confirm that the instrument measurements remains within an expected value. Performing frequent adjustments to instrumentation can cause additional measurement uncertainty. Calibration tolerances have been developed so that as long as the instruments are within the tolerances, adjustments do not need to be made.

To ensure the quality of the data collected within CARB's air monitoring network, all instruments used in the network must be calibrated:

- During initial field installation and annually thereafter,
- Following physical relocation,
- Prior to instrument shut-down,
- After any major maintenance or repair,
- After an instrument has drifted outside of acceptable QC limits.

One of the five common factors considered in defining a PQAO is the use of common calibration facilities and standards. CARB has the responsibility to provide timely certification, calibration, and verification services. Districts have the responsibility to utilize these services in order to maintain commonly used calibration facilities and standards throughout the PQAO as agreed upon in the Roles and Responsibilities document. If using non-CARB sources for these services, a district must maintain certification records and make them available for CARB review.

B6.1 – Particulate Matter Instrument Verification/Calibration

A calibration is comprised of up to three components; an "AS-IS" multi-point calibration verification, an instrument specific calibration adjustment procedure, and a "Final" multi-point calibration verification.

Multi-point calibrations are used to establish or verify the accuracy of analyzers and serve to meet verification requirements of 40 CFR Part 58 and associated regulatory guidance. Multi-point instrument calibrations at all stations within the CARB network shall be performed in a consistent manner and in accordance with the appropriate

SOP and instrument manual. This ensures that all network monitoring instrumentation in the CARB network are calibrated in a similar fashion.

CARB utilizes two forms of field multi-point calibrations, nominally referred to as "AS-IS" verifications and "Final" calibrations. An "AS-IS" verification is performed initially to evaluate the performance of an instrument. No adjustments, modifications or repairs are made to the instrument prior to the "AS-IS" verification. This confirms instrument performance for the recently generated data; usually back to the previous calibration or verification.

Typically, an "AS-IS" verification will determine if an instrument is outside of acceptable calibration criteria for the respective parameter. If so, the instrument warrants maintenance, repair, or adjustment. A "Final" calibration is performed after the instrument has undergone major maintenance, repair, or an adjustment. The "Final" calibration confirms that maintenance, repairs, or adjustments bring the instrument within acceptable calibration criteria. The analyzer to be calibrated should be in operation prior to calibration to ensure it has fully warmed up and its operation has stabilized. The instrument operation manual or instrument manufacturer should be consulted to determine the minimum amount of time required for an instrument to fully warm up. Prior to calibration, a leak check of the sampling system should be performed.

Table B.8 lists the frequency and acceptance criteria used to test the calibration of particulate matter air monitors:

Table B.8 – PM Monitor Multipoint Flow Rate Calibration Table

Parameter	Frequency	Acceptance Criteria
PM2.5 Filter-Based/ PM10 Lo-Vol Filter-Based	Any electromechanical maintenance or transport or every 365 days and one a calendar year	< ± 2.1% of transfer standard
PM10 Hi Vol Filter-Based	Every 365 days and once per calendar year	3 of 4 cal points within < ± 10.1% of design
PM2.5 Continuous	Any electromechanical maintenance or transport or every 365 days and one a calendar year	< ± 2.1% of transfer standard
PM10 Continuous	Every 365 days and once per calendar year	3 of 4 cal points within < ± 10.1% of design

Calibrations are typically performed by designated staff that are separate from those responsible for daily site operations, where possible. Calibrations should be

performed using equipment and standards separate from those used by site operators for performing routine QC checks, wherever possible.

B6.2 – Calibration Equipment and Standards

The calibration standards must be traceable to a primary standard such as a National Institute of Standards and Technology (NIST) Standard Reference Material (SRM). "Traceable" is defined in 40 CFR Parts 50 and 58 as meaning that a local standard has been compared and certified, either directly or via not more than one intermediate standard, to a primary standard such as a NIST SRM or a U.S. EPA/NIST-approved Certified Reference Material (CRM).

CARB operates and maintains a Standards Laboratory to provide authoritative standards for determining whether data meets the established data quality objectives. The equipment evaluated includes flow measuring devices (i.e., orifices, mass flow meters, and mass flow controllers) and meteorological sensors (i.e., temperature, pressure, and relative humidity). The Standards Laboratory has developed a Quality Assurance Manual that details the policies and procedures that ensure consistent collection and validation of the data generated by the Standards Laboratory. The QA Manual and Standards Laboratory SOPs can be found on CARB's QA webpage at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/standards-laboratory. Standards calibrated outside of the Standards Laboratory are expected to be certified to meet at a minimum the same traceability and quality assurance requirements listed in Table B.9. The following table B.9 outlines the frequency and acceptance criteria for verifications of calibration equipment used in the particulate matter air monitoring program.

Table B.9 – Calibration Equipment Acceptance Criteria

All PM Methods		
Criteria	**Frequency**	**Acceptable Range**
Flow Rate Transfer Standard	Every 365 days and once per calendar year	< ± 2.1% of NIST Traceable Standard
PM2.5; PM10 Lo-Vol		
Criteria	**Frequency**	**Acceptable Range**
Microbalance Calibration	At installation, every 365 days, and once a calendar year	Manufacturer's specification

Calibration and Check Standards		
Working Mass Standards Verification Compared to Primary Standards	Every 90 days	< ± 2.1 µg using the Double Substitution method
Primary Standards Certification	Every 365 days and once a calendar year	0.025 mg tolerance (Class 2) or better
PM10 Hi-Vol		
Criteria	**Frequency**	**Acceptable Range**
Microbalance Calibration	Every 365 days and once a calendar year	Manufacturer's specification
Primary Mass Standards (compare to NIST-traceable standards)	Every 365 days and once a calendar year	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1, or 2)
Controlled Room Condition Sensors for Temperature and Relative Humidity	Every 365 days and once a calendar year	Replacement with newly calibrated sensors, or calibration of existing sensors

B6.3 – SOP/Document References

CARB has documented calibration activity procedures in each instrument's SOP. The calibration documents applicable to field instrumentation use in the Particulate Matter Pollutant Monitoring Program can be found on CARB's Quality Assurance webpage at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring, and the documents applicable to the laboratory at: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air.

B7 – Instrument/Equipment Testing, Inspection, and Maintenance

CARB uses various types of instruments in support of particulate matter air monitoring activities. To ensure data collected by CARB instrumentation is valid, credible, and legally defensible, it is critical to properly test, inspect, and maintain air monitoring instrumentation.

B7.1 – Acceptance Testing and Inspection

Among the reference and equivalent U.S. EPA designated methods, a variety of analyzer designs and features are available. CARB has documented processes for acceptance testing, inspection, and maintenance of equipment used in its network. Acceptance testing is performed on newly purchased equipment prior to field or laboratory deployment to verify that equipment used in the CARB air monitoring network meets purchase specifications.

Field instrumentation testing is performed by the Operations and Data Support Section (ODSS) and generally includes a physical inspection, operational checks, performance checks, and configuration for field use. Acceptance criteria for sampling instrumentation are defined in acceptance test procedures located on CARB's Quality Assurance webpage, located at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring. It is the responsibility of monitoring organizations within CARB's PQAO to perform acceptance testing similar to CARB's procedure on their own equipment if they are not using equipment purchased by CARB. Upon request, CARB may perform acceptance testing for local air monitoring organizations. Equipment returning from a vendor following repair undergoes a bench test procedure, an abbreviated acceptance test procedure, prior to deployment.

Acceptance criteria for laboratory instrumentation are defined in the MLD Laboratory Quality Control Manual, located at: https://www.arb.ca.gov/aaqm/sop/nlbqcm.pdf. For filter-based sampling methods, in general the laboratory analyst or field staff must also refer to the specific SOP guidelines for acceptance testing, inspection, and cleanliness criteria for reusable filter support equipment or parts (such as canisters, cassettes, cassette covers, etc.), and indicators of contamination. If the analyst or field staff notices that new or reused filter support equipment or parts have experienced a change or possess a previously unidentified condition, such as an inherent contamination which could affect the quality or integrity of the results, field and laboratory management must be notified immediately. Management must evaluate the situation to determine if action is necessary when corrective action is not specified in the SOP. If an action is deemed necessary, management must verify that the appropriate action has been taken and documented by the analyst.

B7.2 - Maintenance

Routine service checks and preventative maintenance are critical areas of quality control that help to prevent downtime, costly errors, and data loss. Routine service checks are day to day functions which confirm and document that particulate matter monitors and laboratory instrumentation are properly operating. Preventative maintenance tasks involve routine service checks, and should be performed at the prescribed intervals listed in each instrument's or monitor's appropriate SOP and/or operating manual. Preventative maintenance tasks should be documented on the appropriate quality control maintenance sheets **and** the station log book or laboratory notebook. Clear documentation of monitor or instrument maintenance is required to confirm operation, to aid in troubleshooting, and assist with data validation.

Maintenance procedures specific to CARB operations are listed in detail in the SOPs referenced in Section B2. Further information can be found in each particular monitor or instrument's operation manual. Each monitor has a unique maintenance check sheet for documentation of these activities. These checklists are included on the Quality Assurance webpage at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring.

Although preventive maintenance tasks and frequencies are specific to the monitors or laboratory instrumentation make and model, Table B.10 illustrates generic major preventative maintenance tasks and frequencies for particulate matter pollutant monitors and laboratory equipment used by CARB. In addition, some field operators or laboratory staff may find that these tasks need to be performed more frequently.

Table B.10 – Typical Preventative Maintenance Tasks and Frequency

PM2.5 Filter-Based and Continuous	
Maintenance Item	**Activity/Frequency**
PM2.5 Separator (VSCC)	Cleaned or changed/Every 30 days
PM2.5 Filter-Based & Continuous, PM10 Lo-Vol	
Maintenance Item	**Activity/Frequency**
Inlet Cleaning	Cleaned/Every 30 days
Downtube Cleaning	Cleaned/Every 90 days
Downtube Cleaning – BAM only	Cleaned/Annual or more frequently as needed
Filter Housing Assembly Cleaning	Cleaned/Every 30 days
Circulating Fan Filter Cleaning	Cleaned or Changed/Every 30 days
Manufacturer-Recommended Maintenance	Per manufacturer's SOP

PM10 Filter-Based Hi-Vol	
Maintenance Item	**Activity/Frequency**
Inlet/downtube Cleaning	Cleaned/Every 90 days and 4 times a calendar year
Motor/Housing Gaskets	Inspected or replaced/Every 90 days and 4 times a calendar year
Blower Motor Brushes	Replace/600-1000 hours
Manufacturer-Recommended Maintenance	Per manufacturers SOP
PM10 Continuous	
Maintenance Item	**Activity/Frequency**
Inlet/downtube Cleaning	Cleaned/Every 90 days and 4 times a calendar year
Downtube Cleaning – BAM only	Cleaned/Annual or more frequently as needed
Manufacturer-Recommended Maintenance	Per manufacturers SOP
Laboratory Filter-Based PM10 and PM2.5	
Maintenance Item	**Activity/Frequency**
Anti-static strips	Replace/Every 180 days
Balance room	Clean/As needed Minimize incoming ambient dust/Replace sticky entry mats as needed
Balance	Remove dust from surfaces using anti-static brush/As needed Calibration/Annual Manufacturer-recommended maintenance/As needed

Section B8 – Inspection/Acceptance of Supplies and Consumables

Procurement of items and services is performed through an agency or state approved vendor, sole source non-competitive bid process, or a competitive bid/contract process as described in CARB's Procurement Services Guide which is available at http://inside.arb.ca.gov/as/asl/97-12.htm. This guide is intended to clarify state purchasing requirements, the responsibilities of procurement staff, and the responsibilities of the individual/group making a request to purchase. Item and service requirements are typically based on program or project needs. Generally, MOs perform their own acceptance testing with CARB offering assistance if needed.

CARB maintains a supply of frequently used spare parts and consumable materials through our Monitoring and Laboratory Division's (MLD) warehouse operations. Care is taken to ensure that the correct part is stocked and used appropriately. In most (but not all) cases original equipment manufacturer parts and consumables are used. Significant changes from manufacturer's specified parts could compromise the FEM/FRM status of an instrument.

Air monitoring supplies and consumables are directed to the Administration Section of MLD for receiving and inventorying. Parts and supplies are inventoried and tracked in a computer database that is maintained in order to ensure continuous operation of the air monitoring network.

Laboratory supplies and consumables are tracked and inventoried by laboratory staff. Supplies and consumables expiration dates are documented in logbooks and recorded with a label on each item or set of items.

Many of the items purchased by MLD include specific equipment specifications. The items are required to be inspected, and acceptance tested, as necessary, before any invoices can be paid. MLD typically has a 60 day window beginning from the date of receipt of the equipment to complete acceptance testing.

Acceptance criteria for supplies and consumables vary with the operation being conducted and are generally described in the relevant method and acceptance test or operational procedure SOPs. In general, specifications are checked to ensure adequate criteria for supplies and consumables are met and appropriate for use and operation by the Operation and Data Support Section.

The sampling media type used for discrete particulate matter testing is a filter. Filters for the PM10 program are received from U.S. EPA. PM2.5 filters are received only from manufacturers who can certify that supplied filter media meet the specifications given in Appendix L of 40 CFR Part 50. Filters are evaluated for acceptance by visual inspection using a light source. Following is a summary of review criteria:

PM2.5 filter: Teflon membrane or PTFE membrane, 46.2 mm diameter with polypropylene support ring.

Pre-sampling rejection considerations:

- Pinhole – A small hole appearing as a distinct and obvious bright point of light when examined over a light source.
- Separation of ring – Any separation of lack of seal between the filter and the filter support 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.
- Other – A filter with any imperfection not described above, such as irregular surfaces or other results of poor workmanship.

Post-sampling Inspection considerations:

- Evidence of contamination and/or damage to the filter - Dent, cut, water, fingerprint, oil, contamination, unusual sampling pattern, etc.
- Non-uniform deposits

PM10 filter: 8x10 inches high purity quartz microfiber filters

Pre-sampling rejection considerations:

Defective filters are useable filters. Rejected filters are unusable filters. The usability of filters may be determined by either field and/or laboratory staff.

- Hole – A hole that goes completely through the filter. A filter containing a hole of any size is rejected.
- Dense spot – Viewed from the filter back, this appears as a dark area (approximately 1/8 –to 1/4 inches in diameter) without sharply defined edges. Viewed from the front, an accumulation of filter fibers can be seen. A filter with more than one dense spot or spot larger than 1/4" is rejected.
- Dark spot or dark fiber cluster – A defect similar to the dense spot, but smaller in diameter. A filter with more than two dark spots is rejected unless darkness is confined in a clearly definable manner that can be indicated as a defect.
- Loose fiber – This appears as if a rough object has moved across this filter and loosened the fiber base. If the fibers are large and/or too numerous to remove without damaging the filter, then the filter is rejected.
- Detached fibers – When viewed from the front this defect resembles a thin spot. The shape can be circular or oval; no evidence of this defect can be seen

from the back. Gently rub the filter to remove the detached fibers. If this creates a hole, the filter is rejected.

- Coloration – Yellow, red, black or other colored spots may appear. A filter with such coloration is rejected unless the coloration is confined on the filter in a clearly definable manner, such as a singular small spot or small area, which can be indicated and the filter identified as defected.
- Frayed edges and corners of otherwise usable filters may be removed during inspection only if the collection area available for sampling is not impacted and only if all removals are clearly defined prior to the pre-weight determination. Usability of filters for sampling is determined by the field staff.
- Other – Filters with any obvious structural imperfections described above such as frayed edges, torn corners, indentations, and pronounced creases or other results of other poor workmanship are rejected.

Post-sampling inspection criteria:

Invalid samples may be determined by either field and/or laboratory staff.

- Filter Contamination – Filters which are dropped or become contaminated by any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) are invalid.
- Damaged or Torn Filters – Filters with tears or pinholes which occurred before or during sampling are invalid. (Note: a filter that has a hole or is torn before or during sampling will show evidence of particulate matter collection on both sides of the filter caused by the lack of filter integrity. If a damaged or torn filter is received by the lab, with all pieces included, that does not show evidence of tears or pinholes occurring prior to sampling, and not invalidated by the site operator, the sample should be considered valid.)
- Filters with missing corners or edges not indicated on the COC – Filters received with missing portions not indicated as having been removed during the filter inspection process, prior to the pre-weight, are invalid.
- Filter Leakage – If the filter shows signs of air leakage due to a worn or improperly seated gasket, the sample will be invalidated.
- Date Samples are received in the laboratory – Samples should be weighed as soon as possible to minimize volatile particle mass loss. Samples received after 30 days are invalidated. However, approved special circumstances may allow a sample to be flagged after 30 days, and invalidated if received after 45 days.
- Incorrect Filter – If the incorrect filter is sampled and the COC does not match the filter number, the sample is invalid.

Section B9 – Data Management

Section B9.1 – Continuous Particulate Matter Monitors

Air quality data measured by continuous particulate matter monitors in CARB's ambient air quality network are captured by CARB's data acquisition and management system. This section describes the functions and security of the CARB system for continuous particulate matter determination and the expectations for the systems utilized by MOs.

PQAO MOs are expected to use data management software that has similar functions and security to CARB's CARBLogger and DMS for continuous PM determination. This includes the processes for data acquisition, management, review, validation, security, and archival. These functions are all critical to the generation and management of complete, accurate, and legally defensible data. Since it is unlikely that MOs use the same data management system as CARB, MOs are expected adopt the baseline functions of the CARB system and describe the details of their own system in a QAPP addendum document.

Before a new data collection/management system becomes operational, extensive QA testing will be conducted to ensure that the new and old systems produce equivalent data sets and that the data is accurate and meets programmatic requirements. This process involves collaboration with the software designer and CARB Information Technology staff. In addition, CARB staff will follow any setup and diagnostic procedures included in the software user's manual. Staff will be trained on the use of the new system and data collection and management SOPs will be modified. Data formatting must be compatible with the end use (AQS upload, etc.).

Hardware and software are configured following standard procedures in instrument manuals, SOPs, quality control manuals, etc. Changes to software and hardware are inevitable, and it is important that necessary changes are documented and critical function is maintained. Verification of changes vary depending on the nature and complexity of the change and the hardware or software involved, and may require audits, operational or user tests, maintenance, installations, and/or inspections. All hardware and software configurations are tested prior to field deployments and before being utilized to collect or manage data involved in the PM pollutant monitoring program. When implementing changes, CARB re-establishes functionality and performance of software and hardware configuration requirements.

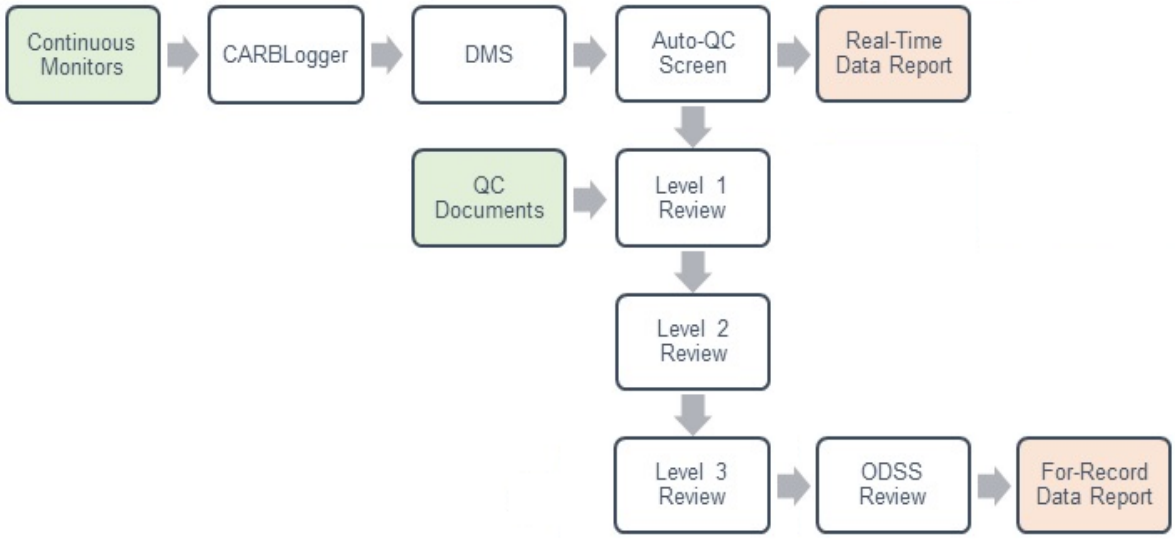
CARB's data acquisition/management system for continuous analyzers is composed of two major components:

1) A PC based logger utilizing a custom Linux software package referred to as CARBLogger; and

2) Data Management System (DMS) which is a SQL database developed by Sonoma Technology Inc.

Figure B.1 below outlines the CARB data management process for continuous PM samplers:

Figure B.1 – Data Flow Process for Continuous PM Samplers



The first level review process is typically performed by the site operator. The first level reviewer reviews preliminary data on a regular basis to confirm normal operation of instrument analyzers, identify any missing or erroneous data values or out-of-range conditions, and take corrective action in a timely manner when required. Second level data review is typically performed by a secondary site staff or another site operator in the section. The third level review is considered a management level review. Typically, the air monitoring section manager reviews all the documents submitted to ensure that the data are accurate and complete, sites have been maintained properly, instruments are operating within acceptable criteria, and all maintenance and repair actions are fully met and documented.

Once the data review process has been completed, approved data packages are forwarded to ODSS. A high level screening is performed on the data package and serves as a final inspection to ensure that all data have been reviewed, validated, and locked in the data system. Once data has passed screening, ODSS generates and uploads the required data files for AQS submission.

B9.1.1 – CARBLogger

Particulate matter pollutant data should be logged using a comprehensive logging system. CARB's Air Quality Surveillance Branch has developed an in-house data acquisition system to expand air monitoring capabilities. This technology utilizes open source software applications to create a digital based data acquisition and logging system. CARB has named this system the California Air Resources Board Data Logger (CARBLogger). CARBLogger continuously monitors and queries station analyzers, and processes one-minute concentration and meta-data files (or hourly data for some instruments).

A data acquisition system must include a function to communicate alarm conditions and to warn monitoring staff. Each hour, CARBLogger transmits air quality data to DMS via a secure file transfer protocol (SFTP) server operated by CARB's Office of Information Services (OIS). In addition, CARBLogger screens instrument diagnostic data and provides alerts to staff via email when diagnostic parameters are out of specification. Twice daily, CARBLogger will send the station operator, second level reviewer, and section manager an email to inform them of alarm conditions and warnings it detects.

To reduce data outages, CARB employs a data recovery process throughout the network. At CARB sites, primary data acquisition is performed by CARBLogger with a backup system utilizing each instrument's internal data logging feature. In the event of an intermittent failure of CARBLogger, CARB staff have the ability to utilize internal instrument data loggers, if available, to download the data from each instrument directly. PQAO district data management systems should have similar capabilities. CARBLogger capabilities are outlined in CARB SOP 605 available on the Quality Assurance webpage at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring.

B9.1.2 – Data Management System (DMS)

DMS is a Microsoft SQL Server-based data management system that has been developed by Sonoma Technology Inc. The system allows a user to manage, summarize, document chain-of-custody, and disseminate aerometric data. It also streamlines the processing of aerometric data, performs automated QC routines, provides data analysis tools, and improves the quality and availability of aerometric data to CARB's data clients. PQAO districts are expected to utilize data management systems with similar functions.

DMS ingests one-minute based data (hourly for some instruments) into its database and will aggregate an hourly average value. If properly configured, it will perform automated quality control checks and generate real-time data exports to U.S. EPA's AirNow System and CARB's Air Quality and Meteorological Information System

(AQMIS). In addition, it allows users to create manual AQS data exports to the U.S. EPA's Air Quality System (AQS). Within ninety days following the end of a calendar year, QAS staff generates reports in AQS to review and verify the precision and accuracy data. Please see Appendix A.8 for DMS auto-QC criteria.

DMS currently resides on a virtual server environment maintained at California's State Tier-1 data center. The actual DMS system is composed of two parts, 1) backend database and 2) the frontend client interface.

The backend database or application called "ARBAQDMS" is where the data get stored and processed. Access to the DMS MS-SQL database is limited to staff with administrative rights which include the Operation and Data Support section (ODSS) and the Office of Information Services (OIS) only.

The frontend client or user interface resides on a terminal server called "ARBFDCTS1". Access to the DMS client is conducted via remote access and allows multiple user connections at the same time. Hosting the DMS client on a terminal server allows updates and maintenance on the client to be performed more efficiently.

Data management review and validation processes using DMS are detailed in CARB SOP 610, *Data Review and Validation*, while the actual operation of DMS is detailed in SOP 606, *Data Management System*. These SOPs can be found on the Quality Assurance webpage at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring. A more in-depth description of these review steps is also found in section C2 of this document.

B9.1.3 – Data Security

Access to DMS is only provided to CARB staff with a need to use the system. Initially a user will log onto the CARB domain with a unique password. The password to the CARB domain is required to be updated every 90 days. To use the DMS system, users are provided with a DMS account which includes a login ID and password. All users with an account on DMS, at a minimum, are granted public access. A public account allows a user to view all data but no data edit rights. Users with data edit rights can make changes to data, which are recorded in the system's chain of custody with the date and initials of the editor.

To prevent unauthorized edits, DMS further limits the ability of data editors by only allowing a user to edit sites/monitors for which they are responsible. Only staff directly involved in CARB air monitoring operations (Air Quality Surveillance Branch) have edit rights on DMS. Once data are transmitted to DMS, all changes to data are tracked via the system and modifications made to data by any user are retained. Data security is further detailed in CARB SOP 610, *Data Review and Validation* and in SOP 606, *Data Management System*. These SOPs can be found on the Quality Assurance

webpage at: https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring.

MOs are expected to have data security systems of similar quality to that of CARB. If MOs use any additional data transmittal equipment, the details and security of these devices must be included in a QAPP addendum document.

B9.1.4 – Data Archival

A copy of the DMS database and raw data are backed up daily at the State's Office of Technology (OTech) Tier-1 data center. The back-up by OTech serves as a part of CARB's overall disaster recovery process. In addition, ODSS creates a nightly backup of DMS and stores this information on a SAN Drive within CARB HQ.

B9.2 – Filter-Based Sample Data Management

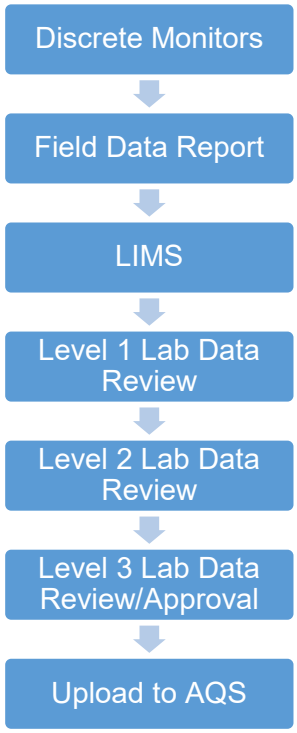
Field personnel have the responsibility of ensuring the needed sampling information for each filter-based sample is properly retrieved from the discrete sampler. Once field personnel have retrieved sampling information, the data will be recorded on the associated field sample report form and will accompany the sampled filter(s) when forwarded to the laboratory. Data from field data report forms are transcribed to LIMS upon arrival of the filter-based sample at the laboratory.

Laboratory staff and management are all integral parts of data management. The laboratory utilizes a LIMS database to perform data management activities. LIMS facilitates the recording, verification and validation, transmittal, reduction, analysis, management, storage, retrieval, and reporting of analytical data generated by the laboratory. LIMS is maintained by the LIMS administrator.

The LIMS administrator creates and/or modifies approved laboratory staff access to LIMS; creates and modifies LIMS methods, data templates and transfers and data reports; and is able to modify data in LIMS. All sample and analysis information shall be entered into LIMS or recorded in bound or electronic notebooks. Changes to any data in LIMS must be made by authorized individuals only. Management's approval may be required.

Figure B.2 below outlines the CARB data management process for filter-based PM samplers:

Figure B.2 – Data Flow Process for Filter-Based PM Samplers



LIMS Accessibility

All users must be authorized by management to receive program access to LIMS. Different privileges are given to authorized users depending on need.

Access may include:

1. Read-only
2. Data entry
3. Addition of test methods
4. Modification of preliminary data
5. Data transfer
6. Data reporting
7. Data upload
8. Data administration

Initial Data Assessment

Samples are inspected and the instrument QC results are reviewed by the site operator prior to shipment to the laboratory. Corrective action should be taken as needed when QC criteria are not met. Laboratory staff will contact site operators, or other appropriate staff, directly when issues arise that require clarification of information to validate a sample at log-in, when a sample is invalidated, or when a

make-up sample is recommended. This notification is performed as soon as possible, and the issue is documented on the COC or sample report form according to established laboratory procedures.

Data Transfer to LIMS

Data from the analytical system is transferred to LIMS manually or electronically. Instrument to LIMS transfers should be verified by the analyst. In management-approved special situations where LIMS transfer and storage is not possible the data must be electronically stored in an appropriate file on the NLB shared drive. All raw data should be archived appropriately.

Data Analysis Records

All raw data, calculations, observations, validation information, and results generated by the analyst must be placed in an appropriate computer file, bound or electronic laboratory notebook, or other approved format. For bound notebooks, all entries must be dated and initialed by the analyst. All analysis hardcopies must be stored in an appropriate filing system until archiving.

Any raw analytical data stored on a computer hard drive should be routinely backed up. A backup copy of all instrument software, including NLB developed parameters, should be made after the initial development. An instrument maintenance logbook must be assigned to each instrument. All calls for service, repair records, reconfigurations, or changes to the instrument must be recorded, dated, and signed by the analyst or instrument service representative. The logbook must be kept with the instrument and be available for inspection at any time.

Analytical Data Reports

Monthly analytical data reports are generated and reviewed by the analyst and submitted for peer and management review/approval prior to upload to AQS. At a minimum, the following must be included in the data package:

- Method, program, or project name
- Signature and date blocks (staff and management)
- Timeframe or batch of analyses covered
- Data with comments and flags
- Copies of appropriate logbook pages (e.g., extraction logs)
- Calibrations
- QC results
- Description of unusual occurrences with sample, analysis, and/or data
- Corrective actions taken
- Any deviations from approved SOP with written approval from management

LIMS Verification

LIMS is programmed by the LIMS administrator(s) to automatically check and verify data. Data outside QC criteria are highlighted for analyst, peer, and management review, comment, and corrective action. Requested changes to LIMS (e.g., QC criteria, calculations, etc.) must be approved by management in writing. QC parameters may come from federal and/or State regulations, program guidance documents, QCM, and/or SOPs. LIMS programmed QC parameters are tested and reviewed by the LIMS administrator(s) before placement into LIMS production. Management is notified when updates have been completed by the LIMS administrator.

Data Archive

All final hardcopy reports with the analyst review, peer review, and management approval signatures, shall be filed in a secure manner. Access to hardcopy and LIMS files shall be limited to authorized individuals only. Laboratory retention of hardcopy and electronic LIMS is performed in accordance with U.S. EPA retention requirements for filter-based particulate matter sampling programs.

Section B10 – Non-Direct Measurements

B10.1 – Site Determination Data

Any non-agency data utilized for decision making must meet the highest quality criteria. Monitoring site location requirements are specified in 40 CFR, Part 58, Appendices A, C, D, and E. These data are only to be used to augment and enhance existing methodologies already employed by CARB.

Such information may be used to determine if an air monitoring site or network is representative of a particular geographic area. Such non-direct measurements may include, but are not limited to, the use of:

- non-CARB meteorological information to determine if an air monitoring site is representative of a particular area;
- non-CARB fire data (acres, location, satellite images) provided by California Department of Forestry and Fire Protection (CAL Fire) and National Aeronautics and Space Administration;
- non-CARB census data provided by the U.S. Census Bureau to assess regional air quality effects on population;
- non-CARB traffic counts provided by California Department of Transportation and other agencies when siting new monitors.

Prior to the use of any non-direct measurement for program use, data are reviewed by staff having expertise in the specific type of data generated. This may require review by staff outside of the Air Quality Planning and Science Division (AQPSD). Once these data are reviewed, staff and division management will discuss these data with the staff expert. During this process staff and management will determine if these data are of high enough quality to be used; the decision and data source will be documented in the project directory on the network drive.

B10.2 – Secondary Data

Data from certain non-agency air monitoring sites in California may be used to enhance the picture of air quality in a particular region or to determine compliance with standards. In particular, data from National Park Service monitoring sites is obtained from iADAM (ADAM's web interface) and AQS. Many of these monitoring sites are operated through the Clean Air Status and Trends Network (CASTNET). In order to ensure the quality of this data, CARB frequently reviews CASTNET documents such as: Annual Network Plan, TSA Reports, and site AQDAs.

For sites listed in AQS as Non-U.S. EPA federal/Non regulatory— CARB will use the data as secondary data for understanding spatial PM concentrations across an area, but this use is based on a site by site determination. For State Designations, CARB

uses all NPS data that do not rely on "portable" monitors—that is, monitors that are placed without permanent shelters. In terms of criteria, "due diligence" is applied before data use. The data is reviewed for integrity and completeness, and screened for suspicious data issues. Data action is taken as needed or CARB will refrain from using the data.

Section C1 – Data Review, Verification and Validation

CARB's air monitoring program collects real-time pollutant values and samples of ambient air throughout California. The goal of CARB PQAO data collection activities is to collect data of sufficient quantity and quality to meet the goals of its intended use. This information is outlined in the individual instrument SOPs and the document 'Standard Operating Procedures for Data Review and Validation', SOP 610 for continuous instruments, and CARB's MLD NLB Quality Control Manual and applicable SOPs for filter-based samples.

The terms related to data management in this section are defined as:

> Review – in-house examination to ensure that data has been recorded, transmitted, and processed correctly.
>
> Verification – the process for evaluating completeness, correctness, and conformance/compliance of a specific data set against method, procedural, or contractual specifications.
>
> Validation – an analyte and sample specific process that extends the evaluation of data beyond the method, procedure, or contractual compliance to determine the quality of a specific data set relative to the end use.

Particulate Matter air monitoring data is reviewed for quality and acceptability based on the analytical method, instrument analysis procedures, quality control requirements, and calibration procedures detailed earlier in this QAPP. The objectives reviewed include data capture (amount of ambient data reported), precision (the degree of mutual agreement among individual measurements of the same property), bias/accuracy (the degree of agreement between an observed value and an accepted known or reference value), and the amount of precision and bias/accuracy data collected and reported. CARB releases an annual document detailing the results of this review called the Data Quality Report.

The specific steps of the method for CARB's data review and validation process for continuous particulate matter instruments are detailed in SOP 610, Data Review and Validation. This document can be located at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/sops-data-management. In all cases, data validation procedures should be documented, and a record provided to the entity responsible for upload of data to AQS. Monitoring organizations should follow a similar procedure for data review and validation and provide an addendum noting district specific procedures and responsibilities, which meet all quality and regulatory requirements. The following is a summary of items a station operator is required to be aware of in order to perform a data review:

- Typical concentration variations associated with seasonal, diurnal, or historical trends
- Types of instrument malfunctions associated with characteristic data irregularities
- Cyclical or repetitive variations caused by excessive line voltage or temperature variations
- Data patterns indicating a loss of sensitivity, flow issues, or system leaks
- Relationship of one particulate matter pollutant parameter to another

The following required data review steps ensure timely identifications of performance issues:

- Review of the flow rate and leak checks indicating performance shifts
- Frequent review of buddy sites or collocated data sites
- Twice daily review of automated CARBLogger emails for indications of alarm conditions
- Daily monitoring of abnormal local events which may impact data
- Review of graphical data displays for recognition of data spikes
- Review of data reporting to ensure completeness criteria are met

For filter-based samplers, a station operator is also required to review:

- Chain of custody and field forms for completeness and accuracy
- Scheduled "make-up" samples, if needed

Refer to Section C2.2 for verification and validation of data for laboratory analyses of filter-based samples.

Section C2 – Verification and Validation Methods

C2.1 – Particulate Matter Monitors

CARB has a minimum three level process which incorporates the concept of review, verification, and validation for continuous samplers. The following is a summary of the process, review levels, and staff positions typically responsible for the review of the particulate matter pollutant data. These review levels should be completed and submitted to the next level of review according to the data reporting schedule. Below is a summary of the separate review levels. For more information, see SOP 610, *Data Review and Validation*: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/sops-data-quality-management. CARB PQAO districts are expected to have similar multi-level data review procedures.

C2.1.1 – Data Review and Approval

1St Level Review

The 1st level review process is performed by the station operator. Station operators should review values on a frequent basis to confirm normal operation of monitors, and take corrective action in a timely manner, if required. The 1st level review process includes review of data flagged for outliers, instrument and diagnostic data, maximum and minimum values, consistently repeating data values, automatically flagged values, and the data patterns discussed in section C1.

The station operator will submit a monthly data report for each site ensuring that the report meets all 1st level criteria. The monthly data report will include a copy of the monthly calibrations, a 'Monthly Quality Maintenance Checklist', a copy of the station logbook, and a 'Data Capture report.'

For field sampling data generated for filter-based samplers, the site operator will record the required sampling information on the field sample report and sample chain of custody. This information will include: site name, filter identification, sampling date, sampling start/stop time, flow rate, and other information relevant to the validity of the sample. This information will be submitted with the filter sample to the laboratory for analysis. See section C2.2 for further details on the verification and validation process for laboratory data.

2nd Level Review

The 2nd level review is a more site specific review focusing on diurnal and seasonal trends surrounding high/low values and exceedances. Typically, this review is performed by designated staff or the station operator from another site. Also, a 2nd level review ensures that all the QC practices were performed to meet the data quality objectives for each pollutant or parameter. The 2nd level review process includes

review of quality control documents, monthly maintenance check sheets, hourly data for reviewed 1-minute data, data completeness, buddy site comparisons for all data values, and/or null codes.

A data package is then submitted to CARB management. Any significant issues or data anomalies at a site should be highlighted and described in sufficient detail on the cover page of each data package. For example, any interruptions of data that are at least 24 consecutive hours in duration should be documented on the cover page.

3rd Level Review

During the 3rd level review, the section manager reviews the documents to ensure that the data are complete, the stations have been maintained properly, and that the instruments are operating within acceptable criteria. Any concerns should be addressed to the appropriate section staff. The section manager assembles the documentation for the Branch Chief under an initialed cover memo including: all control charts, all of the percent data capture reports, site/parameter monthly data summaries, copies of station logs, and a brief summary of any event out of the ordinary that disrupts the collection of quality data.

The Branch Chief reviews and initials the cover letters with the attached documents signifying approval of the data for submittal to AQS. The Branch Chief also should perform 'buddy site' comparisons for like parameters between sites within close proximity of each other and/or in the same air basin.

C2.1.2 – Data Issues

During the review process, a first level reviewer will determine whether instrumentation issues will affect data. When problems are identified, troubleshooting and repair will occur in a timely manner. Inform second level reviewer to determine if follow up actions are needed (i.e. calibrations, etc.). First level reviewers should view QC data daily, if possible.

If encountering an issue, a second level reviewer will contact the station operator and notify him/her that the QC data indicates a problem exists. They will inquire whether the problem was identified and repaired. Corrective action taken must be documented in the station logbook and monthly maintenance check sheet, and also documented in the corrective action on DMS's Editor's Notes only if data is affected. Second level reviewers should view QC data daily, if possible, and weekly, at a minimum.

There are several tools that may be used to correct the data already submitted to AQS: Data Correction Memo, CAN, and an AQDA. CANs and ADQAs are discussed in detail in section D1.

A Data Correction Memo is typically used in conjunction with a CAN or an AQDA. The memo acts as a cover letter that documents the findings of the CAN or AQDA, specifying how the data in AQS is to be corrected.

The Data Correction Memo should contain:

- Action requested.
- Detailed reason for requested action.
- The site information (Site name and ID).
- Parameter affected by request (including parameter/method codes, POC numbers, instrument property numbers).
- Timeframe affected and sampling duration.
- Have the corresponding CAN or AQDA attached.

The Data Correction Memo, with the attached AQDA or CAN (if initiated) should be sent to the Branch Chief through the section manager, with the ODSS manager cc'd.

Upon approval, the ODSS manager will direct staff to carry out the request. AQSB staff can submit a Data Correction Memo without a CAN or AQDA when the request is initiated internally within AQSB and the scope of the correction is very focused. AQSB should initiate a CAN, in lieu of a stand-alone Data Correction Memo, when the findings may affect other station operators or can affect instruments network wide.

C2.2 – Laboratory

C2.2.1 – LIMS Verification

LIMS is programmed by the LIMS administrator(s) to automatically check and verify data. Data outside QC criteria are highlighted for analyst, peer, and management review, comment, and corrective action. Requested changes to LIMS (e.g., QC criteria, calculations, etc.) must be approved by management in writing. QC parameters may come from federal and/or State regulations, program guidance documents, QCM, and/or SOPs. LIMS programmed QC parameters are tested and reviewed by the LIMS administrator(s) before placement into LIMS production. Management is notified when updates have been completed by the LIMS administrator.

C2.2.2 – Data Review and Approval

The data review and approval process consists of a series of checks to ensure the analytical data generated by the laboratory and transferred to LIMS meets all the method specific QC criteria. The multistep process includes, at a minimum, analyst and peer review followed by management review and approval prior to submittal to

clients. All levels of review and approval are signed and dated on the cover page of the data package.

1st Level Review – Analyst Review

The following items will be documented and verified by the analyst that performed the extractions and sample analysis as required by the method SOP.

- Laboratory instrument conditions
- Analytical run conducted per SOP
- Expiration dates of standards
- Analytical sequences
- Environmental conditions
- Laboratory QC
- Calculations
- Raw data concentrations transferred to LIMS
- Laboratory holding times
- Calibrations
- Parameters of laboratory SOPs and QC manual are met
- Laboratory anomalies and corrective actions are documented and management notified, as necessary

2nd Level Review – Peer Review

The following items will be verified by a second analyst:

- Data package completeness
- Spot-check calculations
- Check for documentation of unusual events
- Corrective action review
- Check for outliers
- Analytical run sequence
- Laboratory QC
- Expiration dates of standards
- Reasons for invalid samples
- Flags and comments
- Parameters of laboratory SOP and QC manual are met

3rd Level Review – Management Review and Approval

The following will be reviewed by management prior to data release:

- Data package completeness

- Spot-check calculations
- Check for documentation of unusual events
- Corrective action review
- Check for outliers
- Analytical run sequence (run sequence available in balance room)
- Laboratory QC
- Expiration dates of standards
- Reasons for invalid samples
- Flags and comments
- Parameters of laboratory SOP and QC manual are met

At any time during the process, the data package may be returned to the analyst for edits or clarification. After corrections are made, the data package will be returned to management for confirmation. Once the review is complete, management signs and dates the analytical data package.

C2.2.3 – Data Issues

All laboratory issues must be documented on the analytical data package cover page. Samples and data results affected along with an explanation and course of action taken must be described on the cover page. In addition, these incidences are also documented in the logbook(s) for the program.

If invalid samples repeatedly occur and are deemed to be indicative of a systemic issue in the laboratory, management will utilize the CAN process. This initiates a formal corrective action process that informs all responsible and impacted parties; documents the issue and resolution; and prevents potential future data loss.

Data may be amended for reasons such as Corrective Action Notifications (CAN), Air Quality Data Actions (AQDA), requests by clients (i.e., AQS qualifier code updates), etc.

There are several tools that may be used to correct the data already submitted to AQS: an amendment data package, a Corrective Action Notice (CAN) and an Air Quality Data Action Request (AQDA). CANs and ADQAs are discussed in detail in section D1.

An amendment data package may be used in conjunction with a CAN or an AQDA. The amendment package documents the findings of the CAN or AQDA, specifying how the data in AQS is to be corrected.

The amendment data package should contain:

- Action requested.

- Detailed reason for requested action.
- The site information (Site name and ID).
- Parameter affected by request (including parameter/method codes, POC numbers, instrument property numbers).
- Timeframe affected and sampling duration.
- Have the corresponding CAN or AQDA attached.

The amendment data package, with the attached AQDA or CAN (if initiated) should be sent to the Branch Chief through the section manager. Upon approval, the manager will direct staff to carry out the request. NLB staff can submit an amendment data package without a CAN or AQDA when the request is initiated internally and the scope of the correction is very focused. NLB should initiate a CAN, in lieu of a stand-alone amendment data package, when the findings may affect other station operators or laboratory staff.

C2.3 – Data Certification

Data certification is required by U.S. EPA regulations. Data certification is very important as it:

- Ensures data quality and integrity
- Is required before U.S. EPA can use the data in regulatory actions
- Ensures data are defensible
- Ensures data are correct and have been validated to the best of our knowledge

CARB is responsible for submitting a data certification package to U.S. EPA Region 9 that covers the data reported to AQS by CARB. The data certification package includes: (1) the certification letter, (2) letters supporting data certification from monitoring agencies, and (3) required AQS reports. Each monitoring organization reviews their regulatory data on a quarterly basis. The quarterly review consists of review of the following reports: the AMP430 (Data Completeness Report), AMP350 (Raw Data Report), and AMP 256 (QA Indicator Report) to address any identified data issues. On an annual basis, each monitoring organization reviews the AMP 600 (Certification Evaluation Report) and once any outstanding data issues have been addressed, sends a data certification package to CARB for the certification of data no later than April 15th. CARB ensures that, once approved, AQS flags have been updated for certification, prepares, and submits it electronically to U.S. EPA Region 9. A copy of a sample data certification letter is included in appendix C.1.

Section D1 – Assessment and Response Actions

The information in this section, along with the information available on CARB's Quality Assurance website: https://ww2.arb.ca.gov/our-work/programs/quality-assurance, provides an overview of CARB's QMB compliance status with the assessment and response requirements of 40 CFR Part 58, Appendices A, C, and E. The compliance status overview is part of the annual network plan requirement.

D1.1 – Quality Assessment and Quality Control

QAS and QMS fulfill the QMB mission to ensure ambient air quality data meet or exceed the quality and program objectives of the end users. QAS and QMS perform various quality assurance activities to verify that the data collected comply with procedures and regulations set forth by U.S. EPA and can be considered good quality data and data-for-record. The quality assurance activities are achieved through various audits and data quality assessments which are independent from the ambient air monitoring program responsibilities.

As an example of these activities, QMB ensures the quality of the data collected by the air monitoring stations operating in California through the analysis of precision data submitted to U.S. EPA's AQS database. QMB staff analyze the precision data in accordance with 40 CFR 58, Appendix A. Air monitoring staff review these data and take corrective action when the results exceed U.S. EPA's requirements. These processes are explained in further detail in QAPP section D2.

QMB is responsible for ensuring that CARB meets its federally mandated PQAO responsibilities. QMB also performs system audits and provides quality assurance oversight of the PQAO districts.

D1.2 – Monitoring Station and Laboratory Audits

California's large network and unique ambient air monitoring challenges require a comprehensive state of the art audit program. CARB's audit program meets the federal requirements for conducting annual performance evaluations. Audits are conducted by using independent National Institute of Standards and Technology (NIST) traceable standards and must adhere to federally established acceptance criteria.

QAS is responsible for conducting performance audits of criteria and non-criteria pollutant analyzers, particulate matter samplers, meteorological equipment, and laboratory analyses utilized for generating ambient level measurements. QAS also performs site reviews as well as reports quality assessment and quality control results.

A performance audit is an on-site test aimed at challenging the integrity of the air monitoring site's or laboratory's ability to generate data of acceptable quality.

Variations in the audit procedures correspond to the type of performance audit being conducted.

Sampler flow audits are performed on particulate matter samplers throughout the CARB PQAO. NIST traceable flow measurement instruments are used to compare the sampler's measured and actual flow rate. Flow audits are conducted semi-annually (5-7 months apart) using independent certified equipment.

Laboratory Audits use NIST traceable instrumentation annually where available, to verify the accuracy of the filter conditioning and mass analysis procedures and equipment. Annual mass analysis performance audits are conducted for PM10 and PM2.5 laboratory operations. The mass analysis audits include an on-site check of the filter weighing balance, relative humidity and temperature sensors, as well as a review of the laboratory documentation records. The laboratory microbalance is evaluated against the manufacturer's specifications. The audit is conducted to ensure that the programs are operating in accordance with U.S. EPA guidelines as outlined in 40 CFR, Part 50, Appendices J and L, and that the data generated are good quality and can be considered data-for-record.

Table D.1 outlines acceptance criteria for audits of particulate matter samplers, and Table D.2 outlines audit standard acceptance criteria.

Table D.1 – Audit Acceptance Criteria

PM2.5 Filter-Based & Continuous; PM10 Lo-Vol Filter-Based		
Criteria	**Frequency**	**Acceptance Criteria**
Flow Rate Audit	Twice per calendar year and 5-7 months apart	< ± 4.1% of audit standard < ± 5.1% of design flow rate
Siting	Every 365 days and once per calendar year	Meets 40 CFR Part 58, App E criteria or waiver documented
PM10 High Vol		
Criteria	**Frequency**	**Acceptable Range**
Flow Rate Audit	Every 180 days and twice a calendar year	< ± 7.1% of transfer standard; < ± 10.1% from design flow rate
Siting	Every 365 days and once per calendar year	Meets 40 CFR Part 58, App E criteria or waiver documented
PM 10 Continuous		
Criteria	**Frequency**	**Acceptable Range**
Flow Rate Audit	Twice a calendar year and 5-7 months apart	< ± 10.1% of audit standard
Siting	Every 365 days and once per calendar year	Meets 40 CFR Part 58, App E criteria or waiver documented

Table D.2 – Audit Standard Acceptance Criteria

Calibration Equipment or Standard	Frequency	Acceptance Criteria
Flow Rate Transfer Standard	Annually	± 2 percent of a NIST traceable standard and independent of those used in routine calibration

The procedures followed by QAS are detailed in the Air Monitoring Quality Assurance Manual, Volume V, entitled "Audit Procedures for Air Quality Monitoring," at: https://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/vol5.htm. The purpose of this documentation is to define the responsibilities for conducting system and performance audits and to provide standardized documented system and performance audit procedures and their respective reporting formats.

D1.3 – Technical Systems Audits (TSA)

A TSA is an on-site inspection and review of a monitoring organization's entire ambient air monitoring program. The entire measurement system is reviewed which includes sample collection, sample analysis, and data processing. TSAs include a review of staff records, procedures, instrumentation, facilities, and documentation to assure compliance with all applicable requirements.

U.S. EPA is responsible for conducting TSAs of PQAOs every three years. Each local agency within a PQAO must be audited on a six year schedule. A U.S. EPA TSA consists of an audit of CARB's air monitoring program plus three agencies within CARB's PQAO. CARB will audit the remaining agencies within the PQAO on a schedule of approximately every six years. QMB conducts audits of monitoring organizations operating SLAMS. TSA procedures utilized by QMB auditors are located in U.S. EPA's quality assurance guidance document "Conducting Technical Systems Audits of Ambient Air Monitoring Programs" (EPA-454/B-17-004, November 2017). TSAs are conducted in three phases:

The first phase consists of a questionnaire derived from Appendix A of U.S. EPA's quality assurance guidance document, "Conducting Technical Systems Audits of Ambient Air Monitoring Programs," which is designed to gather information regarding program areas including network management, field operations, laboratory operations, data management, quality assurance, and data reporting. The completed questionnaire undergoes a thorough review by QMB and is used as a tool to determine areas requiring further clarification and discussion during the on-site assessment phase.

The second phase is an on-site assessment of a monitoring organization's field, laboratory, and data management operations, as appropriate. The evaluation includes a follow-up to questionnaire responses, a review of procedures, practices, and records in all related program areas, and a data audit for select sites and data generated by the audited organization. The data audit includes, but is not limited to, a review of outliers, data gaps, data flagging/qualifiers, and QA/QC data.

The third phase is an in-depth evaluation of the information gathered from the questionnaire, performance audit reports, precision and accuracy reports, data audit, and on-site assessment.

Following evaluation of available information, a draft written report is prepared which includes a summary of the audit process, and a summary of findings and recommendations to correct any issues identified. A TSA report is provided to the audited monitoring organization for review and response. The monitoring organization, along with QMS staff, will develop corrective actions and timelines to address each of the identified findings noted during the TSA process. These items may be specific or systematic in nature, so the scope of the corrective action and timeline may differ dependent upon the finding.

D1.4 – Performance Audit Report Summary

Information about each air monitoring station audited by QMB is available at: https://www.arb.ca.gov/qaweb/sitelist_create.php. This web page provides the map location, latitude and longitude coordinates, site photos, and the pollutants monitored, along with a detailed site survey of the instrumentation and physical parameters for each site.

The results of CARB audits and audit reports are available via the Audit Information System (AIS) web page at: https://ww3.arb.ca.gov/qaweb/panda/panda.php. Monitoring organizations are provided access to AIS generated reports for retrieving the complete and final audit reports.

Audit results are directly submitted to AQS quarterly per Appendix A of 40 CFR Part 58. In addition, as required by 40 CFR Part 58.15, CARB submits a data certification letter along with the required AQS reports (AMP600) to U.S. EPA annually.

D1.5 – Troubleshooting

During a performance audit, if a parameter fails to meet CARB audit acceptance criteria or critical criteria (QA Handbook Volume II, Appendix D), an AQDA request is issued to the facility operator.

An AQDA is a request for an investigation of the validity of ambient air quality data for a certain period of time. AQDAs are issued by QAS staff based upon audit results that

show air monitoring equipment operating outside CARB's control limits or federal criteria. AQDAs are issued to the person responsible for data collection and submittal for the monitoring organization. A copy is also sent to AQPSD's Air Quality Planning Branch (AQPB), which may withhold potentially impacted data from processing and publication until appropriate actions are taken. All AQDAs must be investigated by the operator or laboratory analyst and resolved to bring the parameter in question into compliance. The station operator or laboratory analyst completes the AQDA by documenting the resolution, specifying the time period during which data were potentially affected, and recommending whether the data are to be released, corrected, or invalidated. QMB reviews the completed AQDA and discusses any concerns with the operator. A finalized copy of the AQDA, along with applicable documentation, is forwarded to the operator or laboratory analyst and CARB's Air Quality Analysis Section.

Other issues identified as systematic or operational criteria that may impact or potentially impact data quality are documented through the issuance of a CAN. The objective of the CAN process is to document, investigate, correct, and reduce the recurrence of air monitoring issues that impact or potentially impact data quality, completeness, storage, or reporting. Additionally, the process improves data quality and ensures compliance with state, federal, and local requirements.

The CAN process may be initiated by any person in CARB's PQAO who identifies an air monitoring issue that impacts or may impact the quality of air monitoring data. Examples of issues include site monitoring conditions outside of specifications or requirements, out of date calibration gas standards, incomplete chain-of-custody forms, laboratory parameters outside of specifications, late AQS upload, etc. The responsible organization is expected to investigate the issue and implement appropriate corrective action to resolve the issue and prevent recurrence. A copy of the completed CAN form including the corresponding corrective action is submitted to QMB for review. Once QMB and the responsible organization have worked together to implement appropriate corrective action and provided documentation, a CAN closure letter, along with applicable documentation, will be sent by QMB to the responsible organization.

QMB will maintain a database that tracks the CAN process and helps identify trends and possible systemic issues. QMB will ensure that all issues have been resolved and that appropriate action was taken. CARB will summarize data quality issues identified through the CAN process in an annual data report.

The CAN process will help ensure the data collected within CARB's PQAO is scientifically and legally valid and meets the requirements for which it is intended. Monitoring organizations within CARB's PQAO are encouraged to adopt this process. If a monitoring organization chooses to use an alternative process, the monitoring organization must submit the process to CARB for review and approval.

Section D2 – Reports to Management

In addition to CARB's oversight responsibilities of the particulate matter monitoring network, CARB is required to submit reports internally, to U.S. EPA, and to the public. Below is a list of these reports.

D2.1 – Annual Data Quality Report

The Annual Data Quality Report presents an overview of various QA/QC activities to verify the quality of the ambient data. The report describes the quality of the ambient air quality data in quantifiable terms in relation to measurement quality objectives established by U.S. EPA. The report focuses primarily on the precision and bias/accuracy of gaseous criteria and particulate matter measurements and the amount of such data collected and reported. Tables included in the report provide summary data for ambient air monitoring stations in the statewide network within CARB's PQAO, with comparisons to other PQAOs where appropriate. This report can be found at: https://ww2.arb.ca.gov/resources/documents/data-quality-report-primary-quality-assurance-organizations.

As required by 40 CFR, Part 58, Appendix A, data and information reported to U.S. EPA's AQS for each reporting period (i.e., quarter) must include all data gathered and must be uploaded to AQS within 90 days after the end of each quarterly reporting period. AQS contains ambient air pollution data collected by U.S. EPA, state, local, and tribal air pollution control agencies from over thousands of monitors. QMB staff is responsible for review and assessment of all accuracy data reported to AQS for all monitoring organizations within its PQAO and precision data for those local air districts for which CARB has AQS submittal authority. The primary purpose of the assessment is to analyze and assess quality assurance data in accordance with data requirements prescribed in 40 CFR, Part 58, Appendix A and to investigate and resolve any issues identified, and to generate the Annual Data Quality Report.

D2.2 – Annual Network Plan

The ANP describes the network of ambient air monitors operated by air monitoring organizations in more than 20 counties in California. Certain local air districts within CARB's PQAO prepare their own Annual Network Plans. These local air districts are Great Basin, Monterey, North Coast, Sacramento Metro, San Joaquin, San Luis Obispo, and Santa Barbara. The reports meet requirements for an annual network plan as defined in 40 CFR, Part 58.10 and Appendices A through E. As required by regulations, this report includes detailed information about Federal Reference Method and Federal Equivalent Method monitors that are covered in the scope of the report. Regulations require submittal of this report to U.S. EPA by July 1 of each year. The most current version of this report can be found at: https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report.

D2.3 – Annual Certification Letter and Summary Report

CARB's Air Quality Planning Branch (AQPB) is responsible for submitting ambient air quality data to AQS for SLAMS and special purpose monitors operated by CARB, and a number of monitoring organizations in California, for which CARB has data submittal authority. In accordance with 40 CFR, Part 58, Section 15, CARB submits an annual data certification letter to U.S. EPA by May 1 of each year. Along with the annual certification letter, CARB also submits AQS report (i.e., AMP 600 for criteria pollutants, and AMP450C for PM-Coarse for NCore sites) and a justification for any data to be certified that does not meet all U.S. EPA quality control criteria as required by federal regulations. These reports include criteria data for which CARB is the certifying agency. CARB certifies that the previous year of ambient air data and the certification package includes a statement that any previously certified data that was modified is complete and accurate.

Monitoring organizations work with CARB to determine and document the annual certification process via a Roles and Responsibilities document (See appendix A.1). At a minimum, the annual data review process includes the monitoring organization providing an annual data certification recommendation letter stating that the data validation step has been performed and providing appropriate justifications for data issues.

D2.4 – Five Year Network Assessments

The Ambient Air Monitoring Network Assessment performed by CARB's Air Quality Planning and Science Division (AQPSD) every five years is an assessment of the technical aspects of CARB's air monitoring network. The purpose is to evaluate and determine if the air monitoring network meets all monitoring objectives. Additionally, the assessment determines if new sites are needed, if existing sites should be discontinued, and if new technologies are appropriate for incorporation into the ambient air monitoring network. The report is required by federal regulations and covers only a portion of the CARB PQAO. Larger districts in the PQAO conduct their own assessment and submit it separately to the U.S. EPA. These districts are Monterey, North Coast, Sacramento, San Joaquin, San Luis Obispo, and Santa Barbara. Additionally, the Yolo-Solano district has opted to be included in the BAAQMD assessment.

Section D3 – Reconciliation with User Requirements

The process of evaluating monitoring data against QAPP data quality objectives (DQO) is referred to as a data quality assessment (DQA). The DQA process determines how well the validated data can support their intended use.

As stated in U.S EPA QA/G-9R "*Data quality, as a concept, is meaningful only when it relates to the intended use of the data*". By using the DQA process, one can answer four fundamental questions:

- Can the decision (or estimate) be made with the desired level of certainty, given the quality of the data set?
- How well did the sampling design perform?
- If the same sampling design strategy is used again for a similar study, would the data be expected to support the same intended use with the desired level of uncertainty?
- Is it likely that sufficient samples were taken to enable the reviewer to see an effect if it was really present?

The DQA process requires a familiarity with the DQOs and sample design goals when reviewing data reports. As issues are discovered during review, they must be assessed to determine if the goals were met. The information listed in the Reports to Management (D2) section of the QAPP will be used to make this determination. The annual network plan reflects how the current monitoring network is complying with federal regulations as well as expected changes in the next 18 months. A more thorough analysis is conducted during the 5-year network assessment, wherein a comprehensive analysis is done that evaluates the current monitoring network, population exposure to unhealthy pollutant levels, monitoring technology development, changes to State and federal monitoring requirements, as well as local program needs and resources. Potential changes to the monitoring network are proposed based on the assessment and are prioritized. Network changes are implemented through a process that generally involves close coordination with air districts, U.S. EPA, and CARB staff. The CARB network assessment covers CARB monitors as well as monitoring network programs in smaller districts. Larger districts in the PQAO conduct their own network assessments, some of which include statistical analyses used to compare station correlations and review objectives and population scales.

The DQA includes review of AQS's Data Quality Indicator Report, AMP 256 or equivalent report, which provides statistical estimates of the precision, bias, and accuracy of monitors reporting data for criteria air pollutants, and summarizes the completeness of precision and accuracy checks from which the statistical estimates are derived. The primary purpose of the assessment is to analyze and assess quality

assurance data in accordance with data requirements prescribed in 40 CFR, Part 58, Appendix A and to investigate and resolve any issues identified.

It should be noted that achieving the DQOs does not equate to certainty that every NAAQS decision will be a correct decision. Similarly, if the DQOs are not met it is not certain that the data cannot be used for NAAQS decisions. Rather, either of these scenarios will affect the confidence that a decision maker has with the data and may lead to a reassessment of the DQOs.

CARB is committed to ensuring that air monitoring data collected by and on behalf of its PQAO is scientifically and legally valid and of sufficient quality and quantity to meet or exceed all applicable requirements. It is the responsibility of QMB's Chief to ensure that CARB's mission and policies as specified in this document are followed. This is accomplished by implementation and management of a system that emphasizes and promotes continuous quality improvement, utilizes a consistent process of assessing the quality system, encouraging recommendations, identifying and implementing improvements to the quality system, and promoting ongoing training of all staff, as appropriate. Open and timely communication of quality assurance topics are encouraged at all levels within CARB's PQAO through routine meetings, conference calls, newsletters, website updates, and other reports. Timely identification and prevention of data errors that potentially affect data quality is achieved through quality control activities prescribed in appropriate quality management documents (QAPPs and SOPs).

Appendix A.1

Example CARB Roles and Responsibilities Documents

EXAMPLE PRIMARY QUALITY ASSURANCE ORGANIZATION ROLES AND RESPONSIBILITIES FOR AIR RESOURCES BOARD AND (INSERT DISTRICT NAME)

Five common factors have been identified by U.S. Environmental Protection Agency (U.S. EPA) that should be considered in defining a Primary Quality Assurance Organization (PQAO). Under the Air Resources Board (ARB) PQAO, ARB and Monitoring Organizations (MOs) will strive to collaboratively address the following common factors to the extent practical. ARB has defined the roles and responsibilities of ARB and MOs within ARB's PQAO in regard to operation of the PQAO ambient air monitoring network in order to ensure the generation of high quality, legally defensible data.

1. Operation by a common team of field operators according to a common set of procedures

   ARB recognizes the unique air monitoring challenges that face California and that field operations by a common team may not be feasible. ARB and MOs acknowledge the need to strive for uniformity of procedures, thus both parties agree to work together toward employing consistent and reliable field operations.

   ARB Responsibilities:

   a) Maintain and disseminate a Quality Management Plan (QMP). ARB will regularly request input from MOs within ARB's PQAO and agrees to review and update the QMP as needed. ARB will communicate updates to MOs accordingly.

   b) Review and approve alternative QMPs prepared by MOs seeking ARB and/or U.S. EPA approval.

   c) Maintain a PQAO contact list and working webpage to disseminate information;

   d) Serve as a liaison between MOs within ARB's PQAO.

   e) Provide adequate training on key air monitoring fundamentals related to operations, maintenance, quality assurance/quality control, and data management procedures.

   f) Facilitate Ambient Monitoring Technical Advisory Committee (AMTAC) meetings and information updates. Topics may include field, laboratory, quality assurance, and data management related items.

g) Participate in California Air Pollution Control Officers Association (CAPCOA) Monitoring Committee meetings and other informational forums.

(MO name) Responsibilities:

a) Utilize and follow ARB's QMP or an ARB and/or U.S. EPA approved alternative (*specify appropriate choice for each agency - include a note if MO indicates they are planning to develop their own QMP at a later date*) (*include comment- Any deviations to ARB's QMP will be specified in an addendum and submitted to ARB for review and approval*.)

b) Provide a supervisory level PQAO Point-of-Contact to ARB (or designee - if non-supervisory level). The PQAO contact will be added to a list serve to allow for effective and timely dissemination of information.

c) Participate in ARB and U.S. EPA sponsored ambient air monitoring training.

d) Participate in AMTAC meetings and review information updates.

e) Participate in CAPCOA Monitoring Committee meetings and other informational forums.

2. <u>Use of a common Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP) for state and federally mandated air monitoring projects</u>

ARB Responsibilities:

a) Maintain and disseminate an ARB and/or U.S. EPA QAPP for state and federally mandated air monitoring projects or programs.

b) Maintain and disseminate SOPs for monitoring and analysis. These SOPs may also include forms (i.e., check sheets, calibration forms, maintenance forms, etc.).

c) Provide notification of updates/revisions, as they occur, to ARB QAPPs and SOPs via the PQAO point-of-contact list.

d) Review and approve alternative QAPPs and SOPs prepared by MOs.

(MO name) Responsibilities:

a) Utilize and follow ARB's QAPP, or an ARB and/or U.S. EPA approved alternative (*specify appropriate choice for each agency*) (*If ARB's, include comment- Any deviations to ARB's QAPPs will be specified in an addendum and submitted to ARB for review and approval.*).

b) Utilize and follow ARB's SOPs, or ARB approved alternatives (*specify source of SOPs and the pollutant parameters*) (*include comment- Any deviations to ARB's SOPs will be specified in an addendum and submitted to ARB for review and approval.*).

c) District management will review/update SOPs on an established schedule and notify ARB of any revisions made as they occur (*If MO uses ARB SOPs, they should review periodically to ensure they are consistent with MO practices. If MO develops their own SOPs, they should review and update on an established schedule and provide to ARB for approval*).

d) Agree to make available to ARB a record (or list) of quality assurance related documents (QMP, QAPP, SOP, training plan, etc.) being utilized by the MO's ambient air monitoring network.

If a MO conducts a special purpose monitoring program funded by U.S. EPA, the MO will seek quality assurance assistance from the U.S. EPA or ARB's Quality Management Branch. Such monitoring is required to be covered by quality assurance documents prior to sample collection.

3. Common calibration facilities and standards

MOs within ARB's PQAO are encouraged to utilize the services provided by ARB's Standards Laboratory for certifications, calibrations, and verifications. Organizations choosing to utilize external calibration facilities or vendor produced standard materials, will provide documentation of traceability upon request by ARB or U.S. EPA.

ARB Responsibilities:

a) Provide timely certification, calibration, and verification services that meet or exceed Title 40, Code of Federal Regulations (40 CFR), Part 58 requirements via ARB's Standards Laboratory upon request.

(MO name) Responsibilities:

a) Utilize ARB's certification, calibration, and verification services, or provide the name of the qualified vendor being used and the record of traceability to National Institute of Standards and Technology (NIST) (*specify the equipment certified by ARB and that certified by qualified outside vendor in separate bullet items. Add "MO should maintain a schedule and record of certification dates that are available to ARB or U.S. EPA upon request."*).

Additionally, ARB may provide equipment acceptance testing, repair, and field calibration services to MOs upon prior or mutual agreement, which may depend upon budget feasibility and staff availability.

4. Oversight by a common quality assurance organization

ARB Responsibilities:

a) Identify pollutants that are included in ARB's PQAO.

b) Conduct Performance Evaluation (PE) audits of MO monitoring sites as required in 40 CFR Part 58, Appendix A, including Section 3.2.2 (PE audits for SO2, NO2, O3, and CO), and Section 3.2.4 (semiannual flow rate audit for Particulate Matter (PM samplers), as well as, meteorological audits, and lead sampler audits, as appropriate (*specify the pollutants that are audited*).

c) Conduct annual siting evaluations at each air monitoring station to determine compliance with 40 CFR Part 58, Appendix E, and consistency with current Air Quality System (AQS) pollutants.

d) If an instrument or analyzer is found to be outside acceptable limits, ARB will initiate Air Quality Data Action (AQDA) requests. The AQDA will request the MO to correct the identified deficiencies and ensure associated ambient air data are verified to be good quality data. To ensure compliance, ARB will conduct a re-audit to verify the corrective action once the problem has been resolved and will review data in AQS to ensure any recommended data action has been taken (i.e., flagging, invalidation, etc.).

e) Conduct technical systems audits (TSA) of all MOs within ARB's PQAO on a schedule of every 3-5 years.

f) Maintain a database, Corrective Action Notification (CAN), to be used by monitoring agencies to report operational problems,

instrument malfunctions, and/or any items needing corrective action or investigation. ARB will follow-up to verify that appropriate action has been taken to close the CAN, and will perform an annual review of the CAN database for systematic issues.

g) Provide procedures and criteria for data acceptability and corrective action determination.

h) Provide procedures and criteria for data verification and validation to be performed prior to upload to AQS.

i) Provide training on data verification and validation procedures during the PQAO air monitoring training.

j) Perform upload of MO validated data for (*specify pollutants*) to AQS within 90 days following the end of each quarter (*provide note if ARB performs mass analysis determination (PM2.5/PM10) and data upload*).

k) Perform post-AQS screening of MO data submitted by ARB to identify possible issues.

l) Perform annual certification of data for which ARB has AQS submittal authority by May 1st of each year.

m) Perform an annual evaluation of the statistical summaries of quality assurance and quality control data from all MOs in ARB's PQAO, and distribute results to the MOs.

(MO name) Responsibilities:

a) Review and verify pollutant-specific parameters on an annual basis that are included in ARB's PQAO.

b) Participate in criteria pollutant, particulate and meteorological PE audits (*specify which pollutants will be audited*).

c) Participate in laboratory PE audits *(specify laboratory methods (PM2.5 mass analysis, etc.*). For laboratory programs not supported by ARB, the MO agrees to participate in a U.S. EPA or ARB approved alternative audit program, if available.

d) Participate in U.S. EPA required technical system audits conducted either by ARB or U.S. EPA.

e) Utilize and follow ARB's, or an ARB approved, (*choose applicable*) procedure to validate (*specify pollutants*) data quality against ARB or U.S. EPA established acceptance criteria prior to submittal to AQS (*If ARB's procedure, include comment- Any deviations to ARB's procedures will be specified in an addendum and submitted to ARB for review and approval.*).

f) Submit validated data (*specify pollutants*) to ARB in an AQS compatible txt. format (See Attachment 1) within 90 days following the end of each quarter (If MO sends data to ARB for upload, they must provide the data within 75 days following the end of each quarter) and provide a letter stating that validation has been performed (See Attachment 2).

g) Participate in data verification and validation training provided by ARB and/or U.S. EPA.

h) Review data in AQS on a quarterly basis to verify accuracy and completeness (AMP 255 and 430 reports).

i) Review data in AQS (AMP 600 and 450 NC reports) on an annual basis to verify accuracy and completeness of data for certification purposes. Provide a letter verifying the data quality by April 15th of each year (See Attachment 3).

j) Utilize ARB's CAN process to report instrument malfunctions, operational problems, impending data actions in U.S. EPA's AQS, and/or any items needing corrective action or investigation within 45 days of determination of issue. Management will use appropriate discretion to determine issues deemed to be anomalous versus routine occurrences.

k) Resolve AQDAs, CANs, and TSA findings, or develop corrective action plan as appropriate, within 45 days of issuance.

l) Utilize the CAN process to communicate to ARB when data have been altered or modified after it has been submitted so ARB can review the justification and adjust data in AQS accordingly. (Note- Districts performing their own data validation and upload to AQS will communicate directly with ARB after the data has been modified in AQS *(delete if ARB performs data upload)*).

m) Districts uploading data directly to AQS will validate data before upload to AQS, review data in AQS (AMP 600 and 450 NC

reports) on an annual basis to verify accuracy and completeness, and certify their data annually by May 1st of each year *(delete if ARB performs upload).*

n) Upload air quality data in accordance with U.S. EPA requirements *(delete if ARB performs upload).*

Note- *Include a note if MO operated their own lab and specify the parameters analyzed and which agencies it supports.*

Data collected from special purpose monitoring (SPM) sites using federal reference method (FRM), federal equivalent method (FEM), or approved regional methods (ARM) should be evaluated against the requirements in 40 CFR Part 58.11, 58.12, and Appendix A; and submitted to AQS according to 40 CFR Part 58.16, as applicable.

5. Support by a common management, laboratory or headquarters

Operating California's complex ambient air monitoring network requires ARB to work collaboratively with each MO. In order to accurately assess the MO's monitoring network, both parties will document and evaluate potential or scheduled modifications to the air monitoring network.

ARB Responsibilities:

a) Provide and review an annual survey questionnaire regarding planned changes to the air monitoring network (i.e., new/removed instruments, site closures, new sites, contracted services, etc.) for MOs in ARB's PQAO that are not drafting their own annual network plans as required by 40 CFR Part 58.10. ARB will review completed questionnaires within 30 days of receipt and provide feedback, as necessary.

b) Participate in annual meeting/teleconference during the network review period (*specify time period*) to discuss ARB's PQAO monitoring network status.

c) Provide laboratory analytical support as required (i.e., PM2.5 and PM10 mass analysis, toxics analysis, speciation, etc.) upon prior or mutual agreement.

(MO name) Responsibilities:

a) Complete the annual questionnaire regarding MO monitoring network changes within 30 day of receipt from ARB (if applicable).

b) Coordinate all site changes (i.e., openings, closures, relocations), not mentioned in the annual questionnaire to ARB. Notify ARB of anticipated changes before they occur and obtain prior approval of the change before executing it, barring exceptional circumstances.

c) Participate in ARB's PQAO monitoring network status meetings/teleconferences.

d) Provide sample return and proper documentation of field sample collection activities (i.e., chain-of-custody, sample collection dates and times, etc.) within established timeframes. (*delete if ARB does not provide analytical services to the MO*).

MOs submitting annual Network Monitoring Plans directly to U.S. EPA will continue to submit plans directly with a copy provided to ARB's AQPSD to utilize during the statewide network assessment.

If circumstances should arise that prevent either ARB and/or MO from meeting the above mentioned responsibilities, the agencies will work collaboratively to ensure that the common goal of generating legally and scientifically defensible data throughout the PQAO monitoring network is met. As needed, the agencies will work with U.S. EPA Region 9 to assist in meeting the PQAO requirements.

EXAMPLE PRIMARY QUALITY ASSURANCE ORGANIZATION ROLES AND RESPONSIBILITIES FOR THE CALIFORNIA AIR RESOURCES BOARD

Five common factors have been identified by the U.S. Environmental Protection Agency (U.S. EPA) that should be considered in defining a Primary Quality Assurance Organization (PQAO): operation by a common team of field operators or according to a common set of procedures, use of a common Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP) for state and federally mandated air monitoring projects, common calibration facilities and standards, oversight by a common quality assurance organization, and support by a common management, laboratory or headquarters. The Air Resources Board (ARB) has defined the roles and responsibilities within its ambient air monitoring network PQAO. ARB's roles and responsibilities are shared between multiple branches: the Air Quality Planning and Science Division (AQPSD), Air Quality Surveillance Branch (AQSB), Northern Laboratory Branch (NLB), and Quality Management Branch (QMB). These branches will work collaboratively to address the roles and responsibilities listed below:

Responsibilities for All ARB Branches Involved in Ambient Air Monitoring:

1) Follow ARB's Quality Management Plan (QMP).

2) Maintain and follow approved QAPPs and SOPs for State and federally mandated monitoring programs. Review and update QAPPs and SOPs on an established schedule to ensure they are consistent with actual practices. Document permanent deviations in an addendum and provide to QMB for review. Once the updated quality management (QM) document has joint approval from QMB and AQSB or NLB, it will be uploaded to the webpage.

3) Participate in ARB and U.S. EPA sponsored ambient air monitoring training.

4) Prepare bulletins clarifying ARB practices and policies for various air monitoring issues.

5) Follow quality assurance and technical bulletins to ensure consistency in the monitoring network.

6) Participate in California Air Pollution Control Officers Association's (CAPCOA) air monitoring committee meetings, and other technical air monitoring meetings, as needed.

7) Utilize and follow ARB's SOPs for the Corrective Action Notification (CAN) and Air Quality Data Action request (AQDA) processes to document, investigate , correct, and reduce the recurrence of ambient

air monitoring or data issues that may impact or potentially impact data quality, completeness, storage , or reporting.

8) Attempt-to resolve AQDAs and CANs within 45 days of issuance. Provide documentation of corrective action implemented to address AQDAs and CANs (Air Quality System (AQS) printouts, etc.) .

9) Participate in technical system audits (TSA) conducted by U.S. EPA.

10) Participate in meetings/teleconferences during the network review period to discuss ARB's PQAO monitoring network status.

11) Coordinate all site changes (i.e., openings, closures, relocations) and monitor/sampler modifications, as appropriate, with the other branches and with any affected District.

Additional AQPSD Responsibilities (Air Quality Planning Branch and Consumer Products and Air Quality Assessment Branch):

1) Work directly with monitoring organizations (MO) on assignments for which AQPSD is responsible and has preexisting communication or working relationships, and include the appropriate ARB PQAO liaison in the communications.

2) Perform upload of validated data to AQS for which AQPSD has submittal authority within 90 days following the end of each quarter.

3) Review recent MO data when requested for anomalous or outlier data events, points, and trends to be further investigated as part of ARB's TSA process. .

4) Update ambient concentration data and metadata in AQS for instruments for which AQPSD has AQS submittal authority, as directed by the affected district, as appropriate. ·

5) Upon receipt of data certification letters from ARB and districts for whom AQPSD has AQS submittal authority, prepare annual data certification package and submit to U.S. EPA by May 1 of each year.

6) Coordinate all site changes (i.e., openings, closures; relocations) with the other branches and with the affected District.

7) Collaborate with and assist in the preparation of analyses and recommendations supporting site/monitor closures, as appropriate.

8) Assist in the preparation of analyses and recommendations supporting the flagging of data for exceptional events, as appropriate.

9) Prepare Annual Network Plans and Five-Year Network Assessments for ARB and MOs included in these documents. Evaluate whether the ARB PQAO includes all pollutant monitoring for federal criteria pollutants as required under federal regulations. Work with other Branches and districts to develop strategies for addressing any identified monitoring deficiencies, as needed.

Additional AQSB Responsibilities:

1) Work directly with MOs on assignments for which AQSB is responsible and has preexisting communication or working relationships, and include the appropriate ARB PQAO liaison in the communications.

2) Coordinate and facilitate technical air monitoring training (e.g., Thermo 2000i/2025i, EBAM, OMS, field sample media handling, quality assurance, etc.), as needed.

3) Provide timely, documented notification, coordination, and collaboration amongst AQSB, NLB, QMB, AQPSD, and affected districts for changes and/or additions on regular air monitoring network and special purpose monitoring programs prior to implementation of the air monitoring project.

4) Prepare quality assurance documents, as appropriate, for special purpose and non-regulatory monitoring programs prior to sample collection.

5) For those standards that ARB's Standards Laboratory can certify, utilize ARB's services for certifications, calibrations, and verifications. If an external calibration facility or vendor produced standard materials are used, ensure documentation of traceability to National Institute of Standards and Technology (NIST) is provided.

6) Maintain a schedule and record of certification dates and a record of traceability to NIST.

7) Provide equipment acceptance testing, repair, and field calibration services to MOs upon prior or mutual agreement, which may depend upon budget feasibility and staff availability. Calibration reports should be provided to MOs in a timely manner.

8) Provide samples along with reviewed and properly documented sample reports within established timelines. Level 1 verification/validation of

sample reports should be performed by field monitoring staff prior to submittal to the laboratory. Levels 2 and 3 validation should be performed during review of the monthly data packages by AQSB staff and management, and data submitted to NLB within 45 days following the end of the month.

9) Participate in Performance Evaluation (PE) audits for ambient air programs, as appropriate, including gaseous, particulate matter, and meteorological programs.

10) Verify and validate criteria pollutant data using the following procedures:

    a) Follow ARB's procedure to validate data for quality against established acceptance criteria prior to AQS upload within 90 days following the end of each quarter.

    b) Review data in AQS on a quarterly basis to verify accuracy and completeness (AMP 256 and 430 reports).

    c) Review data in AQS (AMP 600 and 450 NC reports) on an annual basis to verify accuracy and completeness for certification purposes.

11) Perform upload of validated ambient and QC data to AQS for which AQSB has submittal authority within 90 days following the end of each quarter.

12) Perform post-AQS screening of data submitted by AQSB to identify possible issues.

13) Review and update concentration data and metadata in AQS for instruments that AQSB operates, as appropriate. Communicate to NLB changes made in AQS that involve samplers that NLB has AQS submittal authority (e.g., media-based samplers).

14) Perform annual certification of data for which AQSB has AQS submittal authority, and submit a letter certifying the data to ARB's Consumer Products and Air Quality Assessment branch by April 15 of each year.

Note: Data collected from Special Purpose Monitors sites using Federal Reference Methods, Federal Equivalent Methods, or Approved Regional Methods should be evaluated against the requirements in 40 CFR 58.11, 58.12, and Appendix A, and submitted to AQS according to 40 CFR 58.16.

Additional NLB Responsibilities:

1) Work directly with MOs on assignments for which NLB is responsible and has preexisting communication or working relationships, and include the appropriate ARB PQAQ liaison in the communications.

2) Maintain and follow a Laboratory Quality Contr0I Manual and SOPs detailing the quality system policies and procedures to ensure consistent quality assurance and validation of data.

3) Provide revisions or updates of the Laboratory Quality Control Manual to QMB for review and approval, and upload them to the web once they are approved.

4) Prepare quality assurance documents, as appropriate, for laboratory support of special purpose and non-regulatory monitoring programs. Coordinate with field operations groups to ensure documents are completed prior to collection and analysis of samples.

5) Utilize a qualified vendor for the certification, calibration, and verification of laboratory instrumentation and standards. Maintain documentation of the schedule and traceability.

6) Participate in laboratory PE audits for PM2.5 and PM10 mass analysis laboratories, and other analytical programs, as appropriate.

7) Verify and validate the laboratory portion of ambient air data generated by NLB according to the Laboratory Quality Control Manual and S0Ps prior to AQS submittal.

8) Perform upload of validated data to AQS for which NLB has submittal authority within 90 days following the end of each quarter. Data uploaded to AQS is verified using the AQS Raw Data Inventory report generated after data submittal.

9) When appropriate, data, including metadata, may be amended according to an approved CAN or AQDA;

10) Provide notification of AQS data submittals to MOs in a timely manner.

11) Communicate all laboratory-issued Null and Quality Assurance flagged samples to the field operator or designated MO contact.

12) Provide appropriate documentation for annual certification of data for which NLB has AQS submittal authority. Documentation should state that

analyses were performed in accordance with approved laboratory procedures and data submitted to AQS is accurate and complete to the best of their knowledge. Documentation should be provided to applicable MOs and ARB's Consumer Products and Air Quality Assessment branch by April 15 of each year.

13) Prepare and disseminate an annual laboratory quality control report summarizing sample anomalies, lab issues and implemented corrective action, and any departures from S0Ps.

14) Provide multi-level validated sample media and documentation (i.e., chain-of-custody, media preparation dates and times, mass analysis criteria, filter conditioning criteria, etc.) to field staff within established timeframes.

15) Provide laboratory analytical support (i.e., PM2.5 and PM 10 mass analysis, etc.) for ARB air monitoring programs as required, and provide support to local MOs upon prior or mutual agreement.

Additional QMB Responsibilities:

1) Maintain ARB's QMP. QMB will regularly request input from other ARB branches and local MOs within ARB's PQAO, and agrees to review and update the QMP as needed.

2) Review and approve alternative QMPs prepared by local MOs.

3) Coordinate the development and maintenance of ARB QAPPs.

4) Review and approve alternative QAPPs and SOPs prepared by local MOs.

5) Maintain the ARB PQAO's Quality Management Document Repository located at arb.ca.gov/aaqm/qa/pqao/repository/qm docs.htm.

6) Maintain a PQAO contact list (at arb.ca.gov/aaqm/qa/pqao/pqao-poc.pdf) and webpage (at arb.ca.gov/aaqm/qa/qa.htm) to disseminate information.

7) Provide prompt notification of updates/revisions to QAPPs and SOPs via the PQAO point-of-contact list.

8) Serve as a liaison for local MOs within ARB's PQAO (to ensure concerted action, cooperation, etc.).

9) Coordinate and facilitate training on air monitoring fundamentals related to operations, maintenance, quality assurance/quality control, and data management procedures. Coordinate other technical training forums, as appropriate.

10) Maintain SOPs for the CAN and AQDA processes.

11) Provide timely certification, calibration, and verification services that meet or exceed Title 40, Code of Federal Regulations (40 CFR) Part 58 requirements, upon request (information on available services can be found at arb.ca.gov/aaqm/qa/stdslab/stdslab.htm).

12) Maintain a schedule and record of certification dates and a record of traceability to NIST.

13) Provide detailed reports showing the calculations and results of the certification, calibration, and verification services performed.

14) Conduct annual PE audits of monitoring sites including carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, and semiannual flow rate audits for particulate matter sampling devices as required in 40 CFR Part 58, Appendix A, Section 3.2.2 and Section 3.2.4. Additional PE audits may include meteorological and laboratory analytical programs, as appropriate.

15) Conduct annual siting evaluations at each monitoring station to determine compliance with 40 CFR 58 Appendix E and consistency with current AQS requirements.

16) Initiate an AQDA request if an instrument or analyzer is found to be outside acceptable limits. The AQDA will request the responsible party to correct the identified deficiencies. QMB will conduct a re-audit: to verify the corrective action once the problem has been resolved and will review data in AQS to ensure recommended data action was taken (i.e., flagging, invalidation, etc.) as appropriate.

17) Collaborate with U.S. EPA to conduct TSAs of all MOs within the ARB PQAO on a schedule of every three to six years. As part of these TSAs, conduct data audits to evaluate anomalous or outlier data events, points, data gaps, and trends to be further investigated.

18) Maintain the CAN database for operational problems, instrument malfunctions, and/or any items needing corrective action or investigation, and perform annual review of the CAN database for systematic issues.

QMB will follow up to verify that appropriate action was taken to close CANs.

19) Perform an annual statistical evaluation of quality assurance and quality control data from all monitoring organizations in the ARB PQAO, and distribute results via ARB's Data Quality Report.

If circumstances should arise that prevent any of the ARB branches from meeting the aforementioned responsibilities, the branches will collaboratively ensure that the common goal of generating legally and scientifically defensible data throughout the PQAO monitoring network is met.

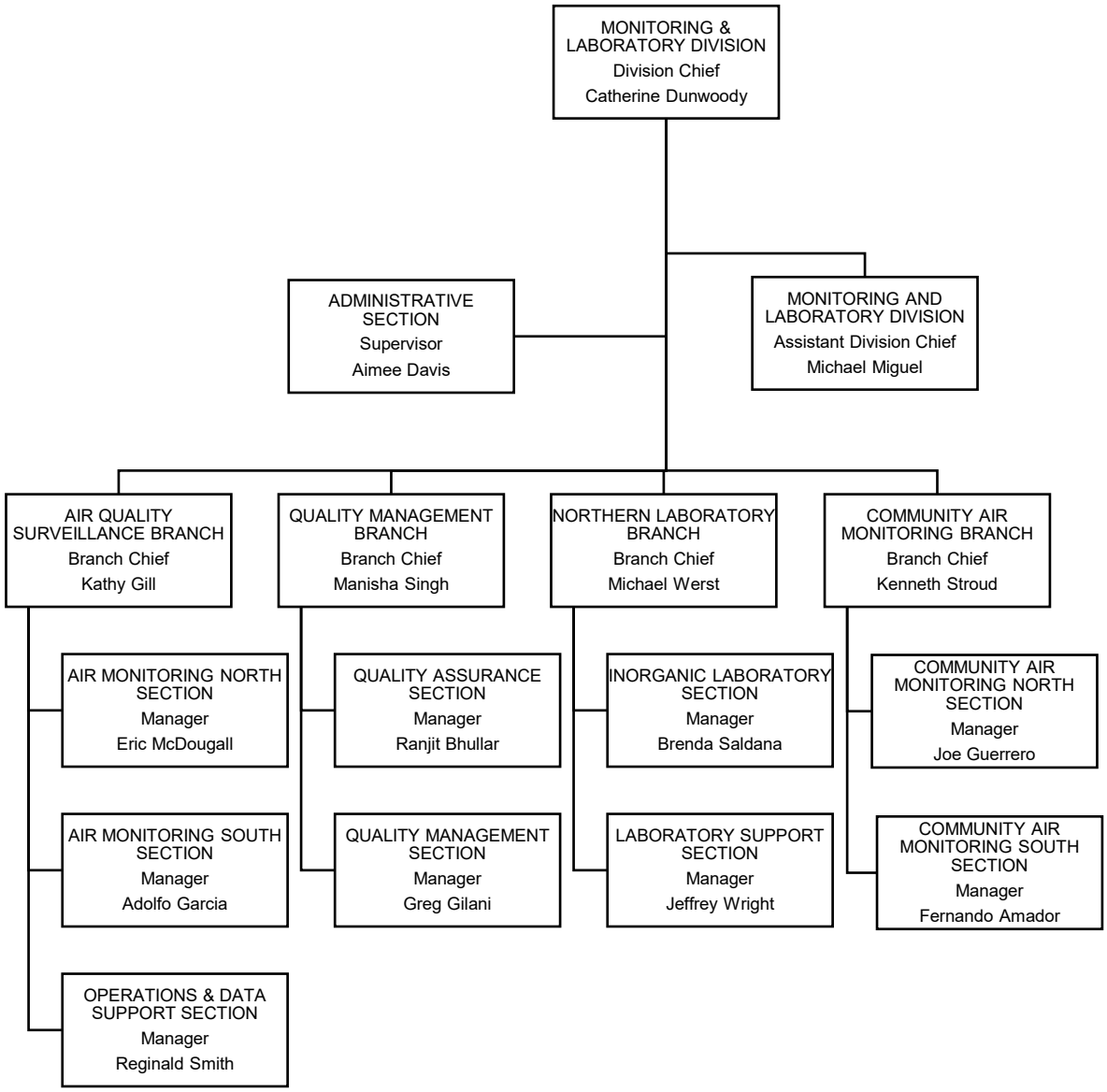
This document outlining the roles and responsibilities of the ARB branches can be found at https://www.arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm.

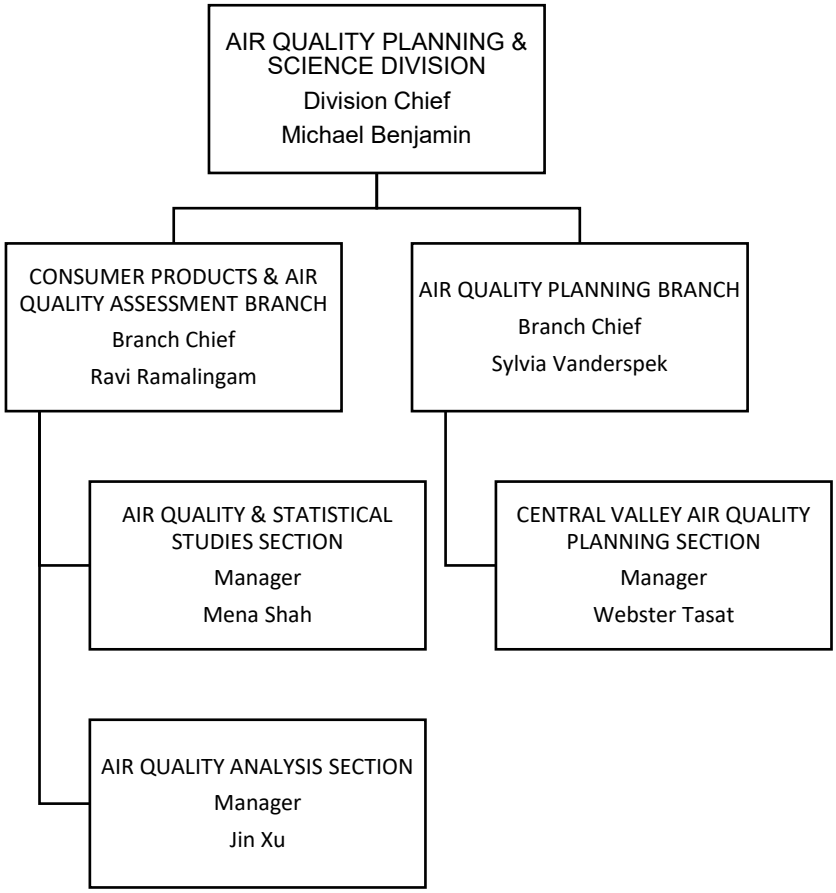
Appendix A.2

CARB Organization Chart

CARB Organization Chart

Note: Charts only lists Divisions and Sections with responsibilities included in the Particulate Matter Pollutant Air Monitoring Program.




AIR QUALITY PLANNING & SCIENCE DIVISION
Division Chief
Michael Benjamin
CONSUMER PRODUCTS & AIR QUALITY ASSESSMENT BRANCH
Branch Chief
Ravi Ramalingam
AIR QUALITY PLANNING BRANCH
Branch Chief
Sylvia Vanderspek
AIR QUALITY & STATISTICAL STUDIES SECTION
Manager
Mena Shah
CENTRAL VALLEY AIR QUALITY PLANNING SECTION
Manager
Webster Tasat
AIR QUALITY ANALYSIS SECTION
Manager
Jin Xu

Appendix A.3

Example Document: 'Protocol for the Ambient Air Monitoring Project A'

Monitoring and Laboratory Division
Air Quality Surveillance Branch

Protocol for the Ambient Air Monitoring Project A

September 19, 2007

Prepared by:

Air Pollution Specialist
Special Purpose Monitoring Section

Signatures:

_____
Date

Air Quality Surveillance Branch
Air Resources Board

_____
Date

Northern Laboratory Branch
Air Resources Board

The following protocol has been reviewed and approved by staff of the Air Resources Board (ARB). Approval of this protocol does not necessarily reflect the views and policies of the ARB, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

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Figures

Appendix

1.0 Introduction

At the request of the Department of Fish and Game (DFG), the Air Resources Board (ARB) and the District A will conduct ambient air monitoring during Project A. DFG has approved the use of CFT Legumine®, a liquid formulation of rotenone, to eradicate the northern pike in Lake X and its tributaries.

CFT Legumine® lists Rotenone as the active ingredients and n-Methyl 2-Pyrrolidinone (MP) and Naphthalene, among others, as inert ingredients that are chemicals known to the state to cause cancer or reproductive toxicity, according to California's Proposition 65. ARB and District A will conduct ambient monitoring to determine levels of Rotenone, Naphthalene, and MP at four sites located downwind and in close proximity to Lake X and the local population; of these sites, one and an additional site, will include monitoring for volatile organic compounds (VOCs).

DFG also approved Noxfish® as an alternate pesticide if sufficient quantities of CFT Legumine® are not available for this project. This protocol assumes that only CFT Legumine® will be applied for treatment of Lake X and its tributaries. The use of Noxfish® may require different sampling and analysis methods that are not addressed in this protocol.

2.0 Project Goals and Objectives

The goal of this monitoring project is to measure the concentrations of Rotenone, MP, Naphthalene, and VOCs in ambient air at locations downstream and in close proximity to Lake X and the local population.

To achieve the project goals, the following objectives should be met:

1. Identification of monitoring sites that mutually satisfies criteria for ambient air sampling and DFGs requirements.

2. Appropriate application of sampling/monitoring equipment to determine ambient concentrations of Rotenone, MP, Naphthelene, and VOCs.

3. As this is a joint effort, District A will provide staff support to retrieve exposed sample media and replace with new media in accordance with this protocol.

1. Application of relevant field quality assurance/quality control practices to ensure the integrity of field samples.

2. At the conclusion of the project, MLD will provide DFG with a final report containing all relevant information and data pertaining to this project.

3.0 Contacts

Manager
Special Purpose Monitoring Section

Air Pollution Specialist
Special Purpose Monitoring Section

Manager
Organics Laboratory Section

Representative
District A

Staff Environmental Scientist
Department of Fish and Game

4.0 Study Location and Design

The CFT Legumine® application at Lake X is scheduled to occur between September 4, 2007 and October 31, 2007. Initial application will begin at the tributaries feeding Lake X, with the application to the Lake X body scheduled for late September 2007. This study is only relevant to the application of the pesticide to the Lake X body. Any pesticide applied to the tributaries will be significantly diluted upon entering the lake body, so much as to not provide any exposure to the local population.

Four sampling methods will be used to obtain samples of ambient air. At four locations downwind and in close proximity to Lake X and the local population, three sampling methods will be used to determine levels of Rotenone, MP, and Naphthalene. A measured quantity of ambient air will be passed through a 47mm Teflon® filter using a Mini-Vol sampler to determine levels of Rotenone, see Figure 2. A second measured quantity of ambient air will be passed through an activated carbon tube using a second Mini-Vol to determine levels of MP, see Figure 3 and 4. A third measured quantity of ambient air will be passed through a Chromosorb tube to determine quantities of Naphthalene, see Figure 3 and 5. At one of these three sites, samples will be collected by

evacuated canisters (fourth method) as shown in Figure 6. As a backup method for Naphthalene determination, an evacuated canister will be collected and analyzed should the Chromosorb method not yield significant recovery levels.

Background samples (one 24 hour sample) will be taken at one site in close proximity to Lake X by Teflon® filter, activated carbon tube, Chromosorb tube, and evacuated canister at least two days but no more than 5 days prior to the application to the Lake X body. A background sample will also be take at a nearby ambient monitoring site by evacuated canister method only. Within one hour of application to the Lake X body, Teflon® filter, activated carbon tube, and evacuated canister sampling will commence at the four sites in close proximity to Lake X. Sampling will continue at these four sites for five (5) days. At one of these sites, a second Teflon® filter, activated carbon tube, Chromosorb tube, and evacuated canister will run each day as a collocated sample, including the background event.

Teflon® Filter Monitoring

An ambient air sample will be collected by passing a measured volume of ambient air through a 47 mm Teflon filter using a Mini-Vol sampler, see Figure 2. Care should be used when handling exposed Teflon filters as light adversely affects Rotenone recovery. Therefore, exposed Teflon filters should be immediately wrapped with aluminum foil and stored in a manila envelope on dry ice upon removal from sampler. The operator should use his/her body to shield sun when removing from sampler. The sampling flow rate of 2.5 liters per minute (Lpm) will be accurately measured and the sampling system operated continuously for 24 hours (+/- ½ hour) with the exact operating interval recorded in the logbook. The sampler's filter holder will be protected from direct sunlight and its inlet should be approximately 1.5 meters above the ground during all monitoring sampling periods and 1.5 meters above roofline or in an open secured area which meets siting criteria for ambient monitoring. At the end of each sampling period, the exposed Teflon filter will be placed in a Petri dish with an identification label affixed. Subsequent to sampling, the Teflon filters will be transported on dry ice, as soon as reasonably possible, to the ARB's Monitoring and Laboratory Division laboratory located in Sacramento for analysis. The samples will be stored in the freezer or extracted/analyzed immediately.

The Mini-Vol sampler has an active sample flow control device. The flow rates will be adjusted to 2.5 lpm, as measured by a digital mass flow meter (MFM) before the start of each sampling period. The flow rate will be checked with the MFM and recorded in the logbook at the beginning and the end of each sampling period. Samplers will be leak checked prior to each sampling period

with the Teflon filter installed. The field logbook will be used to record start and stop times, start and stop flow rates, start and stop counter readings, sample identifications, and any other significant data.

Activated Carbon Tube Monitoring

An ambient air sample will be collected by passing a measured volume of ambient air through an activated carbon tube using a Mini-Vol sampler, see Figures 3 and 4. The exposed activated carbon tube are stored in an ice chest (on dry ice) or in a freezer until extracted in the laboratory with organic solvent. The sampling flow rates of 2.5 liters per minute (Lpm) will be accurately measured and the sampling system operated continuously for 24 hours with the exact operating interval recorded in the logbook. The tubes will be protected from direct sunlight and supported about 1.5 meters above the ground during application monitoring sampling periods and 1.5 meters above roofline or in an open secured area which meets siting criteria for ambient monitoring. At the end of each sampling period, the exposed tubes will be placed in culture tubes with an identification label affixed. Subsequent to sampling, the sample tubes will be transported on dry ice, as soon as reasonably possible, to the ARB's Monitoring and Laboratory Division laboratory located in Sacramento for analysis. The samples will be stored in the freezer or extracted/analyzed immediately.

The Mini-Vol sampler has an active sample flow control device. The flow rates will be adjusted to 2.5 lpm, as measured by a digital mass flow meter (MFM) before the start of each sampling period. The flow rate will be checked with the MFM and recorded in the logbook at the beginning and the end of each sampling period. Samplers will be leak checked prior to each sampling period with the Teflon filter installed. The field logbook will be used to record start and stop times, start and stop flow rates, start and stop counter readings, sample identifications, and any other significant data.

Chromosorb Tube Monitoring

An ambient air sample will be collected by passing a measured volume of ambient air through a Chromosorb tube using a Mini-Vol sampler, see Figures 3 and 5. The exposed Chromosorb tube are stored in an ice chest (on dry ice) or in a freezer until extracted in the laboratory with organic solvent. The sampling flow rates of 2.5 liters per minute (Lpm) will be accurately measured and the sampling system operated continuously for 24 hours with the exact operating interval recorded in the logbook. The tubes will be protected from direct sunlight and supported about 1.5 meters above the ground during application monitoring sampling periods and 1.5 meters above roofline or in an open

secured area which meets siting criteria for ambient monitoring. At the end of each sampling period, the exposed tubes will be placed in culture tubes with an identification label affixed. Subsequent to sampling, the sample tubes will be transported on dry ice, as soon as reasonably possible, to the ARB's Monitoring and Laboratory Division laboratory located in Sacramento for analysis. The samples will be stored in the freezer or extracted/analyzed immediately.

The Mini-Vol sampler has an active sample flow control device. The flow rates will be adjusted to 2.5 lpm, as measured by a digital mass flow meter (MFM) before the start of each sampling period. The flow rate will be checked with the MFM and recorded in the logbook at the beginning and the end of each sampling period. Samplers will be leak checked prior to each sampling period with the Teflon filter installed. The field logbook will be used to record start and stop times, start and stop flow rates, start and stop counter readings, sample identifications, and any other significant data.

Evacuated Canister Monitoring

Samples will be collected by drawing ambient air through a passive flow controller and into an evacuated, treated stainless-steel canister (6 liters capacity). The air sample inlet will be located at breathing-level (approximately 1.7 meters above the ground) using a ¼ inch diameter and 0.2 meters long Siltek® treated stainless-steel sample probe, see Figure 6. The sample will be collected over a 24 hour time period with the exact operating interval recorded in the logbook. Subsequent to sampling, the canister will be transported, as soon as reasonably possible, to the ARB's Monitoring and Laboratory Division laboratory located in Sacramento for analysis.

The installed orifice flow controller will be adjusted to 3 cubic centimeters per minute (cc/min), as measured using a digital MFM before the start of each sampling period. The flow rate will be checked with the MFM and recorded in the logbook at the beginning and the end of each sampling period. The field logbook will also be used to record start and top times, start and stop flow rates, sample identifications, and any other significant data.

Locations

Working in conjunction with DFG and District A staff, five sites have been identified as ambient air monitoring sites. They are:

Site 1
Address

Site 2
Address

Site 3
Address

Site 4
Address

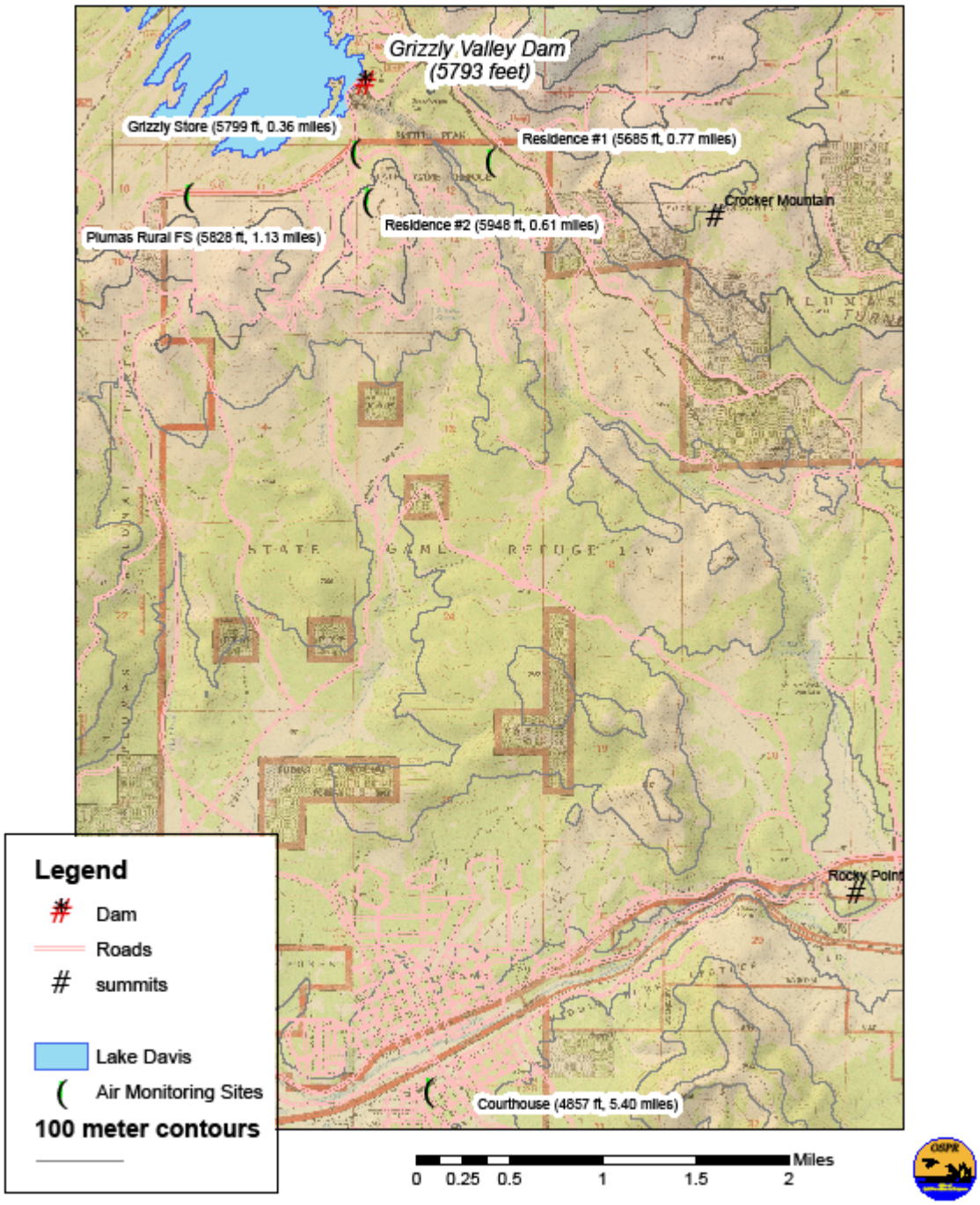
Site 5
Address

Site 1, Site 2, Site3 Site 4, and Site 5 will each have Teflon, activated carbon tube, Chromosorb, and evacuated canister monitoring, with the Site 1 having collocated and background sampling. In addition, the Site 4 will have evacuated canister monitoring for VOC monitoring.

Lake Davis Pike Eradication Project

Potential Air Quality Monitoring Sites

Figure #4 - 09/12/2007



5.0 Sampling and Analysis Procedures

Community Air Monitoring North and Community Air Monitoring South Section personnel will hand-carry samples to and from MLD's laboratory in Sacramento, and deliver to District A staff for sampling. The samples will not be exposed to extreme conditions or subjected to rough handling that might cause loss or degradation of sample.

Teflon® Filter Monitoring

Prior to commencing sampling, log number, sample identification, starting time, starting flow rate, and starting elapsed time meter reading will be recorded in the appropriate fields of the log sheet (Figure 7). The Mini-Vol sampler will then be programmed to run continuously and achieve a flow rate of 2.5 lpm. The sample media will be exposed for 24 hours +/- ½ hour.

Upon completion of sampling, the operator will record ending time, ending flow rate, and ending elapsed time meter reading in the appropriate fields of the log sheet (Figure 7). The operator will place filter in a Petri dish and wrap with aluminum foil to protect it from light. The operator will enter the sample run information on an identification label and affix to the foil wrapped Petri dish. The foil wrapped Petri dish will be placed in a cooler at 4° C or less until returned to the laboratory. The filters will be transported on dry ice, as soon as reasonably possible, to the ARB Sacramento Monitoring and Laboratory Division laboratory for analysis. These samples will be stored in the freezer or extracted/analyzed immediately. Samples are collected in the field with a flow rate of 2.5 lpm.

Activated Carbon Tube Monitoring

Prior to commencing sampling, log number, sample identification, starting time, starting flow rate, and starting elapsed time meter reading will be recorded in the appropriate fields of the log sheet (Figure 6). The Mini-Vol sampler will then be programmed to run continuously and achieve a flow rate of 2.5 lpm. The sample media will be exposed for 24 hours +/- ½ hour.

Upon completion of sampling, the operator will record ending time, ending flow rate, and ending elapsed time meter reading in the appropriate fields of the log sheet (Figure 6). The operator will remove the activated carbon tube from Mini-Vol sampler and place cap the ends. The operator will enter the sample run information on an identification label and affix to upper half of sample tube. The sample tube will then be placed into a glass tube and stored in a cooler at 4° C or less until returned to the laboratory. The samples will be

transported on dry ice, as soon as reasonably possible, to the ARB Sacramento Monitoring and Laboratory Division laboratory for analysis. These samples will be stored in the freezer or extracted/analyzed immediately. Samples are collected in the field with a flow rate of 2.5 lpm.

Chromosorb Tube Monitoring

Prior to commencing sampling, log number, sample identification, starting time, starting flow rate, and starting elapsed time meter reading will be recorded in the appropriate fields of the log sheet (Figure 6). The Mini-Vol sampler will then be programmed to run continuously and achieve a flow rate of 2.5 lpm. The sample media will be exposed for 24 hours +/- ½ hour.

Upon completion of sampling, the operator will record ending time, ending flow rate, and ending elapsed time meter reading in the appropriate fields of the log sheet (Figure 6). The operator will remove the Chromosorb tube from Mini-Vol sampler and place cap the ends. The operator will enter the sample run information on an identification label and affix to upper half of sample tube. The sample tube will then be placed into a glass tube and stored in a cooler at 4° C or less until returned to the laboratory. The samples will be transported on dry ice, as soon as reasonably possible, to the ARB Sacramento Monitoring and Laboratory Division laboratory for analysis. These samples will be stored in the freezer or extracted/analyzed immediately. Samples are collected in the field with a flow rate of 2.5 lpm.

Evacuated Canister Monitoring

At each sampling site, the operator will assure that the canister valve is closed and record the pre sampling information on the field sample report. The passive flow controller with sample probe will then be attached to the canister. Prior to any sampling the flows will be set to 3 +/- 0.5 cc/min, as measured by the MFM. The valves of the canister will be opened and the start time, beginning vacuum reading on the controller's pressure gauge, beginning vacuum reading on the canister, and beginning flow rate will be recorded in the appropriate field on the log sheet (Figure 8). The canister sample time period is 24 hours +/- ½ hour.

After 24 hours, the operator will measure the sample flow rate using the MFM and record in the appropriate field in the log sheet (Figure 8). The operator will then close the valve on the canister and record ending time, ending vacuum reading on the flow controller's pressure gauge, and ending vacuum reading on the canister. Note that start and stop flow controller pressure gauge readings will be recorded in the "Comment Number" field of the log sheet (Figure 7).

The operator will enter all appropriate sample data on the Canister Tracking Sheet in Appendix C. The Northern Laboratory Branch (NLB) will analyze all sample canisters with a final laboratory canister pressure of -12 to -4"Hg.

All reported sampling times, including meteorological data, will be reported in Pacific Standard Time (PST).

The Northern Laboratory Branch (NLB) will supply SPM with Teflon® filters, activated carbon tubes, Chromosorb, and evacuated canisters. NLB will perform analyses for Rotenone, MP, Naphthalene, and VOCs on all collected samples and report results to SPM.

Laboratory analyses will be performed in accordance with applicable standard operating procedures included in this Protocol as Appendix A, B, and C.

The following Teflon filter, activated carbon tube, and canister validation and analytical quality control criteria should be followed during analysis.

1. **Sample Hold Time**: Sample hold time criteria will be established by the Laboratory. Samples not analyzed within the established holding time will be invalidated by the Laboratory.

2. **Duplicate Analysis**: Laboratory to establish relative percent difference (RPD) criteria for duplicate analysis. Lab to provide duplicate analytical results and RPD.

3. **Method Detection Limit (MDL)**: MDL sample analytical results less than the MDL shall be reported as a less than numerical value. This less than numerical value shall incorporate any dilutions/concentrations.

4. **Estimate Quality Limit (EQL)**: This EQL reporting convention shall be eliminated. In the past, measurements falling between the MDL and five times the MDL (EQL) were reported as "detect". All values at or above the MDL shall be reported as a numeric value.

5. **Analytical Linear Range**: Any analytical result greater than the highest calibration standard shall be reanalyzed within the calibrated linear range.

6.0 List of Field Equipment

Quantity	Item Description
(1)	Global Positioning System (GPS) with backup batteries and carrying case.
(1)	Digital Camera with backup batteries and carrying case.

(2) Aalborg mass flow meter 0-5 Lpm.
(2) Aalborg mass flow meter 0-10ccm.
(1) Dry ice chest with dry ice.
(1) Ladder.
(15) Mini-Vol samplers with media holding devices (Figures 2 and 3).
(10) Sample Tripods.
(32) Teflon Filters (2 background, 25 application, 5 spares).
(32) Activated carbon tubes (2 background, 25 application, 5 spares).
(32) Chromosorb tubes (2 background, 25 application, 5 spares).
(8) 50 foot Extension cords.
(4) Elapse time meters.
(29) Evacuated stainless-steel canister, each equipped with a vacuum/pressure gauge and a field data/sample tracking sheet, and carrying case (2 background, 25 application, 2 spare).
(7) Restek passive flow controller equipped with 24-hour orifices and 0.2 meter long, ¼ inch diameter, Siltek® treated stainless-steel sample probe (1 spare).

FIGURE 2: MINI-VOL WITH TEFLON FILTER

FIGURE 3: MINI-VOL WITH MEDIA TUBE

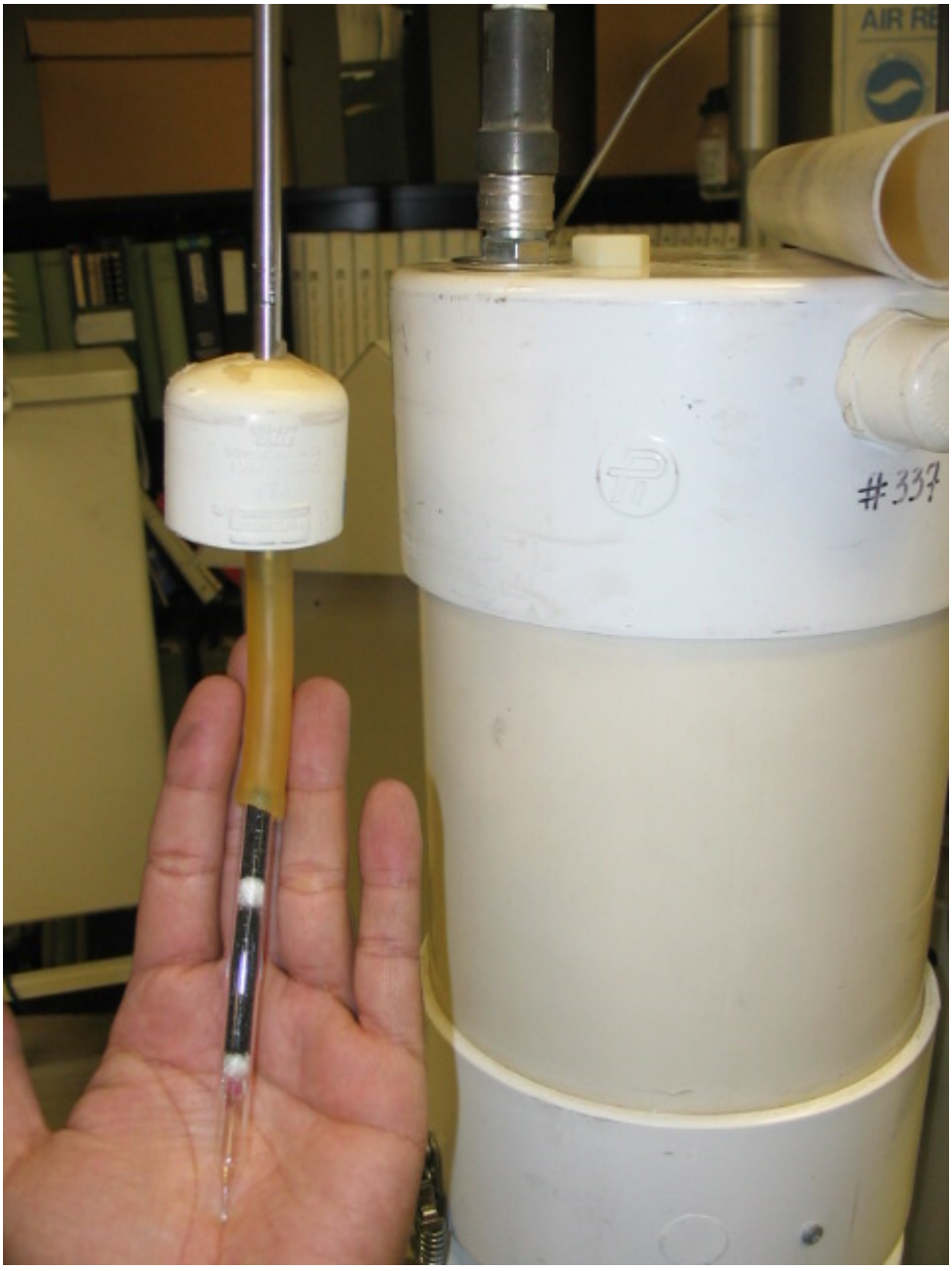


FIGURE 4: MINI-VOL WITH ACTIVATED CARBON TUBE

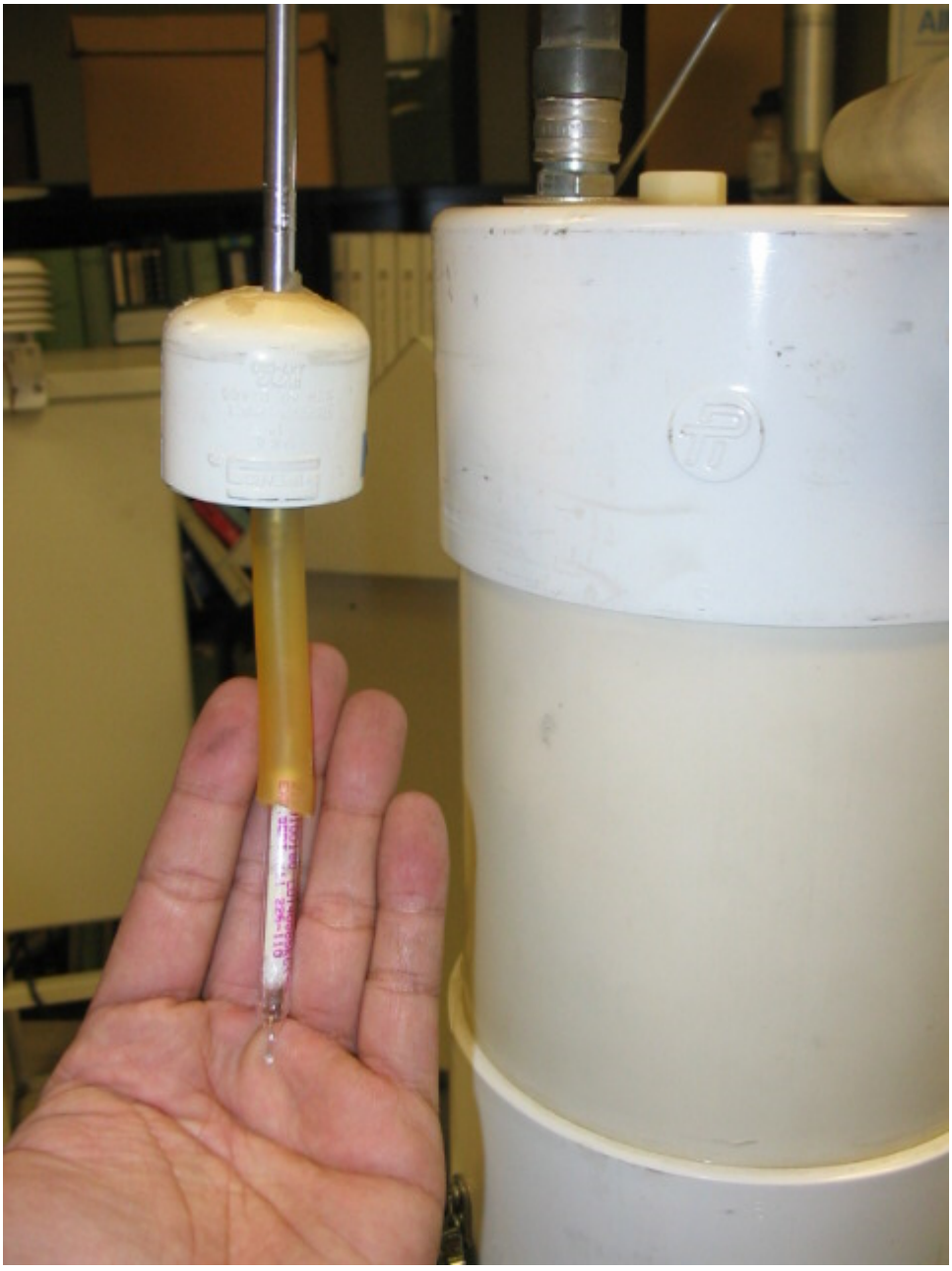


FIGURE 5: MINI-VOL WITH CHROMOSORB TUBE

FIGURE 6: CANISTER AIR SAMPLER WITH PASSIVE FLOW CONTROLLER

7.0 Quality Control

Quality control procedures will be observed to ensure the integrity of samples collected in the field. National Institute of Standards and Technology (NIST)-traceable transfer standards will be used to calibrate measure sample flow rates.

The sample flow rate of the Mini-Vol sampler will be measured using a MFM having a current calibration certification and a range of 0-5 lpm.

The sample flow rate of the passive flow controllers will be measured using mass flow meters having a current calibration certification and a range of 0-10 cubic centimeter per minute (ccm).

8.0 Site/Sample Identification

The site/sample identification will be named accordingly for the locations, type of sample, date (month and day), QC activity (if any), and type of sampling, see following examples:

Ambient Site Naming:
S1 B-XX/XXTEF Site 1, background, date started, Teflon filter.

QC Activity Abbreviations:
CO= Co-located

Site Abbreviations

S1	Site 1
S2	Site 2
S3	Site 3
S4	Site 4
S5	Site 5

Sampling Method Abbreviations
TEF = Teflon Filter Method
CAR = Activated Carbon Tube Method
CHR = Chromosorb Tube Method
CAN = Evacuated Canister Method

Following the nomenclature identified above will insure the quality and integrity of the collected samples and will provide DFG with accurate field and laboratory data.

Filter Media Sample Log Sheet for CFT Legumine® Ambient Air Monitoring

Log- #	Sample ID	Start Date/Time	End Date/Time	Sample Flow (Start)	Sample Flow (Stop)	ETM Start	ETM Stop	Comments

CANISTER FIELD LOG SHEET

Project: Acrolein Ambient Air Monitoring In Kern County

Start Flow Set: 17 to 16ccm End vacuum Criteria: -12 to -4"Hg

ample	Sampler	Date & Time		Canister Vacuum		Mass Flow		Corrected		Weather	
	ID	Entry Example (6/14/07 13:42)		Display		Meter Display		Average	Comment	K,P,C,F&R	
lame	Number	Start	End	Start	End	Start	End	Flow	Number	Start	End
M Used #:		Slope:		Intrcpt:							

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog and R

9.0 Deliverables

9.1 Air Quality Surveillance Branch Deliverables

Within 30 days from receipt of the final results report from the Northern Laboratory Branch (NLB), AQSB will provide DFG with a report containing the following topics:

1) Sampling Protocol.
2) Personnel Contact List.
3) Site Maps.
4) Site Photographs.
5) Site Descriptions and Measurements, GPS coordinates, inlet height.
6) A map of the monitoring site locations.
7) Sample Summary Table.
8) Field Sample Log.
9) Laboratory Analysis Reports with calculations in electronic format.
10) Met Station and Sampler Calibration Reports.
11) Transfer Standards' Certification Reports.
12) Disk containing electronic files of Report.

In addition, the Special Purpose Monitoring Section (SPM) will prepare a project binder containing the above information. This binder will remain with SPM though available for viewing and review as requested.

9.2 Northern Laboratory Branch (NLB) Deliverables

Within 30 days from the last day of analysis, the NLB will provide SPM with a report that will include the following topics:

1) Table(s) of sample to include:
    a. Sample identification (name).
    b. Date sample received from field.
    c. Date sample analyzed.
    d. Dilution ratio.
    e. Analytical results.
2) All equations used in calculating analytical results.
3) Table of duplicate results including calculated relative percent difference (RPD).
4) Table of collocated results.
5) Table of analytical results from all field, trip and laboratory spikes including percent recoveries.

6) Table of analytical results from all trip blanks.

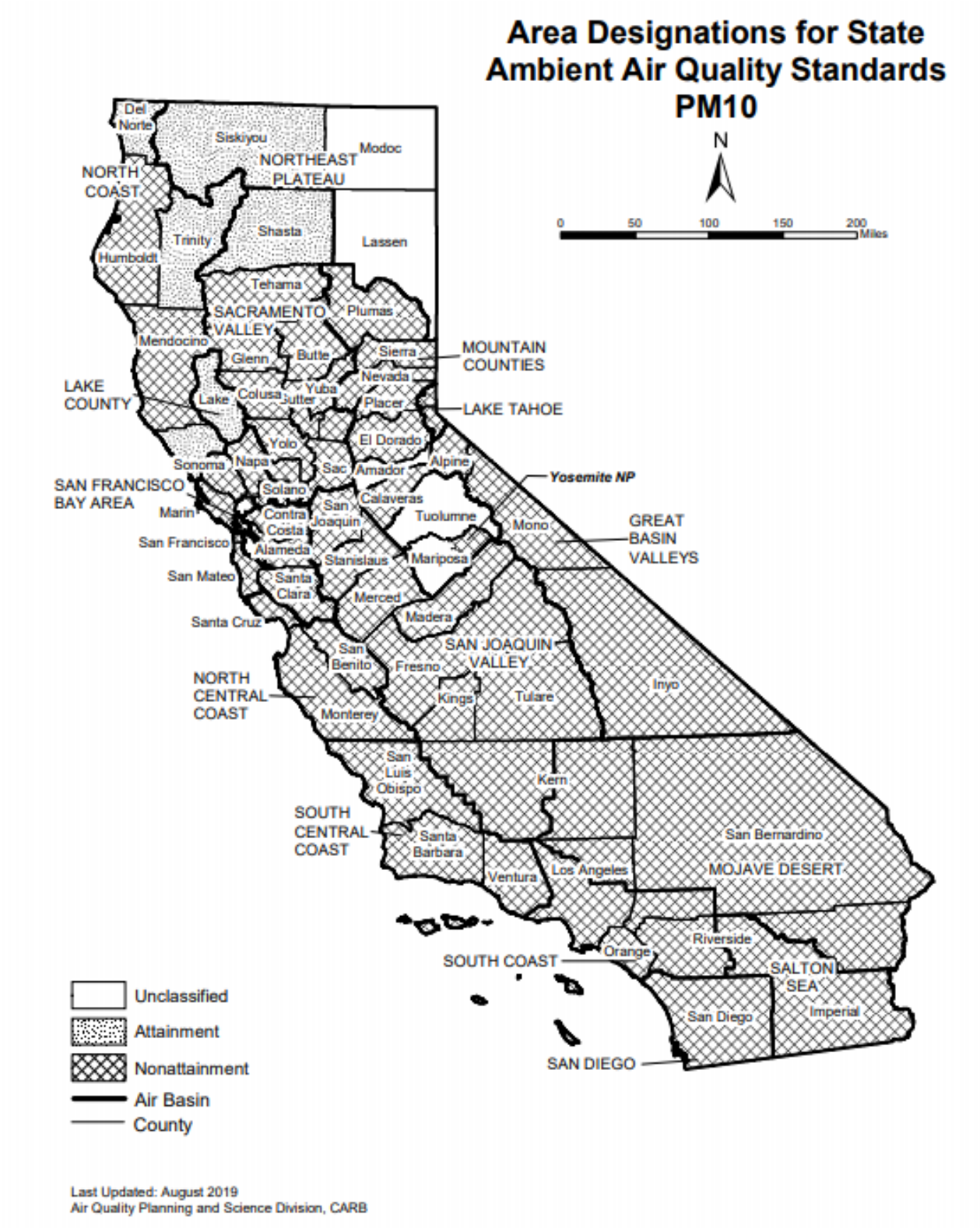
7) Table of analytical results from all laboratory blanks, standards and control checks performed, including dates performed and relative percent recoveries if applicable.

8) Copy or location of analytical method or Standard Operating Procedures (SOP) used for analysis.

9) Section or provision listing or reporting any and all deviations from analytical SOP and this protocol.

Appendix A.4

State and Federal Designation Maps


Area Designations for State Ambient Air Quality Standards PM10
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0 50 100 150 200 Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Lake
Colusa
Yuba
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
Yosemite NP
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
Fresno
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NORTH CENTRAL COAST
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Riverside
Orange
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San Diego
Imperial
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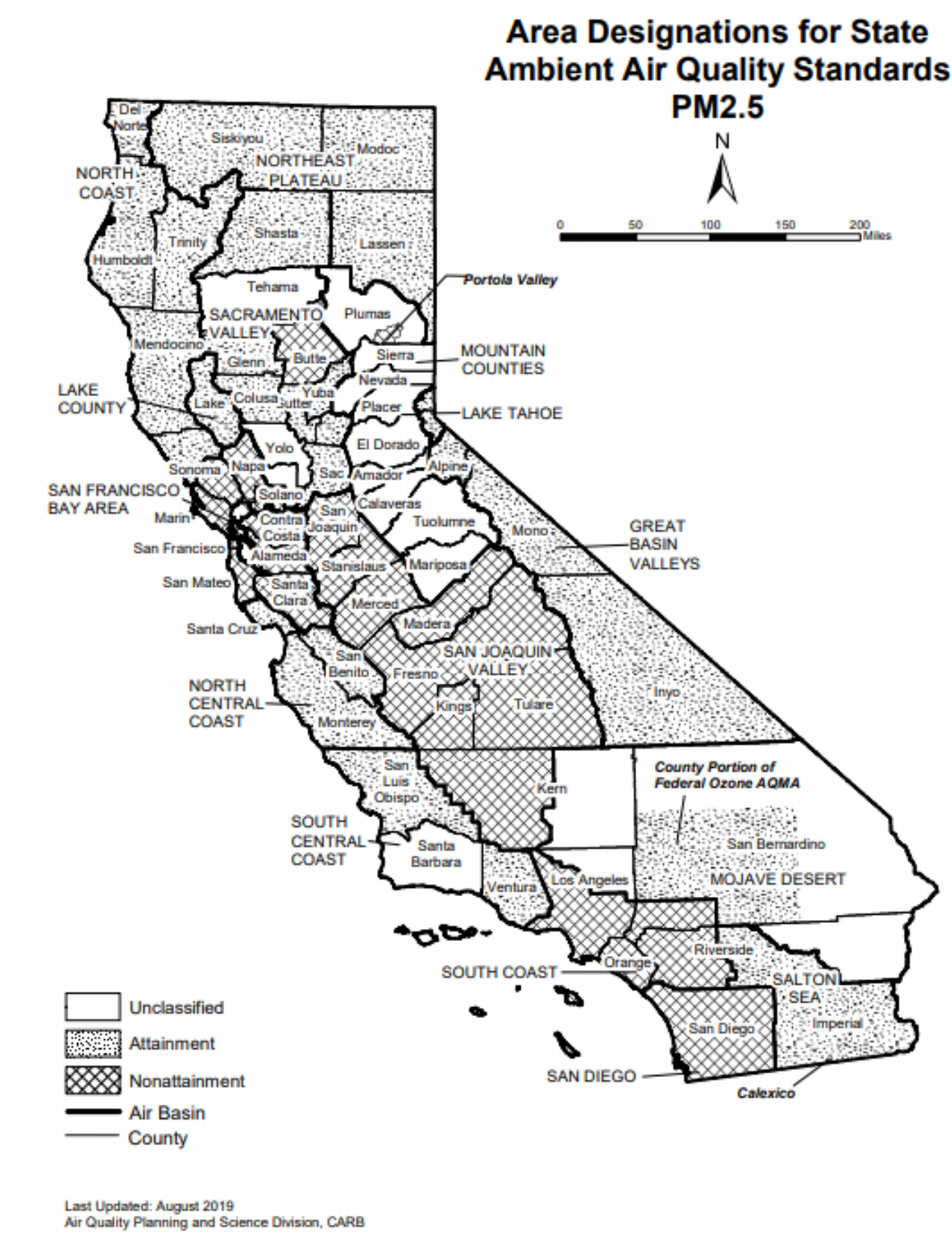
Unclassified
Attainment
Nonattainment
Air Basin
County
Last Updated: August 2019
Air Quality Planning and Science Division, CARB


Area Designations for State
Ambient Air Quality Standards
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NORTH COAST
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Tehama
Portola Valley
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Lake
Colusa
Yuba
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
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San Joaquin
Tuolumne
Mono
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Alameda
Stanislaus
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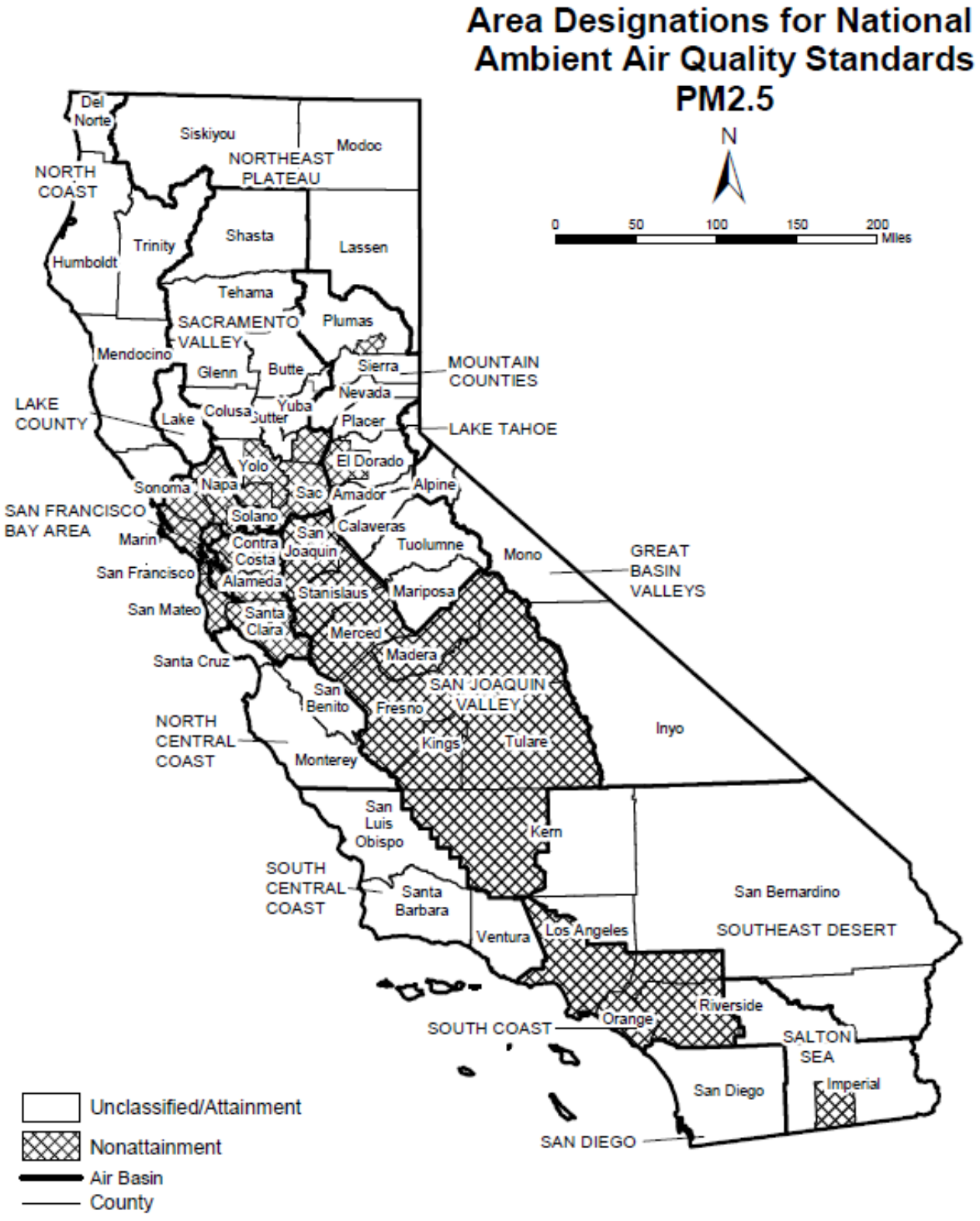
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
Fresno
SAN JOAQUIN VALLEY
Inyo
NORTH CENTRAL COAST
Kings
Tulare
Monterey
San Luis Obispo
Kern
County Portion of Federal Ozone AQMA
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Calexico
Unclassified
Attainment
Nonattainment
Air Basin
County
Last Updated: August 2019
Air Quality Planning and Science Division, CARB


Area Designations for National Ambient Air Quality Standards
PM2.5
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Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
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Sonoma
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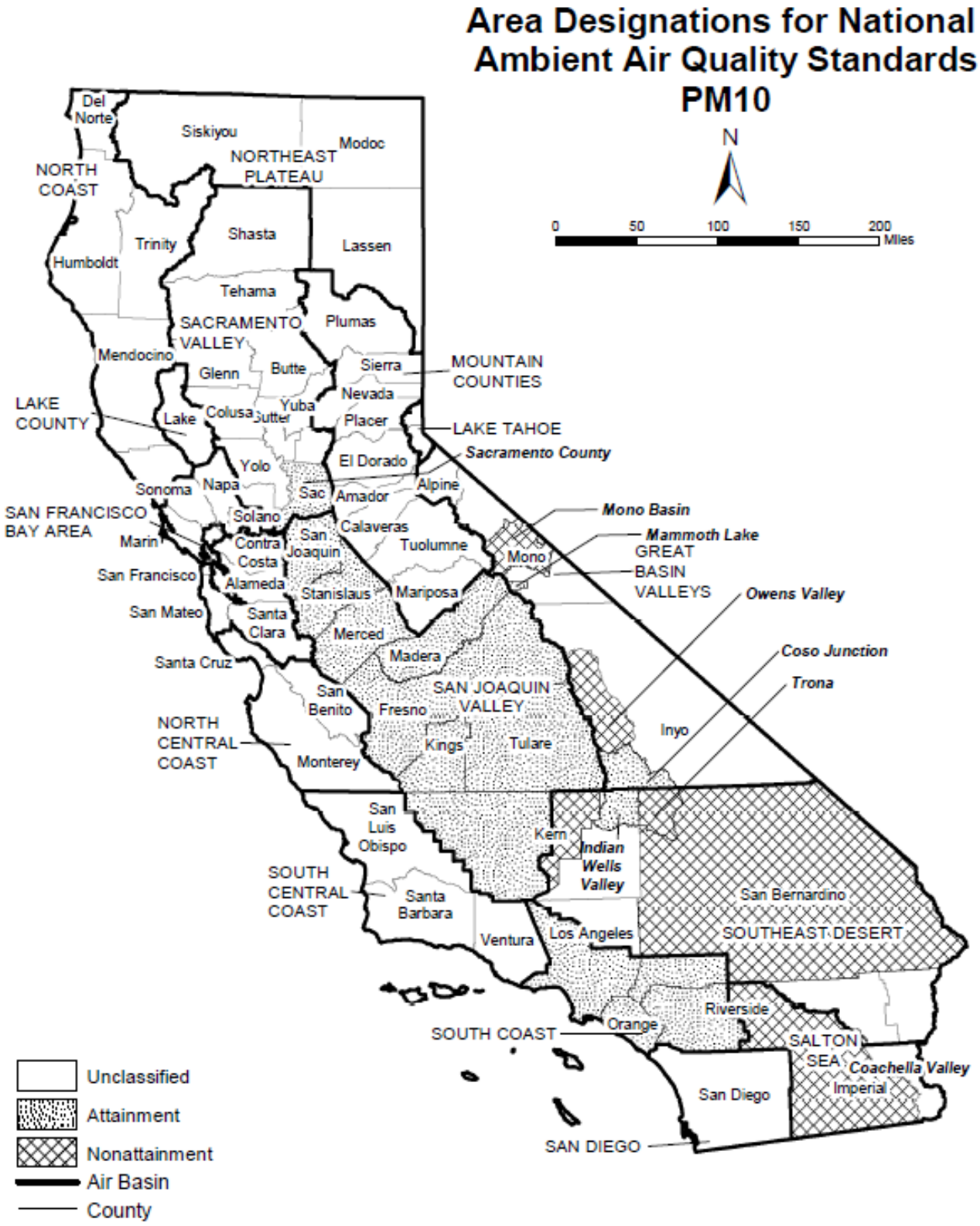
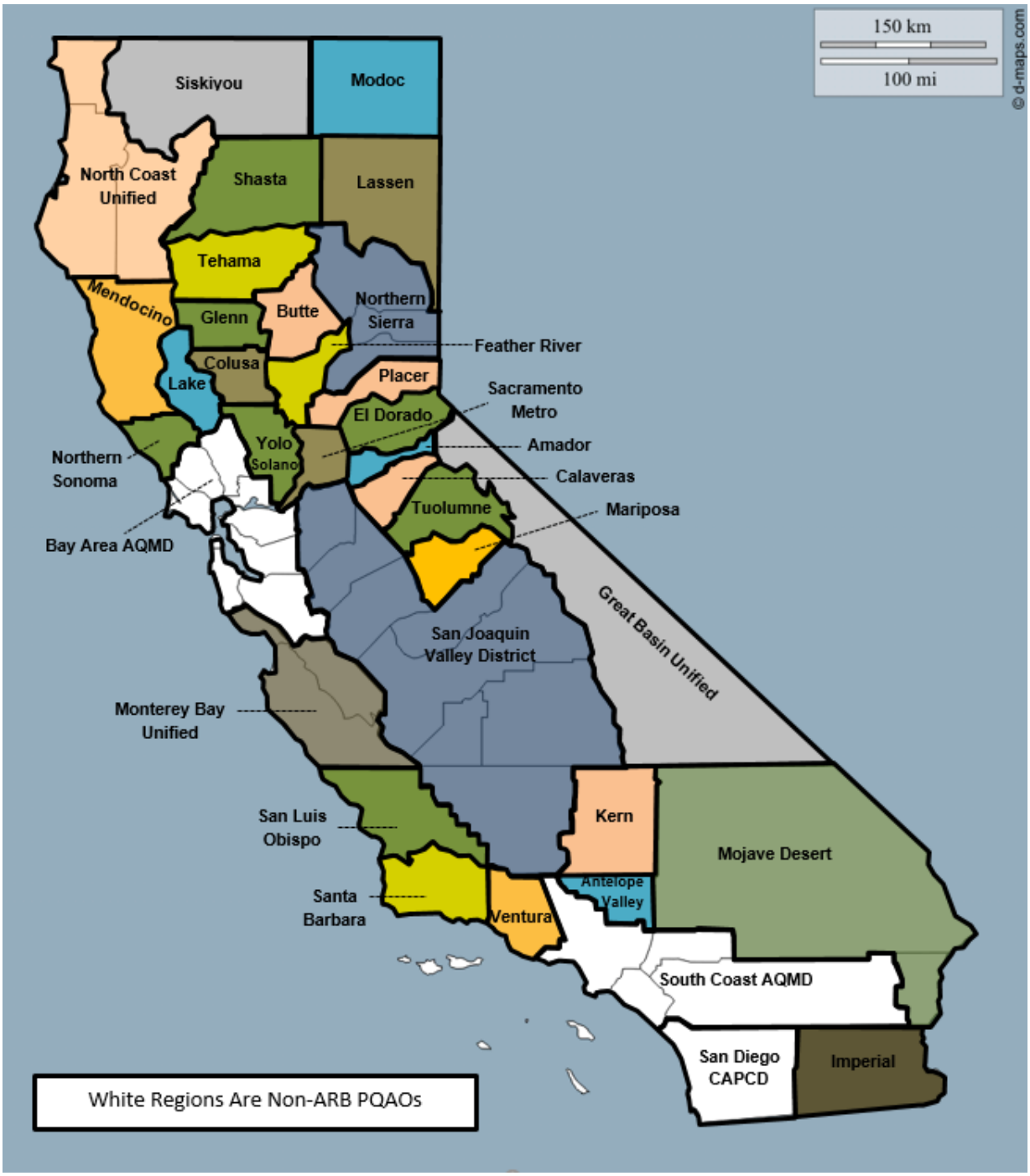
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Kings
Tulare
Inyo
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
SOUTHEAST DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Unclassified/Attainment
Nonattainment
Air Basin
County
Last Updated: October 2018
Air Quality Planning and Science Division, CARB


Area Designations for National Ambient Air Quality Standards
PM10
N
0
50
100
150
200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Lake
Colusa
Sutter
Yuba
Placer
LAKE TAHOE
Sacramento County
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Mono Basin
Mammoth Lake
Marin
Contra Costa
San Joaquin
Calaveras
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
Owens Valley
San Mateo
Santa Clara
Merced
Coso Junction
Madera
Santa Cruz
Trona
San Benito
SAN JOAQUIN VALLEY
Fresno
Inyo
NORTH CENTRAL COAST
Kings
Tulare
Monterey
San Luis Obispo
Kern
Indian Wells Valley
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
SOUTHEAST DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
Coachella Valley
Imperial
San Diego
SAN DIEGO
Unclassified
Attainment
Nonattainment
Air Basin
County
Last Updated: October 2018
Air Quality Planning and Science Division, CARB

Appendix A.5

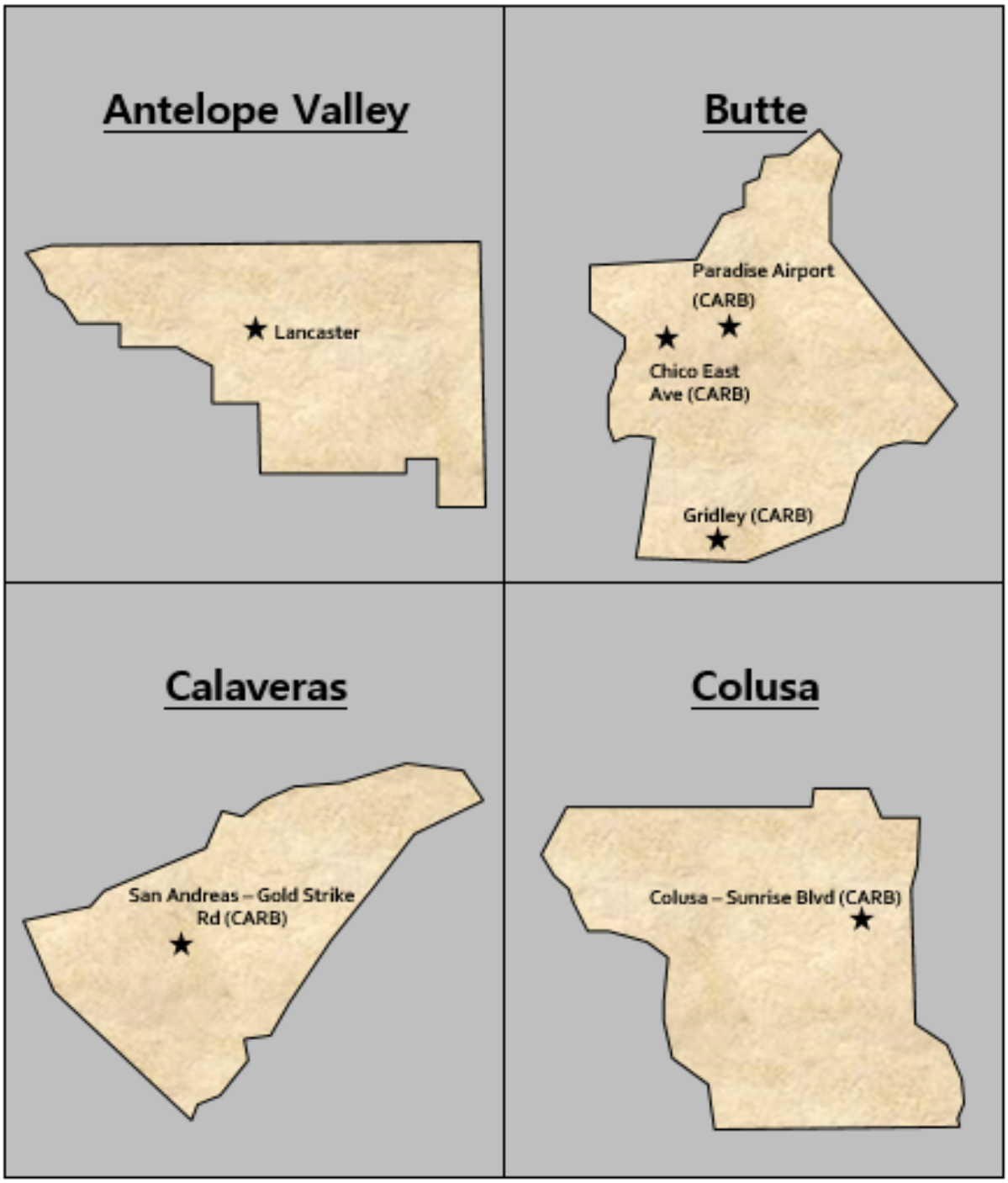
PQAO Monitoring Organization Map

CARB PQAO Monitoring Organization Map

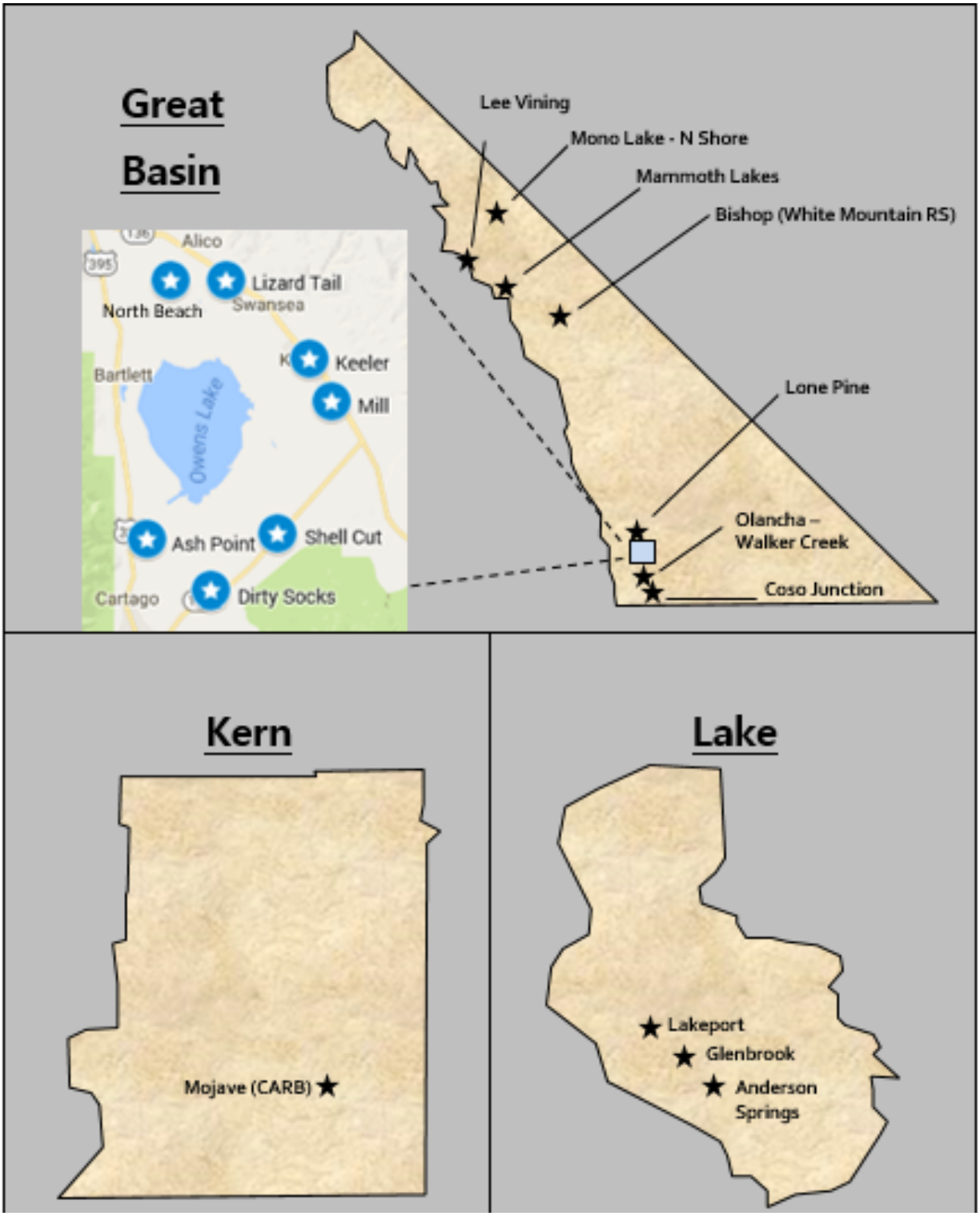


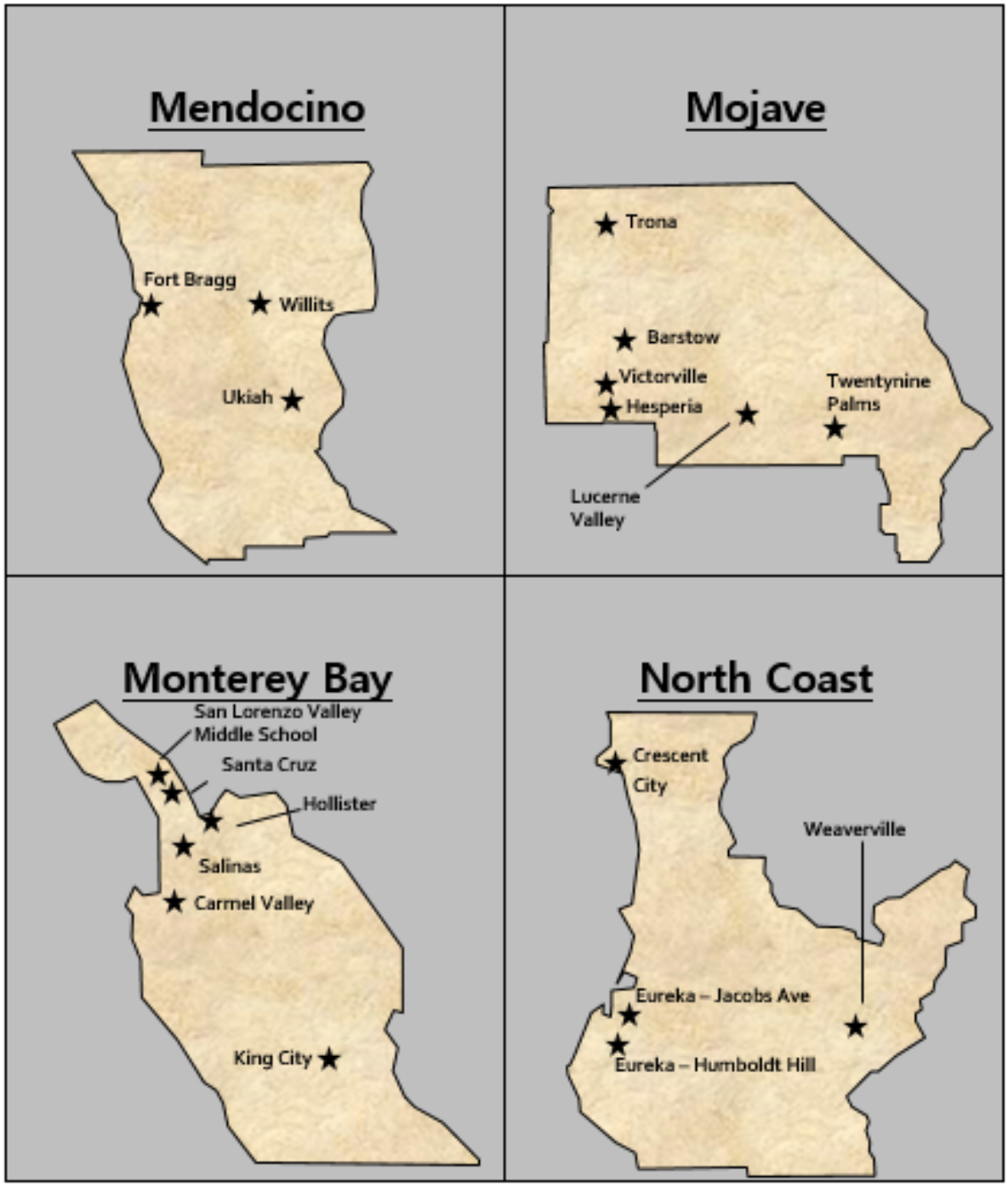
Appendix A.6

Particulate Matter Air Monitoring Site Distribution Maps

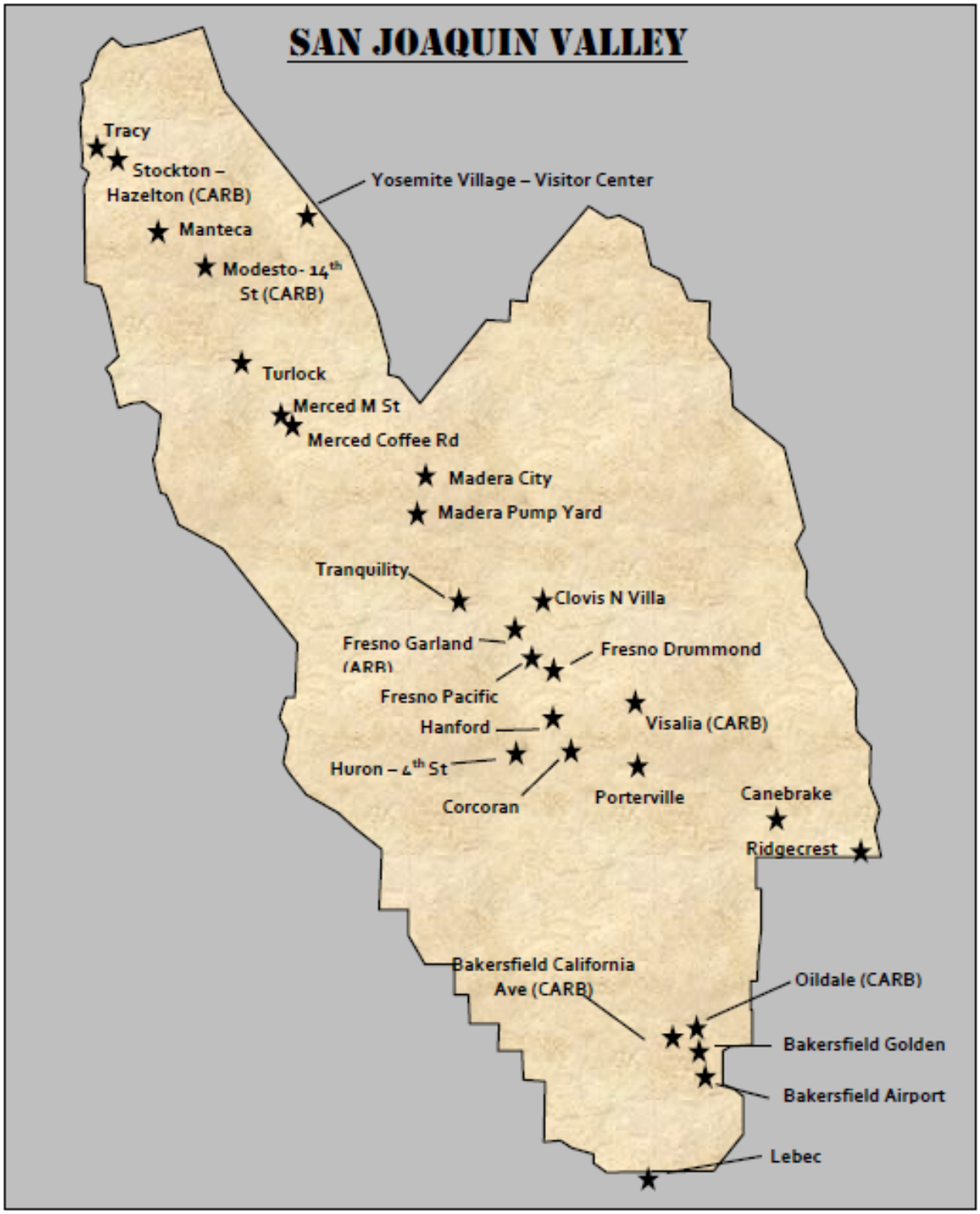

Antelope Valley
Lancaster
Butte
Paradise Airport (CARB)
Chico East Ave (CARB)
Gridley (CARB)
Calaveras
San Andreas – Gold Strike Rd (CARB)
Colusa
Colusa – Sunrise Blvd (CARB)

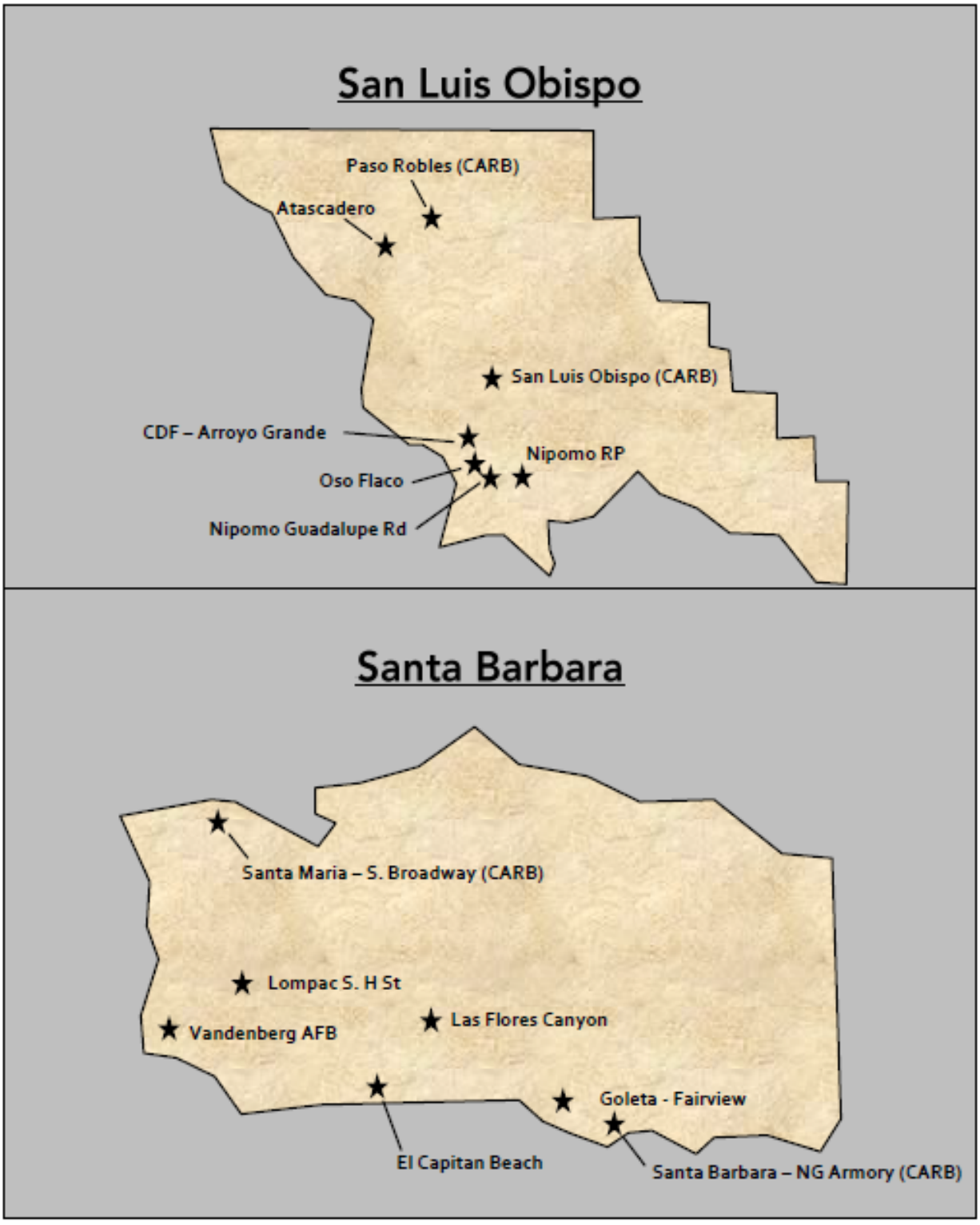

El Dorado
South Lake Tahoe – Sandy Way (CARB)
Feather River
Yuba City (CARB)
Glenn
Willows (CARB)
Imperial
Westmorland
Niland
Brawley
El Centro
Calexico (CARB)


Great
Basin
Lee Vining
Mono Lake - N Shore
Mammoth Lakes
Bishop (White Mountain RS)
Lone Pine
Olancha –
Walker Creek
Coso Junction
Alico
Lizard Tail
Swansea
North Beach
Keeler
Bartlett
Owens Lake
Mill
Ash Point
Shell Cut
Cartago
Dirty Socks
Kern
Mojave (CARB)
Lake
Lakeport
Glenbrook
Anderson
Springs


Mendocino
Fort Bragg
Willits
Ukiah
Mojave
Trona
Barstow
Victorville
Hesperia
Twentynine Palms
Lucerne Valley
Monterey Bay
San Lorenzo Valley Middle School
Santa Cruz
Hollister
Salinas
Carmel Valley
King City
North Coast
Crescent City
Weaverville
Eureka – Jacobs Ave
Eureka – Humboldt Hill


Sacramento Metro
GARDENLAND
Discovery Park
Sacramento - Bercut Dr...
Raging Wat
Sacrame
West Sacramento
Sacramento
MIDTOWN
EAST SACRAMEN
Sacramento - 1309 T St (CARB)
LAND PARK
NORTH OAK PARK
Sacramento City College
Sacramento Zoo
North Highlands
Folsom
Sacramento – Del Paso
Sacramento – Branch Center #2
Sloughhouse
Elk Grove


SAN JOAQUIN VALLEY
Tracy
Stockton – Hazelton (CARB)
Manteca
Modesto- 14th St (CARB)
Yosemite Village – Visitor Center
Turlock
Merced M St
Merced Coffee Rd
Madera City
Madera Pump Yard
Tranquility
Clovis N Villa
Fresno Garland (ARB)
Fresno Drummond
Fresno Pacific
Hanford
Visalia (CARB)
Huron – 4th St
Corcoran
Porterville
Canebrake
Ridgecrest
Bakersfield California Ave (CARB)
Oildale (CARB)
Bakersfield Golden
Bakersfield Airport
Lebec


San Luis Obispo
Paso Robles (CARB)
Atascadero
San Luis Obispo (CARB)
CDF – Arroyo Grande
Nipomo RP
Oso Flaco
Nipomo Guadalupe Rd
Santa Barbara
Santa Maria – S. Broadway (CARB)
Lompac S. H St
Vandenberg AFB
Las Flores Canyon
Goleta - Fairview
El Capitan Beach
Santa Barbara – NG Armory (CARB)


Siskiyou
Yreka
Tehama
Red Bluff –
Walnut St.
Ventura
Piru -
Pacific
Ojai –East Ojai Ave
El Rio – Rio Mesa School #2
Thousand Oaks –
Moorepark Rd.
Simi Valley –
Cochran St.
Yolo Solano
Woodland –
Gibson Rd.
West Sacramento
Davis- UCD
Campus (CARB)
Vacaville –
Merchant St.
Vacaville –
Ulatis Dr.

Appendix A.7

U.S. EPA's Handbook for Air Pollution Measurement Systems Volume II Validation Template

The source of the following information is EPA's 'Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Management Program', Appendix D (March 2017), 'Measurement Quality Objectives and Validation Templates.' CARB has adopted the specific measurement quality objectives presented in the validation template with the exceptions listed in Table A.7 of this QAPP. These exceptions correspond with the line-outs in the validation template below.

In June 1998, a workgroup was formed to develop a procedure that could be used by monitoring organizations that would provide for a consistent validation of $PM_{2.5}$ mass concentrations across the US. The workgroup included personnel from the monitoring organizations, EPA Regional Offices, and OAQPS who were involved with assuring the quality of $PM_{2.5}$ mass; additionally, the workgroup was headed by a State and local representative. The workgroup developed a table consisting of three criteria: critical, operational, and systematic criteria, where each criterion had a different degree of implication about the quality of the data. The criteria included on the tables were from 40 CFR Part 50 Appendices L and N, 40 CFR Part 58 Appendix A, and Method 2.12; a few criteria were also added that were neither in CFR nor Method 2.12, but which the workgroup felt should be included. Upon completion and use of the table, it was decided that a "validation template" should be developed for all the criteria pollutants.

To determine the appropriate table for each criterion, the members of the workgroup considered how significantly the criterion impacted the resulting concentration. This was based on experience from workgroup members, experience from non-workgroup members, and feasibility of implementing the criterion.

Criteria that were deemed critical to maintaining the integrity of a sample or group of samples were placed on the first table. Observations that do not meet each and every criterion on the **Critical Criteria** should be invalidated unless there are compelling reason and justification for not doing so. In most cases, this criterion can identify a distinct group of measurements and time period. For example, a flow rate exceedance represents a single sampler for a particular period of time (and therefore distinct number of samples), whereas a field blank or QA collocation exceedance is harder to identify what samples the exceedance may represent. In most cases the requirement, the implementation frequency of the criteria, and the acceptance criteria are found in CFR and are therefore regulatory in nature. The sample or group of samples for which one or more of these criteria are not met is invalid until proven otherwise[1]. The cause of not operating in the acceptable range for each of the violated criteria must be

[1] In a number of cases precedence has been set with invalidating data based on failure of critical criteria.

investigated and minimized to reduce the likelihood that additional samples will be invalidated. Typically, EPA Regional Offices will be in the best position to assess whether there are compelling reasons and justification for not deleting the data. The evaluation will be informed by a weight of evidence approach, consider input from States/locals and EPA's national office, and be documented.

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

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

NOTE: The designation of quality control checks as Operational or Systematic do not imply that these quality control checks need not be performed. Not performing an operational or systematic quality control check that is required by regulation (in CFR) can be a basis for invalidation of all associated data. Any time a CFR requirement is identified in the Requirement, Frequency or Acceptance Criteria column it will be identified by ***bold*** and ***italics*** font. Many monitoring organization/PQAOs are using the validation templates and have included them in QAPPs. However, it must be mentioned that diligence must be paid to its use. Data quality findings through data reviews and technical systems audits have identified multiple and concurrent non-compliance with operational criteria that monitoring organization considered valid without any documentation to prove the data validity. The validation templates were meant to be applied to small data sets (single values or a few weeks of information) and should not be construed to allow a criterion to be in non-conformance simple because it is operational or systematic

Following are the tables for all the criteria pollutants. For each criterion, the tables include: (1) the requirement (2) the frequency with which compliance is to be evaluated, (3) acceptance criteria, and (4) information where the requirement can be found or additional guidance on the requirement.

The validation templates have been developed based on the current state of knowledge. The templates should evolve as new information is discovered about the

impact of the various criteria on the uncertainty in the resulting mass estimate or concentration. In recent years there has been a number of circumstances where critical criteria and in some cases operational criteria that were in regulation (had a frequency and acceptance criteria) where not met. In these cases, EPA has been consistent in their application of invalidating data not meeting regulations. Interactions of the criteria, whether synergistic or antagonistic, should also be incorporated when the impact of these interactions becomes quantified. Due to the potential misuse of invalid data, data that are invalidated should not be uploaded to AQS, but should be retained on the monitoring organization's local database. This data will be invaluable to the evolution of the validation template.

Use of Bold Italics Font to Identify CFR Requirements.

The criteria listed in the validation templates are either requirements that can be found in the Code of Federal Regulations, guidance found in a variety of guidance documents, or recommendations by the QA Workgroup or EPA. As mentioned above any time a CFR requirement is identified in the Requirement, Frequency or Acceptance Criteria column it will be identified by ***bold and italics*** font and can be used for data invalidation depending on the infraction. The Information/Action column will provide the appropriate references for CFR or guidance documents.

Hyperlink References

Where requirements or guidance documents are found on the web, a hyperlink is created which will lead the user to the closest URL address. Any links to CFR are directed to the electronic CFR document (e- CFR) which is the most up-to-date. E-CFR will not get you to an individual section. Therefore, e-CFR is only hyperlinked once on each page.

Change in Acceptance Criteria

In order to provide more consistent guidance in the use of acceptance criteria we have developed more definitive information on rounding. The acceptance criteria will show more digits than might otherwise be found in regulations or guidance. For example, where in the past the one-point flow rate verification was $\pm$ *4% of transfer standard*, some monitoring organizations equated a flow rate of $< \pm$ 4.5% as acceptable while others considered anything $< \pm$ 4.1% acceptable. Therefore, in order to ensure consistency, EPA has provided more definitive information of these acceptance limits. In this case, the acceptance criteria for the flow rate verification is $< \pm$ 4.1%. In the cases where the CFR lists a requirement (as is the case with the flow rate verification which is listed as $\pm$ 4%), EPA will interpret the acceptance criteria to a level that will provide a more consistent application of the template across the ambient air monitoring network. The rounding policy is included in Appendix L of the QA Handbook.

Truncation

Under no circumstances should quality measurements for comparison to acceptance criteria be truncated, rather than rounded.

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

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

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

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

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

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

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

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

Continuous PM2.5 Local Conditions Validation Template

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

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

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

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Internal/External Data Logger Data	Every 30 days 10 randomly selected values	agree exactly (digital) and $\pm$ 1 µg/m^3 (analog). Note: digital is expected and should be used unless there is no capacity to utilize digital in the monitoring agencies' data system.	1, 2 and 3) TEOM SOP Sec. 10.1.24
Replace In-line filters	every 180 days and twice a calendar year	replaced	1, 2 and 3) TEOM SOP Sec. 10.2
Clean cooler assembly	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.1
Clean/Maintain switching valve	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.2
Clean air inlet system of mass transducer enclosure	every 365 days and once a calendar year	cleaned	1, 2 and 3) TEOM SOP Sec. 10.3.3
Replace the dryers	1/yr or due to poor performance	Review dryer dew point data to determine acceptable performance of dryer	1, 2 and 3) TEOM SOP Sec. 10.3.4
Calibration (KO) constant verification	every 365 days and once a calendar year	Pass or Fail ($\leq$ 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 < 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 L/min	1) BAM 5014i Instruction Manual 3) BAM 5014i Instruction Manual
Replace or clean pump muffler	every 180 days and twice a calendar year	Cleaned or changed	

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

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

1/24 hour average value must be flagged if not meeting criteria
SD= standard deviation , CV= coefficient of variation

**** = need to ensure data system stamps appropriate time period with reported sample value**

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

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

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

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

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Field Filter Blank	10% or 1 per weighing session	<± 30.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.1 2 and 3) Method 2.12 Table 7-1 & Sec.10.5
Lab Filter Blank	10% or 1 per weighing session	<± 15.1 µg change between weighings	1) 40 CFR Part 50, App. L Sec. 8.3.7.2 2 and 3) Method 2.12 Sec. 10.5
Balance Check (working standards)	beginning, 10th sample, end	< ±3.1 µg from certified value	1, 2 and 3) Method 2.12 Sec. 10.6 Standards used should meet specifications in Method 2.12, Sec. 4.3.7
Routine Filter re-weighing	1 per weighing session	<± 15.1 µg change between weighings	1, 2 and 3) Method 2.12 Sec. 10.8
Microbalance Audit	every 365 days and once a calendar year	<± 0.003 mg or manufacturers specs, whichever is tighter	1, 2 and 3) Method 2.12 Sec. 11.2.7
Lab Temp Check	Every 90 days	< + 2.1°C	1, 2 and 3) Method 2.12 Sec. 10.10
Lab Humidity Check	Every 90 days	< + 2.1%	1, 2 and 3) Method 2.12 Sec. 10.10
Verification/Calibration			
Microbalance Calibration	***At installation*** every 365 days and once a calendar year	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec. 8.1 2) 40 CFR Part 50, App. L, Sec. 8.1 and Method 2.12 Sec. 10.11 3) NA
Lab Temperature Certification	every 365 days and once a year	< ± 2.1°C	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Lab Humidity Certification	every 365 days and once a year	< ± 2.1%	1, 2 and 3) Method 2.12 Sec. 4.3.8 and 9.4
Calibration & Check Standards -			
Working Mass Stds. Verification Compared to primary standards	Every 90 days	< ± 2.1 ug	1, 2 and 3) Method 2.12 Sec. 9.7
Primary standards certification	every 365 days and once a calendar year	0.025 mg tolerance (Class 2)	1, 2 and 3) Method 2.12 Sec. 4.3.7
SYSTEMATIC CRITERIA - PM10c Filter Based Local Conditions			
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-5 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-5
Data Completeness	NA	≥ 75% scheduled sampling days in each quarter	1, 2 and 3) Recommendation based on PM2.5 requirements in 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	***all filters***	***µg/m^3 at ambient temp/pressure (PM$_{2.5}$)***	1, 2 and 3) 40 CFR Part 50 App N
Rounding convention for design value calculation	***all filters***	***to one decimal place, with additional digits to the right being truncated***	1, 2 and 3) 40 CFR Part 50 App N Sec. 3.0 (b) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.
Lower DL	***all filters***	***≤ 3 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App O Sec. 3.1
Upper Conc. Limit	***all filters***	***≥200 µg/m^3***	1, 2 and 3) 40 CFR Part 50, App O Sec. 3.2

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

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

PM_{10} Filter Based Dichot STP Conditions Validation Template

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{10} Filter Based Dichot			
Field Activities			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM/ARM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Sample Recovery	***all filters***	***ASAP***	1, 2 and 3) 40 CFR Part 50 App J Sec. 9.15
Sampling Period	***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
Sampling Instrument			
Average Flow Rate	every 24 hours of op	average 16.67 liters/minute	1, 2 and 3) Method 2.10 Sec. 2.1
Verification/Calibration			
One-point Flow Rate Verification	***every 30 days each separated by 14 days***	< ± 7.1% of transfer standard	1, 2 40 CFR Part 58 App A Sec. 3.3.1 and 3) Method 2.10 Table 3-1
Lab Activities			
Filter			
Visual Defect Check (unexposed)	all filters	see reference	1, 2 and 3) Method 2.10 Sec. 4.2
Collection efficiency	***all filters***	***≥ 99 %***	1, 2 and 3) Part 50, App J Sec. 7.2.2
Alkalinity	***all filters***	***< 25.0 microequivalents/gram***	1, 2 and 3) 40 CFR Part 50, App J Sec. 7.2.4
Filter Conditioning Environment			
Equilibration	***all filters***	***24 hours minimum***	1, 2 and 3) 40 CFR Part 50, App. J Sec. 9.3
Temp. Range	***all filters***	***15-30.0° C***	1, 2 and 3) 40 CFR Part 50, App. J Sec. 7.4.1
Temp.Control	***all filters***	***< 3.1° C*** SD* over 24 hr	1, 2 and 3) 40 CFR Part 50, App. J Sec. 7.4.2 SD use is recommendation
Humidity Range	***all filters***	***20% - 45.0% RH***	1, 2 and 3) 40 CFR Part 50, App. J Sec. 7.4.3
Humidity Control	***all filters***	***<5.1% SD**** over 24 hr	1, 2 and 3) 40 CFR Part 50, App. J Sec. 7.4.4 SD use is recommendation
Pre/post Sampling RH	all filters	difference in 24-hr means < ± 5.1% RH	1, 2 and 3) Recommendation based on 40 CFR Part 50, App. L Sec. 8.3.3
Balance	all filters	located in filter conditioning environment	1, 2 and 3) Recommendation based on 40 CFR Part 50, App. L Sec. 8.3.2
OPERATIONAL EVALUATIONS TABLE PM_{10} Filter Based Dichot			
Field Activities			
Verification/Calibration			
System Leak Check	During precalibration check	Vacuum of 10 to 15 in. & rate of decline to 0 in >60 seconds	1, 2 and 3) Method 2.10 Sec. 2.2.1

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
FR Multi-point Verification/Calibration	every 365 days and once a calendar year	Correlation coefficient of >.990 with no point deviating more than 0.5 L/min for total or 0.05 L/min for coarse	1) 40 CFR Part 50, App. J, Sec. 8.0 2 and 3) Method 2.10 Sec. 2.2.4
Field Temp M-point Verification	on installation, then every 365 days and once a calendar year	< ± 2.1°C	1, 2 and 3) Recommendation based on Part 50, App. L
Precision			
Collocated Samples	***every 12 days for 15% of sites***	<5.1 ***µg/m³ for concentrations below 80µg/m³ and <7.1% for concentrations above 80µg/m³***	1 and 2) 40 CFR Part 58 App A Sec. 3.3.4 3) Part 50, App J Sec. 4.1
Semi Annual Flow Rate Audit	every 180 days and twice a calendar year	< ± 10.1% of audit standard	1 and 2) 40 CFR Part 58, App A, Sec. 3.3.3 3) Method 2.10 Sec. 7.1.5
Monitor Maintenance			
Impactor	every 90 days and 4 times a calendar year	cleaned/changed	1, 2 and 3) Method 2.10 Sec. 6.1.2
Inlet/downtube Cleaning	every 90 days and 4 times a calendar year	cleaned	1, 2 and 3) Method 2.10 Sec. 6.1.2
Vacuum pump	every 365 days and once a calendar year	Replace diaphragm and flapper valves	1, 2 and 3) Method 2.10 Sec. 6.1.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Lab Activities			
Balance Check	beginning, 10th sample, end	< 4.1 µg of true zero < 2.1 µg of 10 mg check weight	1, 2 and 3) Method 2.10 Sec. 4.5
"Standard" filter QC check	10%	< ± 20.1 µg change from original value	1, 2 and 3) Method 2.10 Sec. 4.5 From standard non-routine filter
"Routine" duplicate weighing	5-7 per weighing session	< ± 20.1 µg change from original value	1, 2 and 3) Method 2.10 Sec. 4.5 From routine filter set
Integrity- Random sample of test field blank filters	10%	***± 5 µg/m³***	1) 40 CFR Part 50 App J Sec. 7.2.3 2 and 2) Recommendation 3) 40 CFR Part 50 App J Sec. 7.2.3
Lab Temperature Calibration	every 180 days and twice a calendar year	± 2°C	1, 2 and 3) Recommendation related to 40 CFR Part 50, App .L
Lab Humidity Calibration	every 180 days and twice a calendar year	± 2%	1, 2 and 3) Recommendation related to 40 CFR Part 50 App L Sec. 5.8.1
Microbalance Calibration	every 365 days and once a calendar year	Manufacturer's specification	1, 2 and 3) Recommendation related to 40 CFR Part 50 App L
Filter Weighing Audit	every 365 days and once a calendar year	< ± 20.1 µg change from original value	1, 2 and 3) Method 2.10 Table 7-1
Balance Audit	every 365 days and once a calendar year	Observe weighing technique and check balance with ASTM Class 1 standard	1, 2 and 3) Method 2.10 Table 7-1 Sec. 7.2.2

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
Primary Mass Stds. (compare to NIST-traceable standards)	every 365 days and once a calendar year	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1, 2 and 3) Method 2.10 Sec. 9
SYSTEMATIC CRITERIA - PM_{10} Filter Based Dichot			
Siting	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
Data Completeness	***24- Hour Standard***	***≥ 75% scheduled sampling days in each quarter***	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b
Reporting Units	all filters	µg/m^3 at standard temperature and pressure	1, 2 and 3) 40 CFR Part 50 App K
Rounding convention for design value calculation	***Each routine concentration***	***Nearest 10 µg/m^3 (≥ 5 µg/m3 round up)***	1, 2 and 3) 40 CFR Part 50 App K Sec. 2. The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.
Precision			
Single analyzer	every 90 days and 4 times a calendar year.	Coefficient of variation (CV) < 10.1% for values ≥ 3 µg/m^3	1, 2 and 3) Recommendation 3 µg/m^3 cut off in 40 CFR part 58 App A Sec. 4
Single analyzer	1/ yr	CV < 10.1% for values-> 3 µg/m^3	1, 2 and 3) Recommendation 3µg/m^3 cut off in 40 CFR part 58 App A Sec. 4
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV < 10.1% for values-> 3 µg/m^3	1, 2 and 3) Recommendation 3µg/m^3 cut off in 40 CFR part 58 App A Sec. 4
Field Activities			
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 2.10 Table 2-1 (1997 version) 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) Method 2.10 Sec. 9 3) 40 CFR Part 50 App J Sec. 7.1.5
Lab Activities			
Microbalance	at purchase	Readability 1 µg, Repeatability1 µg	1, 2 and 3) Method 2.10 Sec. 4.4
Primary Mass Stds. (compare to NIST-traceable standards)	at purchase	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1, 2 and 3) Method 2.10 Sec. 9

***SD= standard deviation CV= coefficient of variation**

PM_{10} Filter Based High Volume (HV) STP Conditions Validation Template

1) Criteria (PM10 Hi-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{10} Filter Based Hi-Vol			
Field Activities			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM/ARM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Filter Holding Times			
Sample Recovery	***all filters***	***ASAP***	1, 2 and 3) 40 CFR Part 50 App J Sec. 9.15
Sampling Period	***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
Average Flow Rate	every 24 hours of op	~1.13 m^3/min (varies with instrument)	1, 2 and 3) Method 2.11
Verification/Calibration			
One-point Flow Rate Verification	***every 90 days and 4 times a calendar year***	<± 7.1% of transfer standard and <±10.1% from design	1 and 2) 40 CFR Part 58, App A, Sec. 3.3.2 3) Method 2.11 Sec. 3.5.1, Table 2-1
Lab Activities			
Filter			
Visual Defect Check (unexposed)	***all filters***	***see reference***	Method 2.11 Sec. 4.2
Collection efficiency	***all filters***	***99 %***	1, 2 and 3) 40 CFR Part 50, App J Sec. 7.2.2
Alkalinity	***all filters***	***< 25.0 microequivalents/gram***	1, 2 and 3) 40 CFR Part 50, App J Sec. 7.2.4
Filter Conditioning Environment			
Equilibration	***all filters***	***24 hours minimum***	1, 2 and 3) 40 CFR Part 50, App.J Sec. 9.3
Temp. Range	***all filters***	***15.0-30.0° C***	1, 2 and 3) 40 CFR Part 50, App.J Sec. 7.4.1
Temp.Control	***all filters***	***< 3.1° C SD* over 24 hr***	1, 2 and 3) 40 CFR Part 50, App.J Sec. 7.4.2 SD use is recommendation
Humidity Range	***all filters***	***20.0% - 45.0% RH***	1, 2 and 3) 40 CFR Part 50, App.J Sec. 7.4.3
Humidity Control	***all filters***	***< 5.1% SD* over 24 hr***	1, 2 and 3) 40 CFR Part 50, App.J Sec. 7.4.4 SD use is recommendation
Pre/post Sampling RH	all filters	difference in 24-hr means < ± 5.1% RH	1, 2 and 3) Recommendation based on Part 50, App. L Sec. 8.3.3
Balance	all filters	located in filter conditioning environment	1, 2 and 3) Recommendation based on Part 50, App. L Sec. 8.3.2
OPERATIONAL EVALUATIONS TABLE PM_{10} Filter Based Hi-Vol			
Field Activities			
Verification/Calibration			
System Leak Check	During precalibration check	Auditory inspection with faceplate blocked	1, 2 and 3) Method 2.11 Sec. 2.3.2
FR Multi-point Verification/Calibration	every 365 days and once a calendar year	3 of 4 cal points within < ± 10.1% of design	1, 2 and 3) Method 2.11 Sec. 2.3.2
Field Temp M-point Verification	on installation, then every 365 days and once a calendar year	< ± 2.1°C	1, 2 and 3) Recommendation
Precision			

1) Criteria (PM10 Hi-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Collocated Samples	***every 12 days for 15% of sites***	CV < 10.1% of samples ≥ 15 µg/m^3	1) and 2) 40 CFR Part 58 App A Sec. 3.3.4 3) Recommendation
Semi Annual Flow Rate Audit	***every 180 days and twice a calendar year***	< ± 7.1% of transfer standard and< ± 10.1% from design	1 and 2) 40 CFR Part 58, App A, Sec. 3.3.3 3) Method 2.11 Sec. 7 Table 7-1
Monitor Maintenance			
Inlet/downtube Cleaning	every 90 days and 4 times a calendar year	cleaned	1, 2 and 3) Method 2.11 Sec. 6
Motor/housing gaskets	every 90 days and 4 times a calendar year	Inspected replaced	1, 2 and 3) Method 2.11 Sec. 6
Blower motor brushes	600-1000 hours	Replace	1, 2 and 3) Method 2.11 Sec. 6
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	NA
Lab Activities			
Lab QC Checks			
Balance Check (Standard Weight Check and Calibration Check)	beginning, 15th sample, end	< ± 0.51 mg of true zero and < ± 0.51 mg 1-5 g check weight	1, 2, and 3) Method 2 .11 Sec. 4.5.1 and 4.5.2
"Routine" duplicate weighing	5-7 per weighing session	< ± 2.8 mg change from original value	1, 2 and 3) Method 2.11 Sec. 4.5.3 From routine filter set
Integrity- Random sample of test field blank filters	10%	***< ± 5.1 µg/m^3***	1) 40 CFR Part 50 App J Sec. 7.2.3 2) Recommendation 3) 40 CFR Part 50 App J Sec. 7.2.3
Lab Temperature Calibration	every 180 days and twice a calendar year	< ± 2.1°C	1, 2 and 3) Recommendation related to 40 CFR Part 50, App. L
Lab Humidity Calibration	every 180 days and twice a calendar year	< ± 2.1%	1, 2 and 3) Recommendation related to 40 CFR Part 50 App L
Microbalance Calibration	every 365 days and once a calendar year	Manufacturer's specification	
Primary Mass Stds. (compare to NIST-traceable standards)	every 365 days and once a calendar year	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1, 2 and 3) Method 2.11 Sec. 9
Audits			
Filter Weighing	every 365 days and once a calendar year	< ± 5.1 mg change from original value	1) Method 2.11 Table 7-1 2) Recommendation 3) Method 2.11 Table 7-1
Balance Audit	every 365 days and once a calendar year	Observe weighing technique and check balance with ASTM Class 1 standard	1) Method 2.11 Table 7-1 2) Recommendation 3) Method 2.11 Table 7-1

SYSTEMATIC CRITERIA - PM_{10} Filter Based Hi-Vol			
1) Criteria (PM10 Hi-Vol STP)	**2) Frequency**	**3) Acceptable Range**	**Information /Action**
Siting	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
Data Completeness	quarterly	≥ 75%	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b & c
Reporting Units	all filters	µg/m^3 at standard temperature and pressure	1, 2 and 3) 40 CFR Part 50 App K Sec. 1
Rounding convention for design value calculation	***Each routine concentration***	***nearest 10 µg/m^3 (≥ 5 round up)***	1, 2 and 3) 40 CFR Part 50 App K Sec. 1 The rounding convention is for averaging values for comparison to NAAQS not for reporting individual values.
Precision			
Single analyzer	every 90 days and 4 times a calendar year.	Coefficient of variation (CV) ≤ 10% ≥ 15 µg/m^3	1, 2 and 3) Recommendation
Single analyzer	1/ yr	CV < 10.1% ≥ 15 µg/m^3	1, 2 and 3) Recommendation
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV < 10.1% ≥ 15 µg/m^3	1, 2 and 3) Recommendation
Field Activities			
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, ± 0.5° C accuracy	1, 2 and 3) Method 2.11 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 2.11 Sec. 1.1.2
Clock/timer Verification	4/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
Lab Activities			
Microbalance	***at purchase***	Readability 0.1 mg Repeatability0.5 mg (HV)	1 and 2) 40 CFR Part 50, App.J Sec. 7.5 3) Method 2.11 Sec. 4.4
Primary Mass Stds. (compare to NIST-traceable standards)	at purchase	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1, 2 and 3) Method 2.11 Sec. 9

SD= standard deviation CV= coefficient of variation

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/amtic/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- PM_{10} Continuous			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM/ARM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Sampling Period	**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
Average Flow Rate	every 24 hours of op	Average within < ± 5.1% of design	recommendation
Verification/Calibration			
One-point Flow Rate Verification	***every 30 days each separated by 14 days***	< ± 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 PM_{10} Continuous			
Verification/Calibration			
System Leak Check	During precalibration check	Auditory inspection with faceplate blocked	1, 2 and 3) Method 2.11 Sec. 2.3.2
FR Multi-point Verification/Calibration	every 365 days and once a calendar year	3 of 4 cal points within < ± 10.1% of design	1) 40 CFR Part 50 App J Sec. 8.0 2 and 3) Method 2.10 Sec. 2.2.4
Audits			
Semi Annual Flow Rate Audit	***Twice a calendar year and 5-7 months apart***	< ± 10.1% of audit standard	1, 2) Part 58, App A, Sec. 3.3.3 3) Method 2.10 Sec. 7.1.5
Monitor Maintenance			
~~Inlet/downtube Cleaning~~	~~every 90 days and 4 times a calendar year~~	~~cleaned~~	~~1, 2 and 3) Method 2.10 Sec. 6.1.2~~
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
SYSTEMATIC CRITERIA - PM_{10} Continuous			
Siting	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
Data Completeness	24-hour quarterly	≥ 75%	1, 2 and 3) 40 CFR Part 50 App. K, Sec. 2.3b & c

1) Criteria (PM_{10} Cont)	2) Frequency	3) Acceptable Range	Information /Action
Reporting Units	all filters	$\mu g/m^3$ 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 $\mu g/m^3$ ($\geq$ 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	***< $\pm$ 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	$\pm$ 0.1° C resolution, $\pm$ 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	$\pm$ 1 mm Hg resolution, $\pm$ 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

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

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

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

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

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

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

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

Appendix A.8

Auto-QC Criteria

Auto QC Criteria

AirNow Auto QC Criteria

Parameter	Max Suspect	Max Severe	Rate of Change	# of Sticking Hours	Sticking Value (low value)	Fed MDL
O_3 (ppb)	130 (110)	150	40 (25)	5	40 (10)	5 ppb
NOx (ppb)	350	500	30	3	5 (0)	2.7 ppb
NO (ppb)	350	500	30	10	5 (0)	2.7 ppb
NO_2 (ppb)	150	250	50	10	0	2.7 ppb
TCO (ppm)	8 (3)	12 (5)	5 (1.5)	15	0	.02 ppm
TSO_2 (ppb)	150 (50)	200 (100)	100 (25)	5	5 (0)	.2 ppb
PM25 ($\mu g/m^3$)	100	200	50	4	10 (0)	2 $\mu g/m^3$ (3 $\mu g/m^3$ non-FEM)

*(Red) values in parentheses denote what we implemented in DMS which is a deviation from AIRNow QC Criteria.

DMS Auto-QC Criteria

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppb)	Data Points	QC Code	Description
Ozone	1 Hr	Range (<)	0	23	-5		43- Value below MDL	Flags values < negative MDL
Ozone	1 Hr	Range (>)	0	23	150		9-Invalid	Flags hourly values > Value as invalid
Ozone	1 Hr	Range (>)	0	23	110		5-Suspect	Flags hourly values > Value as suspect
Ozone	1 Hr	Rate of Change	0	23	25		5-Suspect	Flags hourly value if rate of change is more than 25
Ozone	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly O_3 value if same for 5 consecutive hours
O_3 Box Temp	1 Hr	Range (>)	0	23	39.9		32-Shelter Temp	Flags hourly O_3 value if box temp more than 39.9

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppm)	Data Points	QC Code	Description
TCO	1 Hr	Range (<)	0	23	-0.02		43- Value below MDL	Flags values < negative MDL
TCO[5]	1 Hr	Range (>)	0	23	5		9-Invalid	Flags hourly values > Value as invalid
TCO[5]	1 Hr	Range (>)	0	23	3		5-Suspect	Flags hourly values > Value as suspect
TCO [4]	1 Hr	Rate of Change	0	23	1.5		5-Suspect	Flags hourly value if rate of change is more than 1.5 ppm
TCO	1 Hr	Sticking	0	23		5	9-Invalid	Flags hourly TCO value if same for 5 consecutive hours
TCO	1 min	Sticking	0	23		6	9-Invalid	Flags API300EU auto-ref data invalid

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppb)	Data Points	QC Code	Description
NO/NOx	1 Hr	Range (<)	0	23	-2.7		43- Value below MDL	Flags values < negative MDL
NO/NOx	1 Hr	Range (>)	0	23	500		9-Invalid	Flags hourly values > Value as invalid
NO/NOx	1 Hr	Range (>)	0	23	350		5-Suspect	Flags hourly values > Value as suspect
NO/NOx[4]	1 Hr	Rate of Change	0	23	30		5-Suspect	Flags hourly value if rate of change is more than 30 ppb***
NO/NOx	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly NOx value if same for 5 consecutive hours
NO	1 Hr	Compare (>=)	0	23			5-Suspect	Flags data if NO values > hourly NOx value for same hour

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppb)	Data Points	QC Code	Description
NO_2	1 Hr	Range (<)	0	23	-2.7		43- Value below MDL	Flags values < negative MDL
NO_2	1 Hr	Range (>)	0	23	250		9-Invalid	Flags hourly values > Value as invalid
NO_2	1 Hr	Range (>)	0	23	150		5-Suspect	Flags hourly values > Value as suspect
NO_2[(4)]	1 Hr	Rate of Change	0	23	30		5-Suspect	Flags hourly value if rate of change is more than 30 ppb***
NO_2	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly NO_2 value if same for 5 consecutive hours

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppb)	Data Points	QC Code	Description
SO_2	1 Hr	Range (<)	0	23	-0.2		43- Value below MDL	Flags values < negative MDL
SO_2	1 Hr	Range (>)	0	23	100		9-Invalid	Flags hourly values > Value as invalid
SO_2	1 Hr	Range (>)	0	23	50		5-Suspect	Flags hourly values > Value as suspect
SO_2	1 Hr	Rate of Change	0	23	25		5-Suspect	Flags hourly value if rate of change is more than 25
SO_2	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly SO_2 value if same for 5 consecutive hours

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ug/m3 LC)	Data Points	QC Code	Description
BAM[(1)]	1 Hr	Range (<)	0	23	-2, -3 or -4		43- Value below MDL	Flags values < negative MDL
BAM[(1)]	1 Hr	Range (>)	0	23	700		9 - Invalid	Flags hourly values > Value as invalid
BAM[(1)]	1 Hr	Sticking	0	23	0	4	5 - Suspect	Will flag if hourly value same for 4 consecutive hours
BAM10	1 Hr	Range (>)	0	23	400	5	5- Suspect	Flags BAM10 values >400 as Suspect
Qtot[(2)]	1 Hr	Range (<)	0	23	<.697		4 - Suspect Flow	Flags BAM_FEM values if Qtot < .697 m^3/min
Qtot[(2)]	1 Hr	Range (>)	0	23	>.703		40-Sample flow out of limits	Flags BAM_FEM values if Qtot > .703 m^3/min
Qtot[(2)]	1 Hr	Range (<)	0	23	<.600		40-Sample flow out of limits	Flags BAM_FEM values if Qtot < .600 m^3/min
Qtot [(3)]	1 Hr	Range (<)	0	23	<.830		4 - Suspect Flow	Flags BAM values if Qtot < .830 m^3/min
Qtot [(3)]	1 Hr	Range (<)	0	23	0.7		40-Sample flow out of limits	Flags BAM values if Qtot > .700 m^3/min
Qtot [(3)]	1 Hr	Range (>)	0	23	>.837		40-Sample flow out of limits	Flags BAM values if Qtot > .837 m^3/min

[(1)] This includes BAM25, BAM25_a, b,c (collocated BAMs), BAM25_FEM, BAMPMC, BAM10 (Actual Conditions), BAM10_S (Local Conditions - units: µg/m^3 25C)
[(2)] Applies to BAM25 FEM samplers
[(3)] Applies to Non- FEM BAM25 samplers
[(4)] NOx, NO_2, and NO and TCO rate of change for Calexico and Fresno is 60 ppb and 3 ppm respectively.
[(5)] TCO max suspect and max invalid for Calexico are 5 and 8 ppm.
REMINDER: When copying QC checks from sites, Verify POC settings within QC Checks.

Appendix B.1

Calculations for Precision and Bias

The materials in this Appendix were adapted from U.S. EPA's "Guideline on the Meaning and the Use of Precision and Bias Data Required by 40 CFR Part 58 to Appendix A".

Data Quality Indicators Calculated for Each Measured Pollutant

Pollutant	***One-Point Flow Rate Bias Estimate***	***PM2.5 Bias***	***Semi-Annual Flow Rate Audits***	***Precision Estimate from Collocated Samples***
PM2.5	One-Point Flow Rate	Bias Estimate	Semi-Annual Flow Rate	Precision Estimate
PM10	One-Point Flow Rate		Semi-Annual Flow Rate	Precision Estimate

Precision Estimates from Collocated Samples

Applies to: PM2.5, PM10

40 CFR Part 58 Appendix A References:

- ***4.2.1 Precision Estimate from Collocated Samplers***
- ***4.3.1 Precision Estimate(PM2.5)***

Precision is estimated for manual instrumentation via duplicate measurements from collocated samplers at a minimum concentration (see table below for minimum concentration levels).

Minimum Concentration Levels for Particulate Matter Precision Assessments

Pollutant	Minimum Concentration Level (in µg/m^3)
PM2.5	3
Lo-Vol PM10	3
Hi-Vol PM10	15

Precision is aggregated at the primary quality assurance organization (PQAO) level quarterly, annually, and at the 3-year level. For each collocated data pair, the relative percent difference, d_i, is calculated by Equation 1.

Equation 1

$$d_i = \frac{X_i - Y_i}{(X_i + Y_i)/2} \cdot 100$$

where X_i is the concentration of the primary sampler and Y_i is the concentration value from the audit sampler.

The precision upper bound statistic, CV_{ub}, is a standard deviation on d_i with a 90 percent upper confidence limit (Equation 2).

Equation 2

$$CV\_ub = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^{\,2} - \left(\sum_{i=1}^{n} d_i\right)^2}{2n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$$

where, n is the number of valid data pairs being aggregated, and $^2_{0.1,n-1}$ is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom. The factor of 2 in the denominator adjusts for the fact that each d_i is calculated from two values with error.

PM2.5 Bias Assessment

Applies to: PM2.5

40 CFR Part 58 Appendix A Reference:

- ***4.3.2 Bias Estimate ($PM_{2.5}$)***

The bias estimate is calculated using the Performance Evaluation Program (PEP) audits described in CFR, section 4.1.3 of Part 58, Appendix A. The bias estimator is based on upper and lower probability limits on the mean percent differences. The mean percent difference, *D*, is calculated by Equation 3 below.

Equation 3

$$D = \frac{1}{n_j} \cdot \sum_{i=1}^{n_j} d_i$$

Confidence intervals can be constructed for these average bias estimates in Equation 7 of this document using equations 4 and 5 below:

Equation 4

$$\text{Upper 90\% Confidence Interval} = D + t_{0.95,df} \cdot \frac{s_d}{\sqrt{n_j}}$$

Equation 5

$$\text{Lower 90\% Confidence Interval} = D - t_{0.95,df} \cdot \frac{s_d}{\sqrt{n_j}}$$

Where, $t_{0.95,df}$ is the 95th quantile of a t-distribution with degrees of freedom df=n_j-1 and s_d is an estimate of the variability of the average bias and is calculated using Equation 6 below:

Equation 6

$$s_d = \sqrt{\frac{\sum_{i=1}^{n_j} (d_i - D)^2}{n_j - 1}}$$

One-Point Flow Rate Bias Estimate

Applies to: PM10, PM2.5

40 CFR Part 58 Appendix A References:

- ***4.2.2 Bias Estimate Using One-Point Flow Rate Verifications (PM10)***

The bias estimate is calculated using the collocated audits previously described. The bias estimator is an upper bound on the mean absolute value of the percent differences, as described in Equation 7 as follows:

Equation 7

$$|bias| = AB + t_{0.95,n-1} \cdot \frac{AS}{\sqrt{n}}$$

where *n* is the number of flow audits being aggregated; $t_{0.95,n-1}$ is the 95th quantile of a t-distribution with n-1 degrees of freedom; the quantity *AB* is the mean of the absolute values of the d_i's (calculated by Equation 8) and is expressed as follows:

Equation 8

$$AB = \frac{1}{n} \cdot \sum_{i=1}^{n} |d_i|$$

and the quantity *AS* is the standard deviation of the absolute value of the d_i's and is calculated using Equation 9 as follows:

Equation 9

$$AS = \sqrt{\frac{n \cdot \sum_{i=1}^{n} |d_i|^2 - \left(\sum_{i=1}^{n} |d_i| \right)^2}{n(n-1)}}$$

Since the bias statistic uses absolute values, it does not have a sign direction (negative or positive bias) associated with it. A sign will be designated by rank ordering the percent differences of the QC check samples from a given site for a particular assessment interval. Calculate the 25th and 75th percentiles of the percent differences for each site. The absolute bias upper bound should be flagged as positive if both percentiles are positive and negative if both percentiles are negative. The absolute bias upper bound would not be flagged if the 25th and 75th percentiles are of different signs (i.e., straddling zero).

Semi-Annual Flow Rate Audits

Applies to: PM10, PM2.5, PM10-2.5

40 CFR Part 58 Appendix A References:

- ***4.2.3 Assessment Semi-Annual Flow Rate Audits***
- ***4.2.4 Percent Differences***

The flow rate audits are used to assess the results obtained from the one-point flow rate verifications and to provide an estimate of flow rate acceptability. For each flow rate audit, calculate the percent difference in volume using Equation 10 of this Appendix where *meas* is the value indicated by the sampler's volume measurement and *audit* is the actual volume indicated by the auditing flow meter.

Equation 10

$$d_i = \frac{meas - audit}{audit} \cdot 100$$

To quantify this annually at the site level and at the 3-year primary quality assurance organization level, probability limits are calculated from the percent differences using equations 11 and 12 of this document where m is the mean and k is the total number of one-point flow rate verifications for the year

Equation 11

$$\text{Upper Probability Limit} = m + 1.96 \cdot S$$

Equation 12

$$\text{Lower Probability Limit} = m - 1.96 \cdot S$$

where, m is the mean (equation 13):

Equation 13

$$m = \frac{1}{k} \cdot \sum_{i=1}^{k} d_i$$

where, k is the total number of one point QC checks for the interval being evaluated and S is the standard deviation of the percent differences (Equation 14) as follows:

Equation 14

$$S = \sqrt{\frac{k \cdot \sum_{i=1}^{k} d_i^2 - \left(\sum_{i=1}^{k} d_i \right)^2}{k(k-1)}}$$

Appendix C.1

Sample Data Certification Letter

[Mailing Date]

(Name), Director
Air Division, Region 9
Mail Code: AIR-1
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Dear (Name)

The California Air Resources Board (CARB) is responsible for submitting air quality data to the Air Quality System (AQS) for State and Local Air Monitoring Stations and Special Purpose Monitoring monitors operated by CARB, as well as for a number of local air districts in California. In addition, CARB submits quality assurance data to AQS for some California districts that are within the Primary Quality Assurance Organization managed by CARB. CARB also submits data for all particulate matter filters weighed and analyzed by CARB's laboratory.

In accordance with Title 40, Part 58.15 of the Code of Federal Regulations, this letter certifies the (20XX) ambient data, except for a few instances that are identified in the enclosed AQS reports. The certified data have been reviewed and are accurate to the best of my knowledge, taking into consideration the quality assurance findings and the data validation performed by the data collection agencies. In addition, this letter also certifies previously certified data that have subsequently been modified.

The following enclosures are included to support data certification:

- Enclosure A CARB and District certification letters
- Enclosure B AMP600 report for all monitors included in this certification
- Enclosure C AMP450NC (only $PM_{10-2.5}$, or PM_{coarse}, as required)

Any AMP600 reports provided by the agencies with data being certified by CARB have been removed from their letters and replaced with the one comprehensive report in Enclosure B.

If you have any questions regarding the ambient air quality data portion of this submittal letter, please contact (Put Name and Contact information here). For questions regarding the quality assurance portion of this submittal letter, please contact (Put Name and Contact Information). Copies of this letter and enclosures are

being sent electronically to the air districts for which CARB submits some or all of the data.

Sincerely,

(Name and Title)
California Air Resources Board
Enclosures (3)

cc: Appropriate Region 9 Staff
Agencies/Departments submitting letters supporting certification