Quality Assurance Program Plan For Gaseous Pollutant Air Monitoring Program

September 2018

FOREWORD

This Quality Assurance Program Plan (QAPP) for the California Air Resources Board's (CARB) Gaseous Pollutant 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

List of Acronyms

AIS	Audit Information System
AMN	Air Monitoring North
AMS	Air Monitoring South
ANP	Annual Network Plan
AQDA	Air Quality Data Action
AQMIS	Air Quality and Meteorological Information System
AQPSD	Air Quality Planning and Science Division
AQS	Air Quality System
AQSB	Air Quality Surveillance Branch
ARM	Approved Regional Method
ASD	Administration Service Division
BAAQMD	Bay Area Air Quality Management District
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAM	Community Air Monitoring Branch
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
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CRM	Certified Reference Material
CV	Coefficient of Variation
DAS	Data Acquisition System
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
GFC	Gas Filter Correlation
MLD	Monitoring and Laboratory Division
MO	Monitoring Organization
MSA	Metropolitan Statistical Area
MSS	Materials and Stores Specialist
N2	Nitrogen
NAAQS	National Ambient Air Quality Standard
NCORE	National Core Multi-pollutant Monitoring Network

NDIR	Non-Dispersive Infrared Method
NIST	National Institute of Standards and Technology
NO2	Nitrogen Dioxide
NOX	Nitrogen Oxides
NPAP	Nation Performance Audit Program
NPS	National Park Service
O3	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
PQAO	Primary Quality Assurance Organization
QA	Quality Assurance
QAPP	Quality Assurance Program/Project Plan
QAS	Quality Assurance Section
QC	Quality Control
QMB	Quality Management Branch
QMP	Quality Management Plan
QMS	Quality Management Section
R&R	Roles and Responsibilities
SCAQMD	South Coast Air Quality Management District
SDCAPCD	San Diego County Air Pollution Control District
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SO2	Sulfur Dioxide
SO4	Sulfates
SOP	Standard Operating Procedure
SPM	Special Purpose Monitors
SRM	Standard Reference Material
TSA	Technical Systems Audit
TTP	Through the Probe Audit
U.S. EPA	United States Environmental Protection Agency

APPROVALS		
California Air Resources Board		
	Signature	**Date**
Catherine Dunwoody, Chief Monitoring and Laboratory Division		11/13/18
Michael Benjamin, Chief Air Quality Planning and Science Division		11/16/18
Mike Miguel, Chief Quality Management Branch		11/7/2018
United States Environmental Protection Agency		
Audrey Johnson, Manager Quality Assurance Office, Region 9		11/7/2018
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		

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 Gaseous Pollutant 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 Gaseous Pollutant Air Monitoring Program.
- All designated contacts in the monitoring organizations (MO) within ARB's Primary Quality Assurance Organization (PQAO)

Distribution is performed by sending an email notification via CARB's PQAO Contact List Serve, placing this document in CARB's Quality Assurance Document Repository at http://www.arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm, 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 five 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), and the National Parks Service (NPS) as 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. CARB operates approximately 35 gaseous air monitoring stations in California. Another approximately 80 monitoring stations 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 (PM), 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 Gaseous Criteria Air Monitoring Program QAPP is to document management policy and those activities and procedures necessary for accomplishing specified program objectives, specifically for Ozone (O3), Carbon Monoxide (CO), Nitrogen Dioxide (NO2) and Sulfur Dioxide (SO2). 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 particulate matter, meteorological parameters, and non-criteria toxic pollutants.

All gaseous 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 and data collected are conducted in accordance with approved procedures and are 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 arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm. 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 Trainings and Certifications	**B8**	Instrument/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 Gaseous Criteria 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 Gaseous Criteria 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 branches are outlined in the QMP and Roles and Responsibilities Documents (http://arb.ca.gov/aaqm/qa/pqao/repository/rr_docs.htm).

Below is a description of the responsibilities of CARB divisions and sections which are involved in the Gaseous Criteria 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 ambient air monitoring activities at ambient air monitoring stations throughout California, including seasonal and toxic air monitoring stations. 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 Gaseous Criteria 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 Quality Management Branch (QMB) that are involved with the Gaseous Criteria 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 collaboratively to conduct Technical System Audits (TSAs) and to provide training to CARB and districts throughout California.

QMS has the responsibility of acting as a 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; conducting TSAs; 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 the 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 gaseous sampling program. AQPSD evaluates the air monitoring network to ensure that it meets federal monitor requirements, creates the Annual Network Plan and five year network assessment, uploads 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 AQMIS and ADAM air quality databases. This work is conducted within the Consumer Products and Air Quality Planning Branch (Branch). Two Sections in this Branch have a role: the Air Quality Analysis Section and the Air Quality and Statistical Studies Section.

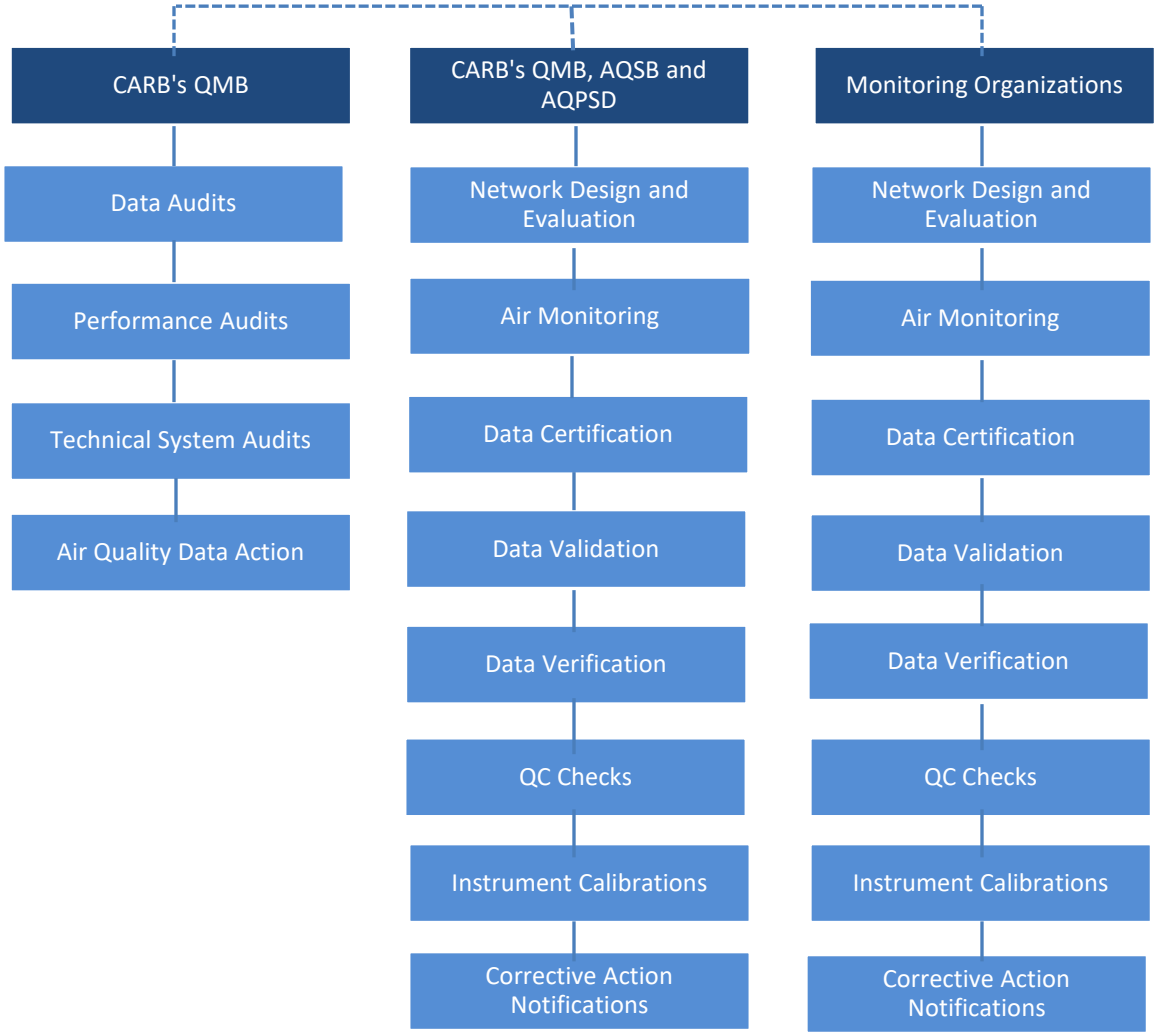
The Air Quality Analysis Section is responsible for conducting a number of complex air quality investigations. Another major area of responsibility includes conducting data evaluations to support federal designations, classifications, and nonattainment. Staff also prepare portions of the State Implementation 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 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.

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 System Audits

(TSAs), and reviews and approves PQAO QAPPs. 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://arb.ca.gov/aaqm/qa/pqao/repository/rr_docs.htm. 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 Gaseous Pollutant Air 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 (MLD), Chief	Responsible for the successful accomplishment of project objectives.	Executive Staff
Quality Management Branch (QMB), Chief	Responsible for the quality assurance program for CARB's PQAO; responsible for timely review, implementation, and assessment of quality management documents and systems throughout the CARB PQAO.	Division Chief
Quality Assurance Section, Manager	Responsible for the scheduling and conducting the annual performance evaluations of all gaseous monitors in the CARB PQAO. Fulfill the NPAP requirements for gaseous monitors in each PQAO of the State. Provide certification services for ozone transfer standards and verification of pollutant concentrations in compressed gas cylinders used for field calibrations of the gaseous analyzers.	Branch Chief
Quality Management Section, Manager	Coordination of liaison activities between CARB and PQAO districts; review of quality management documents for ARB and districts; coordination of PQAO air monitoring training; 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
Air Quality Surveillance Branch (AQSB), Chief	Responsible for overseeing air monitoring activities and the verification and validation of air monitoring data.	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

Position	Responsibilities	Reports To
Operations & Data Support Section, Manager	Responsible for administering the Division'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. Manages the Air Monitoring Web manual and other Branch web pages.	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
Community Air Monitoring Branch (CAM), Chief	Responsible for overseeing Community Air Monitoring North and South Section activities	Division Chief
Community Air Monitoring North and South Sections, Manager	Responsible for the gaseous monitor operation, calibrations, QC equipment calibrations of community air monitoring projects. Data submittal packet to Branch Chief.	Branch Chief
CAM Staff	Responsible for following QAPP and SOP requirements while working on community air monitoring projects.	Section Manager
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	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 ten districts, and submittal of required network assessments and annual network plan to Region 9.	Division Chief
Air Quality & Statistical Studies Section, Manager	Responsible for overseeing evaluation of air toxics data, maintaining ADAM and AQMIS databases, and developing State Implementation Plans.	Branch Chief
Air Quality Analysis Section, Manager	Responsible for preparation of network plan, network assessment, final data certification package and upload of data for ten districts for whom ARB currently uploads data for.	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 annual network plans (ANP), QMPs, QAPPs, 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.

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 Responsibility agreements can be found in CARB's Quality Management Document Repository: https://www.arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm.

A5.1 -Federal and State Standards

Current regulation defines criteria pollutants as particulate matter (PM10 and PM2.5), sulfur dioxide (SO2), carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), and lead (Pb). Ambient air quality standards for O3, CO, NO2, SO2, 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 (SO4) and visibility. The focus of this QAPP is the gaseous criteria 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 Flouresence; 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 µg/m3 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 the ARB 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 µg/m3 to 12.0 µg/m3. The existing national 24-hour PM2.5 standards (primary and secondary) were retained at 35 µg/m3, as was the annual secondary standard of 15 µg/m3. The existing 24-hour PM10 standards (primary and secondary) of 150 µg/m3 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 SO2 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) The ARB 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 µg/m3 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, the ARB 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

Below is a further description of each gaseous criteria air pollutant and their health effects:

- **Carbon Monoxide -** A colorless, odorless gas, carbon monoxide is a byproduct of incomplete combustion and is emitted directly into the atmosphere, primarily from motor vehicle exhaust. Carbon monoxide concentrations typically peak nearest a source, such as roadways, and decrease rapidly as distance from the source increases. Carbon monoxide is readily absorbed into the body from the lungs. It decreases the capacity of the blood to transport oxygen, leading to health risks for unborn children and people suffering from heart and lung disease. The symptoms of excessive exposure-- headaches, fatigue, slow reflexes, and dizziness--also occur in healthy people.
- **Nitrogen Dioxide -** A reddish-brown gas with an irritating odor, nitrogen dioxide is emitted from motor vehicles, industrial facilities, and power plants. Nitrogen dioxide and nitric oxide are products of all types of combustion. Nitric oxide reacts with hydrocarbons in the presence of sunlight to form nitrogen dioxide. In the summer months nitrogen dioxide is a major component of photochemical smog. At ambient concentration levels nitrogen dioxide is an irritating gas that may constrict the airways of asthmatics and increase the susceptibility to infection in the general population.
- **Ozone -** The most widespread air quality problem in the state, ozone is a colorless gas with a pungent, irritating odor. Ozone is not emitted directly into the atmosphere but is primarily formed through the reaction of hydrocarbons and nitrogen oxides in the presence of sunlight. Large spatial and temporal separation can exist between the sources of hydrocarbons and nitrogen and the formation of ozone. Ozone's health effects can include reduced lung function; aggravated existing respiratory illness; and irritated eyes, nose, and throat. Chronic exposure can cause permanent damage to the alveoli of the lungs.
- **Sulfur Dioxide -** A colorless gas with a strong, suffocating odor, sulfur dioxide is primarily a combustion product of coal, fuel oil, and diesel fuel. Only small quantities of sulfur dioxide come from gasoline fueled motor vehicle exhaust. Sulfur dioxide is emitted directly into the atmosphere and can remain suspended for days allowing for wide distribution of the pollutant. Sulfur dioxide can trigger constriction of the airways, causing particular difficulties for asthmatics. Children can experience increased respiratory tract infections and healthy people may experience sore throats, coughing, and breathing difficulties. Long-term exposure has been associated with increased risk of mortality from respiratory or cardiovascular disease.

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 identified as State and Local Air Monitoring Stations (SLAMS). SLAMs monitors are designed for NAAQS comparison and to meet State Implementation Plan (SIPs) 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) stations 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 24 months or less. 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 gaseous criteria 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. Trace level gaseous and NOy instruments used for NCore have technical assistance document requirements, such as conducting instrument specific method detection limit studies. 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 gaseous 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 CARBs PQAO are evaluated for attainment with air quality standards at the Federal (NAAQS) and State (CAAQS) levels. 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 ozone, there must be three or fewer exceedances (see definition below) in the last 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. The

Board may designate areas smaller than an air basin or county, if the Board finds that a smaller area has distinctly different air quality.

- Air Basin is the area designated for ozone, nitrogen dioxide, PM10, sulfates, and visibility reducing particles.
- County (or the portion of a county located within an air basin) is the area designated for carbon monoxide, sulfur dioxide, lead, and hydrogen sulfide.

A5.4 - Current Designation Info

As of May 2016, sixteen areas in California are designated as nonattainment for the 0.075 ppm 8-hour ozone standard. They include California's large urban regions, as well as a number of rural downwind areas. Ozone nonattainment areas are classified according to the severity of their air pollution problem. Areas with higher pollution levels are given more time to meet the standard (attainment date), but are also subject to more stringent control requirements. The South Coast and San Joaquin Valley are the only two Extreme areas in the nation, with an attainment deadline of 2031. The health and economic impacts of exposure to elevated levels of ozone in California are considerable; meeting the standards will pay substantial dividends in terms of reducing costs associated with emergency room visits and hospitalization, lost work and school days, and most critically, premature mortality.

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://www.arb.ca.gov/desig/statedesig.htm

See appendix A.4 for current Federal and State Designation Maps.

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 CRF 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 is identified with a site type in the Air Quality Systems (AQS) database as one of the following:

Table A.4 – U.S. EPA Site Types

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

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.4, which is based on Table D-1 in Appendix D of 40 CFR 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 Annual Network Plans. These local air districts are Great Basin, Monterey, North Coast, Sacramento Metro, 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://www.arb.ca.gov/aqd/amnr/amnr.htm.

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 (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 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 all gaseous criteria pollutants. The minimum number of monitors for each pollutant is based on Core Based Statistical Areas (CBSAs) reported by the U.S. Office of Management and Budget. Minimum monitoring requirements for Ozone 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. The minimum number of monitors required is assessed every five years through the network assessment by CARB and submitted to U.S. EPA Region IV.

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. Another factor is 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 the 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 standard and support of special projects.

Appendix A.5 includes a map identifying the monitoring organization included in the CARB PQAO. Appendix A.6 shows the location of the spatial distribution of the fixed monitoring sites (2017).

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 A6 references U.S. EPA Guidance for Quality Assurance Project Plans, U.S. EPA QA/G4; 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, with the following exceptions in Table 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 MOs 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, 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.'

The following Table A7 details CARB exceptions to the specific measurement quality objectives for the gaseous pollutants listed in Appendix A.7.

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

O3		
Requirement	**Frequency**	**Acceptance Criteria**
Analyzer Calibration		
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	<1 ppb
Multipoint	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span performed biweekly;	0 and 4 upscale points; At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line, whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP)
Annual Performance Evaluations (PE) & National Performance Audit Program (NPAP)	Every monitor 1/calendar year for CARB PQAO sites	Audit levels 3-10: ±10% from true (±7% warning);

O3		
Requirement	**Frequency**	**Acceptance Criteria**
Calibration & Audit Standards		
Level 1 Transfer Standard: Certification (Re-certification) to Standard Reference Photometer	Every 365 days and 1/calendar year	Regression slope = 1.0 ± 0.01; Intercept ≤ ± 1.0 ppb; Single Point Difference < ± 3.1 %
Ozone Level 2 Transfer Standard: Qualification	Upon Receipt of transfer standard	± 4.1 % or ± 4 ppb (whichever greater)
Ozone Level 2 Transfer Standard: Certification(Verification)	After qualification and upon receipt/adjustment/repair	6 tests on 6 different days; Slope w/in 3% of 1; Intercept 0 ± 3 ppb; R^2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5 %
Ozone Level 2 Transfer Standard: Certification (Re-Verification)	Every 365 days and 1/calendar year	3 tests on same or different days; Slope w/in 3% of 1; Intercept 0 ± 3 ppb; R^2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5; Slope shift from previous cert. < 1.0 %
Ozone Level 3 and greater Transfer Standard: Qualification	Upon Receipt of transfer standard	± 4.1 % or ± 4 ppb (whichever greater)
Ozone Level 3 and greater Transfer Standard: Certification(Verification)	After qualification and upon receipt/adjustment/repair	6 tests on 6 different days; Slope w/in 5% of 1; Intercept 0 ± 3 ppb; R2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5 %
Ozone Level 3 and greater Transfer Standard: Certification(Re-Verification)	Beginning and end of O3 season or every 182 days or 2/calendar year whichever less	1 test; Slope w/in 5% of 1; Intercept 0 ± 3 ppb; R^2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5; Slope shift from previous cert. < 1.0 %

CO		
Requirement	**Frequency**	**Acceptance Criteria**
Analyzer Calibration		
Multipoint	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span performed biweekly;	At a minimum, all points <± 2.1% or ≤± 0.030 ppm difference of best-fit straight line whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP)
Gaseous Standards	All gas cylinders	For direct analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; For diluted analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; Relative expanded uncertainty < 1%; NIST Traceable;

NO2		
Requirement	**Frequency**	**Acceptance Criteria**
Converter Efficiency	During multi-point calibrations, span and audit, every 14 days	(≥96 %) 96%-104.1% for heated molybdenum catalytic-reactive converter only.
Analyzer Calibration		
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	NO/NO2 < 1 ppb
Multipoint	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span performed biweekly;	At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP).
Gaseous Standards	All gas cylinders	For direct analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; For diluted analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; Relative expanded uncertainty < 1%; NIST Traceable; NO2 only: 50-100 ppm of NO in Nitrogen with < 1 ppm NO2.

SO2		
Requirement	**Frequency**	**Acceptance Criteria**
Analyzer Calibration		
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	< 1 ppb
Multipoint	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span performed biweekly;	At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP).
Gaseous Standards	All gas cylinders	For direct analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; For diluted analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; Relative expanded uncertainty < 1%; NIST Traceable;
Completeness	1 hour standard	5-min value may be reported for non-valid hours at district discretion

The formal DQO process includes 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 for the Data Quality Objectives Process* (U.S. EPA, 1994), and in Section 3 of the *Quality Assurance Handbook for Air Pollution Measurement Systems* (U.S. EPA, 2011). The seven steps are:

- State the problem
- Identify the decision
- Identify the inputs to the decision
- Define the program or study boundaries
- Develop a decision rule
- Specify tolerable limits on the decision errors
- Optimize the design for obtaining data

State the Problem

Criteria gaseous pollutants (CO, O3, NO2, and SO2) impact human health and the environment. The CAA requires that the U.S. EPA establish the 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; develop air models, emissions inventories and State Implementations Plans. Criteria gaseous 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/

The Monitoring Organization's (MO) attainment status of each gaseous 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 CAA 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 Decision

The primary purpose for monitoring criteria gaseous pollutants is to provide a basis to determine the attainment status for the applicable NAAQS. Monitoring should provide data of appropriate quantity and quality to determine the attainment status of for 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 supporting State Implementation Plans.

Identify the Inputs to the Decision

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

Table A.8 – NAAQS Inputs

Pollutant	Primary/Secondary	Decision Input
O3	Primary and Secondary	Fourth-highest annual 8-hour average O3 value, averaged over 3 years for each O3 monitoring site
NO2	Primary	1 Hour Standard: Three year average of the annual 98th percentile of the 1-hour daily maximum concentrations
	Primary and Secondary	8 Hour Standard: Annual arithmetic mean
SO2	Primary	1 Hour Standard: Three year average of the annual 99th percentile of the 1-hour daily maximum concentrations
	Secondary	3 Hour Standard: Not to be exceeded more than once per year
CO	Primary	8 Hour Standard: Not to be exceeded more than once per year
	Primary	1 Hour Standard: Not to be exceeded more than once per year

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

Table A.9 – CAAQS Inputs

Pollutant	Decision Input
O3, CO	1 Hour Standard: Max value in three years 8 Hour Standard: Max value in three years
NO2	1 Hour Standard: Max value in three years Annual arithmetic mean: Max annual average in three years
SO2	1 Hour Standard: Max value in three years 24 Hour Standard: Max 24 hour average in three years
H2S	1 Hour Standard: Max value in three years

Required Hours

The hours of potentially high concentration must be included. These hours are:

Pollutant	Hours (PST)
Ozone	9 am - 5 pm
Carbon Monoxide	3 pm - 9 am (next day)
Nitrogen Dioxide	8 am - 8 pm
Other Pollutants	Throughout day

Required Months

The months of potentially high concentrations must be included. These months are:

Pollutant	**Months**
Ozone	July - September
Carbon Monoxide	January, November - December
Sulfur Dioxide	September - December
Other Pollutants	January – December

Additional inputs:

- Annual Monitoring Network Plan that demonstrates the monitoring network meets the requirements of 40 CFR Part 58
- Pollutant model requirements and objectives
- Pollutant distribution changes
- Pollution history and trends
- Meteorology
- Topography
- Budget and Staffing
- Maintenance Plan and State Implementation Plan Requirements
- Community Feedback

Define Program or Study 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 a Decision Rule

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 the U.S. EPA that demonstrates how the monitoring organization will remain in attainment with the specified NAAQS.

If the monitoring data for gaseous 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 Tolerable Limits on the Decision Errors

In order to minimize the possibility of coming to erroneous conclusions in correctly assessing uncertainty, 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. Precision is based on one-point QC checks for gaseous instruments. For precision, the statistic is the upper bound of the coefficient of variation (CV), which reflects the highest estimate of the variability in the instrument's measurements. One-point QC checks for gaseous instruments are also used to estimate bias. Bias is the systematic or persistent distortion of a measurement process which causes error in one direction.

The requirements for O3 are an upper 90 percent confidence limit for the coefficient of variation (CV) of 7.1 percent for precision and an upper 95 percent confidence limit for the absolute bias of 7.1 percent for bias.

The requirements for SO_2, and CO are an upper 90 percent confidence limit for the coefficient of variation of 10.1 percent for precision and an upper 95 percent confidence limit for the absolute bias of 10.1 percent for bias.

The requirements for NO2 are an upper 90 percent confidence limit for the coefficient of variation of 15.1 percent for precision and an upper 95 percent confidence limit for the absolute bias of 15.1 percent for bias.

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.7 includes real-time QC Criteria for the AirNow site.

Optimize the Design for Obtaining Data

The primary design objective of a criteria pollutant air 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 for 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 Trainings and Certifications

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 gaseous pollutant monitoring, 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 Gaseous Pollutant Monitoring Plan Program, including the ability to satisfy program and agency QA requirements. Districts shall adopt the training guidelines similar to those described below or develop their own training plan and record-keeping process that is reviewed 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 on-the-job training program created by CARB for field technicians is periodically reviewed and refined and will be available to districts for use directly or for developing their own training plans.

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.

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 Gaseous Pollutant Air Monitoring Program for CARB sections, if applicable. The CARB 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 the trainings on relevant subjects, including, but not limited to: (1) network design, including Annual Network Plans; (2) using other databases including AQS and AirNow; and (3) addressing data anomalies. When a new employee's job 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 Audit Information System (AIS) program, Concur, and CalATERs Global.

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 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 Notification
- Ozone Line Loss
- 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 Primary Quality Assurance Organization (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 to include but not limited to the following:

- DMS Training
- CARBLogger Training
- Vendor offered instrument training (i.e.,Teledyne/API)

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 a critical component of maintaining continuity and an effective and efficient quality assurance program. Training needs are assessed on a continual basis by section managers. 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.

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.

A8.4 – 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://www.arb.ca.gov/aaqm/qa/pqao/repository/training.htm

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, Air Quality Data Action (AQDA) requests, Corrective Action Notifications (CAN), 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. All available documents for CARB and monitoring organizations within its PQAO are available at http://www.arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm. 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.

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 http://www.arb.ca.gov/aaqm/qa/qa.htm. In addition, AQSB, in conjunction with the Office of Information Services (OIS) is responsible for maintaining a copy of the ambient and QC data generated by the air monitoring network.

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. As a general rule, CARB retains documents and records for a period of three years before transferring them to DGS for long term archiving.

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 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 001
API 400A Ozone Analyzer
Second Revision, August 2007
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, effective date, 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 the CARB 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 B9.3. Additionally, the software must have features to create a time stamp of edits, which identifies to editor. MOs using such software must describe their operation and security features in a QAPP addendum.

A9.6 - Archiving of CARB Document 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. Monitoring organization documents should be archived according to the organization's document management procedures.

Table A.7 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. CARB has implemented the Promium Element® LIMS Data System for data centralization and sample tracking.

Table A.10: Data Record Format and Locations

Document Name	Brief Description	Format	Storage Location
Training Files	Records substantiating the training and proficiency of staff relevant to this program	Hardcopy; Electronic	Varies by CARB section method
QAPP	Master version of QAPP, including pending revisions	Electronic	https://www.arb.ca.gov/airwebmanual/vol2.php
SOPs	Current version of all SOPs	Electronic	https://www.arb.ca.gov/aaqm/sop/summary/summary.htm
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
Corrective Action Reports	Results or identified QA problems and their resolution	Hardcopy; Electronic	https://www.arb.ca.gov/aaqm/qa/pqao/pqao_can.htm
Station Notebooks	Logs station activity	Hardcopy	Air monitoring sites
Instrument User's Manual and/or Manufacturer's Instructions	Information for setting up, using, and troubleshooting the continuous gaseous monitors	Hardcopy; Electronically via manufacturer's websites for updates	Air monitoring sites; Online

Document Name	Brief Description	Format	Storage Location
Calibration Certificates and Records	Includes certificates for gases and other chemicals used for calibration	Hardcopy	Air monitoring sites; accompanying instruments
QC Records	Results of instrument blanks, calibrations, standard recoveries, and replicate precision	Hardcopy	Air monitoring sites; CARB Headquarters
Raw Data Records	Results of instrument analyses (including supporting data that are not uploaded to the database)	Electronic	Stored by DMS.
Annual Network Plan (for portions of the CARB PQAO)	Federally required report to meet requirements of 40 CFR 58.10	Electronic	https://www.arb.ca.gov/aqd/amnr/amnr.htm
Ozone Monitoring Waiver	Annual Waiver to annual monitoring season for six ozone sites	Electronic	Available in Annual Network Plan https://www.arb.ca.gov/aqd/amnr/amnr.htm
5 Year Network Assessment (for portions of the CARB PQAO)	Assessment of potential network changes in upcoming 5 years	Electronic	Internal network drive (HQCSAQPSD\branch\aqpb) T:\Network assessment (5 year)
State Implementation Plans	Plans required under the Federal Clean Air Act	Electronic	https://www.arb.ca.gov/planning/sip/sip.htm

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, the National Park Service (NPS), private contractors, and tribal authorities. Gaseous 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 info on the current CARB PQAO air monitoring network design can be found in CARBs Annual Network Plan (ANP) or other districts' ANPs. The 2016 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 Metro, San Joaquin, San Luis Obispo, and Santa Barbara. These district ANPs include monitoring sites operated by the districts and sites operated 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. Air is monitored at each of the monitoring sites noted in the ANP, however not all of the sites operate continuous analyzers for gaseous pollutants.

Appendix A of the CARB ANP also lists the location of many of the monitors, including the Core-Based Statistical Area (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 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 ozone, tied to the minimum monitoring requirements is the need to establish a site where the highest concentrations are expected to occur. As noted in federal regulations, '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 determining:

- 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 the CARB website at http://www.arb.ca.gov/aaqm/qa/pqao/repository/rr_docs.htm.

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

1. periods of routine maintenance plus other instrument or site issues;
2. periods of instrument calibration, quality control checks or performance evaluation; or
3. periods or monitoring seasons exempted by the Regional Administrator.

More specific information about CARB's PQAO network is in the Annual Network Plan, located at https://www.arb.ca.gov/aqd/amnr/amnr.htm.

B1.1 - General Station Design Requirements

The design at CARB gaseous 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://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/v5apxae.pdf
- Standardized sampling components (i.e., tubing , manifold, sampling cane)
- Standardized data acquisition systems

Station manifolds used at CARB PQAO air monitoring stations shall be constructed of glass and all sample lines and probes shall be constructed of Teflon or a suitable material. Station sample probes shall incorporate the use of a glass "candy cane" port attached at the sample probe inlet to (1) prevent rain/debris from entering sample line and (2) provide a port to attach calibration gases to conduct thru the probe QC checks.

Residence times at ARB sites shall be 20 seconds or less as calculated from the sample probe inlet to the rear of instrument. Bypass pumps can be installed if required, and probe line sizing should be appropriate to maintain proper manifold vacuum/pressure and sample residence time.

Additionally, a typical monitoring station for gaseous parameters will include the following components:

- FRM or FEM analyzers
- Station calibrator for performing automatic and/or manual zero, span, precision check
- Data acquisition system (DAS)
- Certified U.S. EPA protocol gases
- Zero-air supply

Section B2 - Monitoring Methods

This section identifies monitoring instrument SOPs for gaseous pollutant monitors operated by CARB monitoring personnel. SOPs list needed equipment, identify support facilities, 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 measurements quality objectives in U.S. EPA Handbook Volume II and 40 CFR Part 58, as applicable. SOPs written by MOs are expected 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. 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.

Current and Legacy Standard Operating Procedures (SOP) for gaseous criteria pollutant instruments are available on the MLD Air Monitoring Web Manual at: https://www.arb.ca.gov/airwebmanual/index.php . CARB and the MOs are currently in the process of creating and updating SOPs to include all procedures related to work in the gaseous air pollutant monitoring program. The goal is to maintain SOPs which have been reviewed within 3 years of original approval.

Table B.1 – Examples of Monitoring SOP and Technical Documents Included on the Air Web Manual

Pollutant	Location of SOP documents
Ozone	https://www.arb.ca.gov/airwebmanual/amwmn.php?c=0
Nitrogen Dioxide	https://www.arb.ca.gov/airwebmanual/amwmn.php?c=1
Carbon Monoxide	https://www.arb.ca.gov/airwebmanual/amwmn.php?c=2
Sulfur Dioxide	https://www.arb.ca.gov/airwebmanual/amwmn.php?c=3

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 filling out the Corrective Action Notification form. More information on the

corrective action process is available in section D1. CARB SOPs for data acquisition, review, and validation are listed on section B9.

Section B3 - Sample Handling and Custody

The pollutants covered in the Gaseous Pollutant Air Monitoring Program QAPP are sampled in real time at monitoring stations. Samples are not transported or re-located to a laboratory for further analysis. Monitoring stations are secure sites which are kept locked when CARB personnel are not present. Locked fencing is additionally used were 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 the local law enforcement agency is notified and requested to complete a report on such an incident.

B4 - Analytical Methods

The pollutants covered in the Gaseous Pollutant Air Monitoring Program QAPP are analyzed using continuous gas monitors. No discrete samples are collected, nor are laboratory based analyses performed. Below is a brief description of the principal of operation for the primary gaseous 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. These manuals can be found at:
https://www.arb.ca.gov/airwebmanual/instrument_manuals/index.php
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.

Ozone

Ozone (O3) instruments used by CARB for ambient air monitoring utilize UV photometry. These instruments are designed to accurately measure ambient ozone concentrations, despite the presence of interfering compounds. The analyzers detect ozone by measuring the absorbance of 254 nm UV light emitted by a mercury vapor lamp and collected by a detector at the other end of the sample gas path. Using the Beer-Lambert law, this UV absorbance can be correlated to the concentration of ozone and any other compound which may absorb UV light at this frequency.

Sulfur Dioxide

Sulfur dioxide (SO2) instruments used by CARB for ambient air monitoring measure (or determine) the amount of SO2 using UV fluorescence. This method measures fluorescence given off by SO2 after the absorption of ultraviolet light. The fluorescent measurement is proportional to the SO2 concentration.

Nitrogen Dioxide

The CARB primarily uses total oxides of nitrogen (NOx) instruments to measure the concentration of nitrogen dioxide (NO2) in the ambient air. These instruments utilize gas phase chemiluminescence as the analytical method. These instruments are designed to accurately determine NO2 concentration by measuring the concentration of nitric oxide (NO) and NOx in ambient air. NO2 is determined by calculation as the difference between NOx and NO.

To first determine the amount of NO present in the sample stream, the air sample is reacted with ozone (O3) in a reaction cell. The NO concentration is determined by detecting the amount of chemiluminescent light that is emitted when the NO sample is exposed to O3.

The light intensity of the NO2 luminescent reaction is detected in the near infrared spectrum and is linear in proportion to the amount of NO present in the reaction chamber. In an alternate stage, NOx is determined when the sample gas is routed through a heated molybdenum catalytic-reactive converter. The heated molybdenum reacts with the ambient NO2 and other N2 species and converts them to NO which combines with the ambient NO in the sample gas that passes through unchanged. This sample gas is then subjected to the chemiluminescent reaction of the first step in order to determine the total NOx value (original NO + converted NO2). NO2 is then determined by subtraction between the known NOx and NO measurements.

Carbon Monoxide

Carbon monoxide (CO) instruments used by CARB to determine the concentration of CO in ambient air utilize the non-dispersive infrared (NDIR) method. In this method, a broad-band infrared (IR) beam is passed through a rotating gas filter correlation (GFC) wheel into a multi-pass cell filled with sample gas, through a 4.7 µm broad-pass filter, and into a photo detector that converts the light signal into a voltage signal representing the attenuated intensity of the beam. The GFC is used to overcome the interference of the water vapor in the sample because water vapor and CO absorb light at 4.7 µm. The GFC has two chambers, one filled with nitrogen (N2) and one filled with a combination of N2 and CO. The N2 + CO side of the wheel acts to produce a CO reference measurement which strips the beam of most of the IR at 4.7 µm. The N2 side of the filter wheel is transparent to the IR radiation and therefore produces a CO measurement. The amount of CO in the air is computed as the ratio between the CO measurement voltage and the CO reference measurement voltage.

Recently, the CARB has begun using instrumentation utilizing a measurement principal based on high-resolution direct-absorption spectroscopy. These instruments are extremely accurate and primarily used in the CARB's greenhouse gas monitoring network. Although direct absorption spectroscopy instrumentation has not been designated as a U.S. EPA equivalent method, this method is designed to work in ambient air and to deliver more accurate measurements, when compared to GFC instruments, over a range of concentrations ranging from typical ambient levels to over ten times ambient levels.

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 calibration checks, instrument diagnostic data screening, preventative maintenance, data review, and documentation.

For gaseous pollutant instruments, CARB conducts QC checks using automated calibration systems to confirm network instruments' ability to respond to known concentrations of gas. These checks are conducted several times per week at zero, precision, and span level concentrations. CARB recommends performing these checks more frequently than the regulatory minimum frequency of every 14 days. Precision level checks generated during automated calibrations represent the required one-point QC check as required in 40CFR58 App. A. In addition, these QC checks are used to generate control charts to assess instrument drift and verify that instruments operated within acceptable control limits.

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.' **Automated QC checks are not used to make any adjustments to analyzers. Doing so will invalidate the multi-point calibration of the instrument.**

The degree of variability in each of these measurements is computed as the precision of those instruments' measurements. Routine QC checks are performed using calibration equipment and standards separate from those used for the multi-point calibrations, if possible (refer to section A7 for more details). 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.

<u>Quality Control (QC) Limits</u>

To assess the quality of QC checks, CARB has established the following QC control limits in the network (warning and action limits) based on the results of automated QC checks.

- Warning level of +/- 5%, all gaseous instruments.
- Action level of +/- 7.1% for ozone and +/- 10.1% for carbon monoxide and sulfur dioxide; +/- 15.1% for nitrogen dioxide.

Zero checks are considered acceptable if the zero drift is < ± 3.1 ppb (24 hr) or < ± 5.1 ppb (>24 hr-14 day) for O3, NO2, and SO2. Zero checks are considered acceptable if the zero drift is < ± 0.41 ppm (24 hr) or < ± 0.61 ppm (>24 hr-14 day) for CO. CARB operates trace level CO and SO2 instrumentation. MOs operating ambient level instruments should note their quality control limits in a CARB approved QAPP addendum.

If precision and span instrument QC checks are less +/- 5%, and zero check are less than values stated above, it can be assumed that instruments are operating properly and no corrective action is required.

The "warning level" is reached when the automated QC check response of any gaseous analyzer varies by more than ± 5% from the expected value. Warning levels are a CARB recommendation and can be defined differently by MOs in a QAPP addendum. At this level, instrument performance should be closely observed and/or corrective action taken before the analyzer reaches the action level.

The "action level" is reached when the automated QC check response for ozone varies more than ± 7.1%, carbon monoxide or sulfur dioxide vary more than ± 10.1%, or nitrogen dioxide varies by more than ± 15.1%. When the action level is reached, corrective action **MUST** be initiated. Associated data should be invalidated unless there are compelling reason and justification for not doing so. Compelling evidence (reason) is data, such as (but not limited to) an independent audit point (s), a multi-point verification, or a zero/span check that establishes whether an analyzer was in fact operating within the percent difference critical criteria acceptance limits and whether the 1-point QC check itself is considered valid or invalid. The associated data should be flagged with an appropriate AQS data qualifier code and the compelling reason and justification documented. This documentation should be done through a formal data review process.

Corrective action means that calibration staff (staff independent from the site operator, if possible) using independent certified transfer standards, verify that QC check results are valid and are not simply caused by a problem with the calibration system (i.e., faulty O3 generator or zero air supply). If it is determined that an instrument has malfunctioned or instrument drift has occurred causing the instrument to drift outside of acceptable criteria, corrective actions must be taken to bring the instrument within acceptable control limits. All corrective actions must be documented on QC maintenance sheets, recorded in station log books and in some cases electronically documented in the data management system.

The following Table B.2 summarizes one-point check acceptance criteria.

Table B.2 – One-Point QC Check Acceptance Criteria

Pollutant	**One-Point QC Check (Action Level)**	**Zero/Span Check (Action Level)**
Ozone	<± 7.1% difference or <± 1.5 ppb difference whichever is greater	Zero Drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14day) Span Drift ≤±7.1 %
Carbon Monoxide	<± 10.1 % difference	Zero Drift < ± 0.41 ppm (24 hr) < ± 0.61 ppm (>24hr-14day) Span Drift ≤ ±10.1 %
Sulfur Dioxide	<± 10.1 % difference or <± 1.5 ppb difference whichever is greater	Zero Drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14day) Span drift ≤±10.1 %
Nitrogen Dioxide	<± 15.1 % difference or <± 1.5 ppb difference whichever is greater	Zero Drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14day) Span Drift ≤±10.1 %

Precision is based on one-point QC checks for gaseous instruments. For precision, the statistic is the upper bound of the coefficient of variation (CV), which reflects the highest estimate of the variability in the instrument's measurements. One-point QC checks for gaseous instruments are also used to estimate bias. The precision and bias calculations are based on requirements in 40 CFR 58, appendix A. See appendix B.1 of this QAPP document for a full description of the calculations.

Table B.3 – Precision and Bias of One-Point QC Checks

Pollutant	**Precision**	**Bias**
Ozone	90% CL CV <7.1 %	95% CL <±7.1 %
Carbon Monoxide	90% CL CV <10.1 %	95% CL <±10.1 %
Sulfur Dioxide	90% CL CV <10.1 %	95% CL <±10.1 %
Nitrogen Dioxide	90% CL CV <15.1 %	95% CL <±15.1 %

CL- Confidence Limit; CV – Coefficient of Variation

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

Gaseous instruments used in the network are maintained within environmentally controlled shelters. The acceptable range for monitoring shelters is 20°C and 30°C. However, per manufacturers' specifications, many gaseous analyzers have been tested, qualified, and designated to operate at wider temperature ranges. It is acceptable to use a wider operating temperature range if specified by the manufacturer. Should the operating temperature range of instruments be exceeded, it is important to closely evaluate other instrument diagnostic parameters. Analyzers must be operated within

the range for which they were designated, in order for data to be considered FRM/FEM. If it is determined that data is valid, but collected when shelter temperature limits are exceeded, data should be flagged with the AQS Quality Assurance Qualifier Code (2 – Operational Deviation). U.S. EPA suggests that shelters be maintained within a standard deviation (SD) of ± 2°C over a 24 hour period. The SD can be assessed using 1-hour shelter temperature estimates.

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 instrument “action level” control limits are exceeded, station operators will begin the process of evaluating the situation and developing appropriate corrective action, document corrective actions taken and if necessary initiate an instrument verification and calibration process. This process is discussed in QAPP section B6.

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 field calibration or audit results that show air monitoring equipment operating outside CARB's control limits or federal requirements, the Quality Management Branch (QMB) will initiate an Air Quality Data Action (AQDA). An ADQA is a request for an investigation of the validity of ambient air quality data for a certain period of time.

In addition to the ADQA 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. Any person working within the CARB PQAO with CARB or the MOs can initiate a CAN. 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.

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 and to report or eliminate those inaccuracies by adjustment.

Prior to implementation of any ambient air monitoring activities, gaseous pollutant monitoring instruments are required to be calibrated by allowing the instrument to sample and analyze test atmospheres of known concentrations of the appropriate pollutants. Once an instrument's calibration relationship is established, periodic calibrations at reasonable frequencies confirm that the instrument remains in calibration. 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 the CARB's air monitoring network, all instruments used in the network must be calibrated:

- During initial field installation and every six months 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 - Gaseous Multi-Point 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 for at least 24 hours 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.

A calibration or verification is performed by generating known amounts of gas using a gas dilution calibrator and or ozone transfer standard to challenge an instrument’s response to the calibration gas. Typically, instrumentation is challenged at zero and a minimum of four (4) upscale points. The output of a gas dilution calibrator/ozone transfer standard is directed into the sampling stream of the instrument (ideally, through the station probe line). The instrument’s response to the calibration gas is compared against the true value generated by the gas dilution calibrator/ozone transfer standard. Calibration points are checked and used to generate a best-fit line. The results of the calibration are compared against calibration acceptance criteria to determine if adjustment is warranted. If an adjustment is made then another calibration verification is performed to verify performance after the adjustment.

The following table lists the frequency and acceptance criteria used to test the performance of gaseous air monitors:

Table B.4 – Gaseous Instrument Calibration Table

Pollutant	**Frequency**	**Acceptance Criteria**
Ozone	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span checks performed biweekly;	0 and 4 upscale points. At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP).

Pollutant	Frequency	Acceptance Criteria
Carbon Monoxide	Upon receipt/adjustment/ repair/installation/moving and repair and recalibration of standard of higher level; Every 182 day and 2/calendar year if manual zero/span checks performed biweekly;	At a minimum, all points <± 2.1% or ≤± 0.030 ppm difference of best-fit straight line whichever is greater and slope 1±.05.* More stringent criteria may be applied (See specific SOP).
Sulfur Dioxide	Upon receipt/adjustment/ repair/installation/moving; Every 182 day and 2/calendar year if manual zero/span checks performed biweekly;	At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1±.05. More stringent criteria may be applied (See specific SOP).
Nitrogen Dioxide	Upon receipt/adjustment/ repair/installation/moving; Every 182 day and 2/calendar year if manual zero/span checks performed biweekly;	At a minimum, all points <± 2.1% or ≤± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1±.05.* More stringent criteria may be applied (See specific SOP).

If an independent check indicates that the criteria has been exceeded, corrective action including adjustment and recalibration will occur as soon as possible, but not to exceed 10 days from determination. No data will be invalidated unless the observed difference is greater than 7.1% for ozone, 10.1% for CO and SO2, and 15.1% for NO2.

Calibrations are typically performed by designated staff that are separate from those responsible for daily site operations, if possible. Calibrations must be performed using equipment and standards separate from those used by site operators for performing routine QC checks.

B6.2 – Gaseous Multi–Point Calibration Equipment and Standards

The calibration equipment and 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 an NIST SRM or a U.S. EPA/NIST-approved Certified Reference Material (CRM).

The following tables outline the frequency and acceptance criteria for verifications of calibration equipment used to calibrate the gaseous air monitors:

Table B.5 – Calibration Equipment Acceptance Criteria

Calibration Equipment or Standard	**Frequency**	**Acceptance Criteria**
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	**O3, NO/NO2, SO2:** < 1 ppb; **CO**: < 10 ppb
Ozone Level 1 Transfer Standard: Certification (Re-Verification) to Standard Reference Photometer	Every 365 days and 1/calendar year	Regression slope = 1.0 ± 0.01; Intercept ≤ ± 1.0 ppb; Single Point Difference < ± 3.1 %
Ozone Level 2 Transfer Standard: Qualification	Upon Receipt of transfer standard	±4.1 % or ±4 ppb (whichever greater)
Ozone Level 2 Transfer Standard: Certification (Verification)	After qualification and upon receipt/adjustment/repair	6 tests on 6 different days; Slope w/in 3% of 1; Intercept 0 ± 3 ppb; R2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5 %
Ozone Level 2 Transfer Standard: Certification (Re-Verification)	Every 365 days and 1/calendar year	3 tests on same or different days; Slope w/in 3% of 1; Intercept 0 ± 3 ppb; R2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5; Slope shift from previous cert. < 1.0 %
Ozone Level 3 and greater Transfer Standard: Qualification	Upon Receipt of transfer standard	± 4.1 % or ± 4 ppb (whichever greater)
Ozone Level 3 and greater Transfer Standard: Certification (Verification)	After qualification and upon receipt/adjustment/repair	6 tests on 6 different days; Slope w/in 5% of 1; Intercept 0 ± 3 ppb; R2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5 %
Ozone Level 3 and great are Transfer Standard: Certification (Re-Verification)	Beginning and end of O3 season or every 182 days or 2/calendar year whichever less	1 test; Slope w/in 5% of 1; Intercept 0 ± 3 ppb; R2 =0.9999 or better; RSD of six slopes < 1.5 %; FRSD of six intercepts < 0.5; Slope shift from previous cert. < 1.0 %
Gas Dilution Systems	Every 365 days and 1/calendar year or after failure of 1 point QC check or performance evaluation	Accuracy <±2.1 %

Table B.6 – Gaseous Standard Acceptance Criteria

Calibration Equipment or Standard	Frequency	Acceptance Criteria
Gaseous Standards	All Gas Cylinders	**CO, SO2, NO2**: NIST Traceable; 50-100 ppm of NO in Nitrogen with < 1 ppm NO2. For direct analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; For diluted analysis of CO, NO, SO2: < ± 2% from manufacturer specification RSD < 1% of measure concentrations; Relative expanded uncertainty < 1%

B6.3 - SOP/Document References

CARB has documented calibration activities procedures in each instrument's SOP. The calibration documents applicable to the Gaseous Pollutant Monitoring Program can be found in the Air Monitoring Web Manual at:
https://www.arb.ca.gov/airwebmanual/amwmn.php?c=7

B7 - Instrument/Equipment Testing, Inspection, and Maintenance

CARB uses various types of instruments in support of gaseous 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 deployment to verify that equipment used in the CARB air monitoring network meets purchase specifications. The 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 instrumentation are defined in acceptance test procedures located on CARB's Air Monitoring Web Manual, located at:

https://www.arb.ca.gov/airwebmanual/index.php. 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.

B7.2 - Maintenance

Gaseous monitors used by CARB are designed to operate unattended for long periods of time. However, 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 gaseous monitors are properly operating. Preventative maintenance tasks involve routine service checks (which vary from instrument to instrument) and should be performed at the prescribed intervals listed in each instruments appropriate SOP and/or each instruments operating manual. Preventative maintenance tasks should be documented on the appropriate quality control maintenance sheets **and** the station log book. Clear documentation of instrument maintenance is required to confirm instrumentation operation, to aid in troubleshooting and assist with data validation.

Maintenance procedures specific to CARB operations are listed in detail in the instrument SOPs referenced in Section B2. Further information can be found in each particular instruments' operation manual. Each instrument has a unique maintenance

check sheet for documentation of these activities. These checklists are included in the Air Monitoring Web Manual at: https://www.arb.ca.gov/airwebmanual/index.php .

Although preventive maintenance tasks and frequencies are specific to the monitors make and model, Table B.8 illustrates generic major preventative maintenance tasks and frequencies for gaseous pollutant monitors and supporting equipment used by CARB. In addition, some site operators may find that these tasks need to be performed more frequently.

Table B.7 – Typical Preventative Maintenance Task and Frequency

Pollutant Instrument	Maintenance Activity	Frequency
O3	Change inlet particulate filter	Weekly
	Clean optical chamber	As required
	Adjust or replace photometer lamp	As required
	Replace sintered filter and O-rings	As required
	Rebuild or replace sample pump	As required
	Replace O3 scrubber	As required
NO2	Change inlet particulate filter	Weekly
	Clean reaction cell	As required
	Rebuild or replace sample pump	As required
	Rebuild or replace NOx converter when C.E. <96%	As required
CO	Change inlet particulate filter	Weekly
	Clean optics	As required
	IR source replacement	As required
	Rebuild or replace sample pump	As required
SO2	Change inlet particulate filter	Weekly
	Replace rubber O-ring in glass capillary if deteriorated	Monthly
	Clean cooling fan filter	Semi-annually
	Replace charcoal filter	Annually
	Replace hydrocarbon scrubber	Every 18 months
	Rebuild or replace sample pump	As required
Gas Calibrator	Inspect/replace air and gas lines	Monthly
	Change particulate filter	Annually
Zero Air Generator	Check/adjust pressure; Confirm presence of water in moisture outlet trap	Monthly
	Change activated carbon filter and Purafil filter	Annually

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 max/min supply of frequently used spare parts and consumable materials through our Monitoring and Laboratory Divisions' (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 inspection, acceptance, 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.

Many of the items purchased by MLD are purchased under 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 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 for the operation by the Operation and Data Support Section.

MLD maintains a supply of certified gases for performance evaluations and equipment verification. These gases are supplied and certified by the vendor in accordance with Procedure G1 of the U.S. EPA Traceability Protocol (EPA-600/R-97/121 Titled: U.S. EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, September 1997). Gas cylinder information, including bottle number, gas composition and concentration, certification expiration date, and location are entered into MLD's cylinder database. This database is maintained by the Administrative Section. Upon request of a new gas standard, the staff in MLD's Standards Lab will make a comparison of the new standard against its assigned value.

B9 - Data Management

Air quality data measured by continuous gaseous analyzers in CARB's ambient air quality network are captured by CARB's data acquisition and management system. In this section, we will describe the functions and security of the CARB system 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. This includes the processes for data acquisition, management, review, and validation, data security, and data 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.

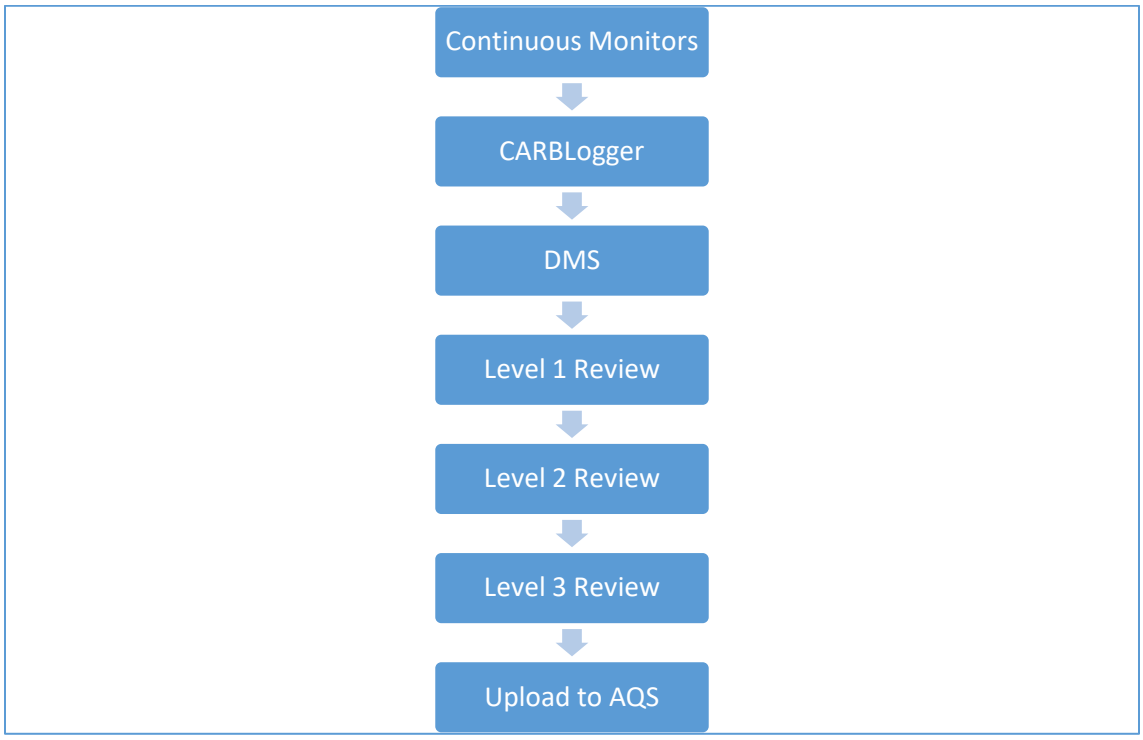
Before a new data collection/management system becomes operational, extensive QA testing will be conducted to ensure that the new and old systems produce equivalent data sets and that the data is accurate and meets programmatic requirements. This process involves collaboration with the software designer 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).

CARB's data acquisition/management system 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.

Below is a flow chart of the CARB data management process:

Figure B.1 – Data Flow Process



B9.1 - CARBLogger

Gaseous 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.

B9.2 - 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, perform 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 the U.S.EPA's AirNow System and the 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 the 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 in the Air Monitoring Web Manual: https://www.arb.ca.gov/airwebmanual/amwmn.php?c=6 . A more in-depth description of these review steps is also found in section C2 of this document.

B9.3 - 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 the 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 systems 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. 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.

B9.4 - 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, the Operations and Data Support Section (ODSS) creates a nightly backup of DMS and stores this information on a SAN Drive within CARB HQ.

Section B10 - Non-Direct Measurements

B10.1 – Site Determination Data

Any non-agency data utilized for decision making must meet the highest quality controls. 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 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 ozone 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 the 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.

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.

Gaseous 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 are detailed in SOP 610, Data Review and Validation. This document can be located at: https://arb.ca.gov/aaqm/qa/pqao/repository/table_6.htm. In all cases, data validation procedures should be documented, and a record provided to the entity responsible for upload of data to AQS. MOs 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 daily and seasonal concentration variations associated with gaseous pollutants
- 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 gaseous parameter to another

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

- Daily review of zero/span and precision 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

Section C2 - Verification and Validation Methods

CARB has a three level process which incorporates the concept of review, verification, and validation. The following is a summary of the process, review levels and staff positions typically responsible for the review of the gaseous 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://arb.ca.gov/aaqm/qa/pqao/repository/table_6.htm . CARB PQAO districts are expected to have similar multi-level data review procedures.

C2.1 – 1St Level Review

The 1st level review process is performed by the station operator. Station operators should review minute 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, 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 calibration control chart for each gaseous parameter, a 'Monthly Quality Maintenance Checklist', a copy of the station logbook, and a 'Data Capture report.'

C2.2 – 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 a manager 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 the monthly exceedance report, monthly maintenance checksheets, DMS control charts, 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. This will at a minimum include all 72 hour background checks and any other interruptions of data which are at least 48 consecutive hours in duration.

C2.3 – 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.

C2.4 – 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 (ie. 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. Follow up by reviewing the Monthly Calibration Control Chart webpage to confirm that the edits were incorporated into DMS.

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

A Data Correction Memo is typically used 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.

C2.5 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's Air Quality and Analysis Section is responsible for submitting a data certification package to U.S. EPA Region IX 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 Region IX. 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, http://www.arb.ca.gov/aaqm/qa/qa.htm, 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, QAS 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. QAS 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.

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

D1.2 - Monitoring Station 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 and has been designated as equivalent to the National Performance Audit Program (NPAP). 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.

Annually, QAS conducts through-the-probe (TTP) audits for all continuous gaseous analyzers in the CARB PQAO monitoring network. Additionally, QAS performs TTP gaseous audits of at least 20% of the monitoring sites in the other PQAOs in California on an annual basis to meet NPAP requirements. TTP audits of the gaseous analyzers, which monitor for carbon monoxide, nitrogen dioxide, hydrogen sulfide, sulfur dioxide, and ozone, are conducted in accordance with U.S. EPA requirements (Title 40, CFR, Part 58, Appendix A). These TTP audits meet the requirements of both annual performance evaluation (PE) and the NPAP. These audits verify the accuracy of the gaseous analyzers and ensure the integrity of the entire sampling system. For most TTP audits, an audit van is transported by QAS to the ambient air monitoring station. Audit vans house the necessary instrumentation and equipment to allow the audit to be conducted at the same condition as the station instruments. TTP audits are conducted via the introduction of NIST traceable gases from the van into the station sampling probe inlet at various concentrations. QAS compares the measurement from the station analyzer to the known values generated in the van.

TTP audit methodology can identify deficiencies caused by poor analyzer response, pollutant scavenging contaminants, and sampling system leaks. Deficiencies like these can cause the gaseous analyzers to fail an audit and possibly affect the quality of the ambient air data. An integral part of a performance audit is conducting a siting evaluation. Stations that meet siting criteria at the time of initial setup may no longer conform due to updated regulations or changes in surrounding conditions and land use. Physical measurements and observations are noted on the site survey or accompanying documentation to determine compliance with 40 CFR Part 58, Appendix E requirements. Many of the siting issues result from the growth of vegetation. Site drawings are prepared to depict the height of and spacing between probe and sampler inlets, and distances from surrounding obstacles and vegetation. The height of any obstacles and vegetation above inlets is also determined. QAS will document situations where audit, quality control, or siting criteria are not met through the Air Quality Data Request (AQDA) or Corrective Action Notification (CAN) process.

The Performance Audit Report will note, in the audit data and comments section, any parameter that exceeds the audit warning limit. An AQDA will be issued for any parameter that exceeds the audit control limit. These situations should be evaluated and corrective action taken to address the issue, as appropriate. Below is a summary table of performance and siting audit acceptance criteria and frequencies:

Table D.1 - Audit Acceptance Criteria

Requirement	Frequency	Acceptance Criteria
Annual Performance Evaluations (PE) - Ozone	Every monitor 1/calendar year for CARB PQAO	Audit levels 3-10: ±10% control limit; ±7% warning; Audit levels 1&2: ± 1.5 ppb difference or ±15% difference, whichever is greater
National Performance Audit Program (NPAP) - Ozone	20% of CA monitors outside CARB PQAO audited in calendar year	Audit levels 1&2: ± 1.5 ppb difference or ±10.1 % difference, whichever is greater
Annual Performance Evaluations (PE) & National Performance Audit Program (NPAP) - Carbon Monoxide	Every monitor 1/calendar year for CARB PQAO; An additional 20% of CA monitors outside CARB PQAO audited in calendar year	U.S. EPA Audit levels 3-10: ±15% control limit; ±10% warning; U.S. EPA Audit levels 1&2: ± 0.03 ppm difference or ±15% difference, whichever is greater
Annual Performance Evaluations (PE) & National Performance Audit Program (NPAP) - Nitrogen Dioxide, Sulfur Dioxide	Every monitor 1/calendar year for CARB PQAO; An additional 20% of CA monitors outside CARB PQAO audited in calendar year	U.S. EPA Audit levels 3-10: ±15% control limit; ±10% warning; U.S. EPA Audit levels 1&2: ± 1.5 ppb difference or ±15% difference, whichever is greater
Sample Residence Time Verification	Verified 1/year; Recalculated 1/2years	< 20 seconds
Sample Probe, Inlet, Sampling Train	All Sites	Borosilicate glass (e.g., Pyrex®) or Teflon®
Siting	Verified 1/year; Recalculated 1/2years	Meets CFR siting criteria or waiver documented
Compressed Gases	1/year	The High CO, Low CO, and Super Blend (SB) cylinders are certified on an annual basis in accordance with the U.S. EPA National Performance Audit Program requirement. SB cylinders are certified in accordance with manufacturer recommendations

Table D.2 – Audit Standard Acceptance Criteria

Calibration Equipment or Standard	Frequency	Acceptance Criteria
Audit Van Ozone Analyzer and Transfer Standard	Quarterly	CARB Standards Laboratory re-certifies the UV Photometer against a Standard Reference Photometer; Slope and intercept derived from recertification are used in calculation of audit van "True" O3 values.
Audit Van Compressed Gases (High and Low CO, Superblend)	Annually	In accordance with the U.S. EPA National Performance Audit Program requirement; Superblend cylinders are certified in accordance with manufacturer recommendations.

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. A diagram of the audit van system can be found in appendix D.1.

D1.3 - Technical System 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 Handbook, Volume II. TSAs are conducted in three phases:

The first phase consists of a questionnaire derived from U.S. EPA's, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Appendix H, 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: http://www.arb.ca.gov/qaweb/sitelist_create.php. This web page provides the map location, latitude and longitude coordinates, site photos, 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: http://inside.arb.ca.gov/wg/mld/ais/login_2.php. Monitoring organizations are provided access to AIS generated audit 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 audit acceptance criteria or a critical criteria (QA Handbook Volume II, Appendix D), an Air Quality Data Action (AQDA) request is issued to the facility operator.

An Air Quality Data Action (AQDA) is a request for an investigation of the validity of ambient air quality data for a certain period of time. AQDAs are generally issued by QMB staff based upon review of field calibrations or audit results that show air monitoring equipment operating outside CARB's control limits or not meeting appropriate siting conditions. 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 and resolved to bring the parameter in question into compliance. The station operator 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 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 Corrective Action Notification (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 the QMB for review. Once the QMB and 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 the QMB to the responsible organization.

The QMB will maintain a database that tracks the CAN process and helps identify trends and possible systemic issues. The 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 gaseous 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 generated by QMS provides a summary of the quality of ambient data in quantifiable terms. The report presents an overview of various QA/QC activities. 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 primary 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 http://www.arb.ca.gov/aaqm/qa/dqreports/dqreports.htm.

As required by 40 CFR, Part 58, Appendix A, data and information reported to U.S EPA's Air Quality System (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. QMS 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 Monitoring Network Report

The Annual Monitoring Network Report describes the network of ambient air monitors operated by air monitoring organizations in more than 20 counties in California. Some larger districts in CARB's QAO generate their own report. 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. 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 http://www.arb.ca.gov/aqd/amnr/amnr.htm.

D2.3 - Annual Certification Letter and Summary Report

CARB's 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) 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 the 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 of the DQO's 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 objectives and population scales are reviewed.

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

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.

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 N1ST.

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 pollutants.

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.

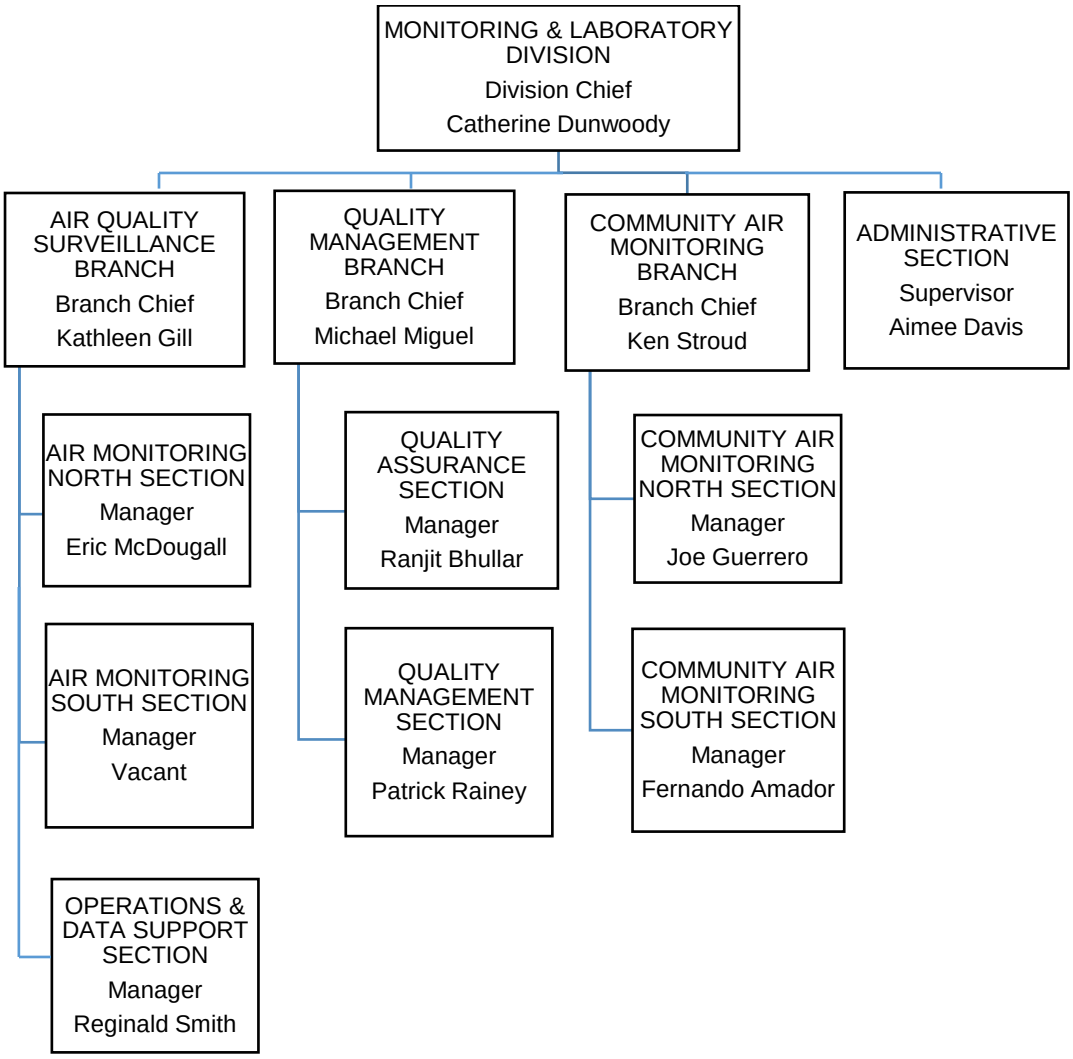
This document outlining the roles and responsibilities of the ARB branches can be found at https://www.arb.ca.gov/aaqm/qa/pqao/repository/qm_docs.htm.

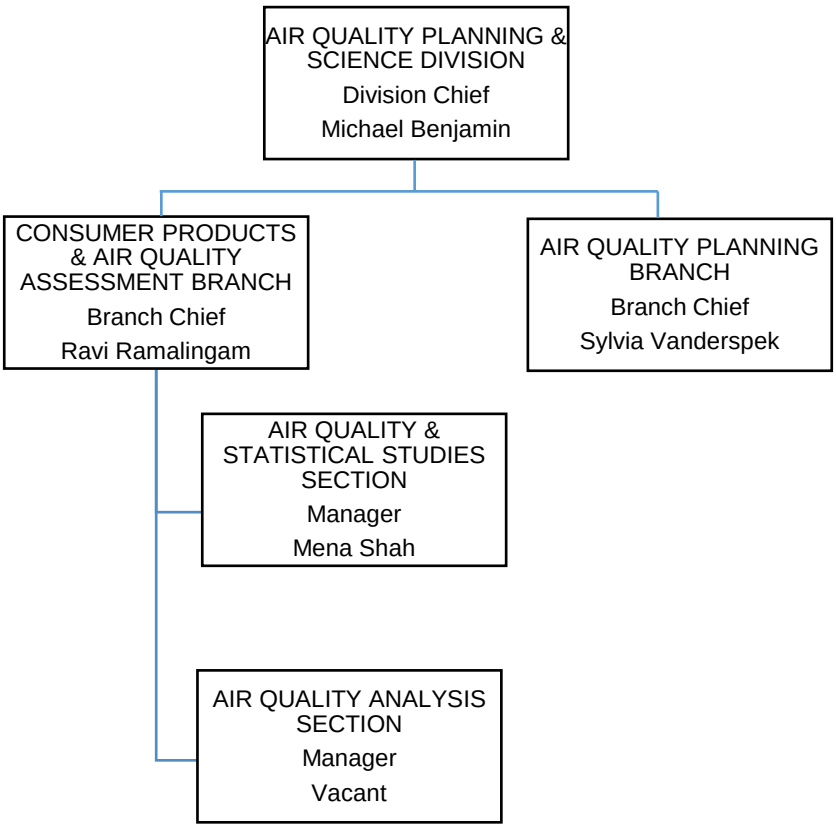
Appendix A.2

CARB Organization Chart

CARB Organization Chart

Note: Chart only lists Divisions and Sections with responsibilities included in the Gaseous 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
AIR QUALITY ANALYSIS SECTION
Manager
Vacant

Appendix A.3

Example Document: ‘Protocol for the Ambient Air Monitoring Project A’

California Environmental Protection Agency
AIR RESOURCES BOARD

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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APPENDIX E: CANISTER TRACKING SHEET

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

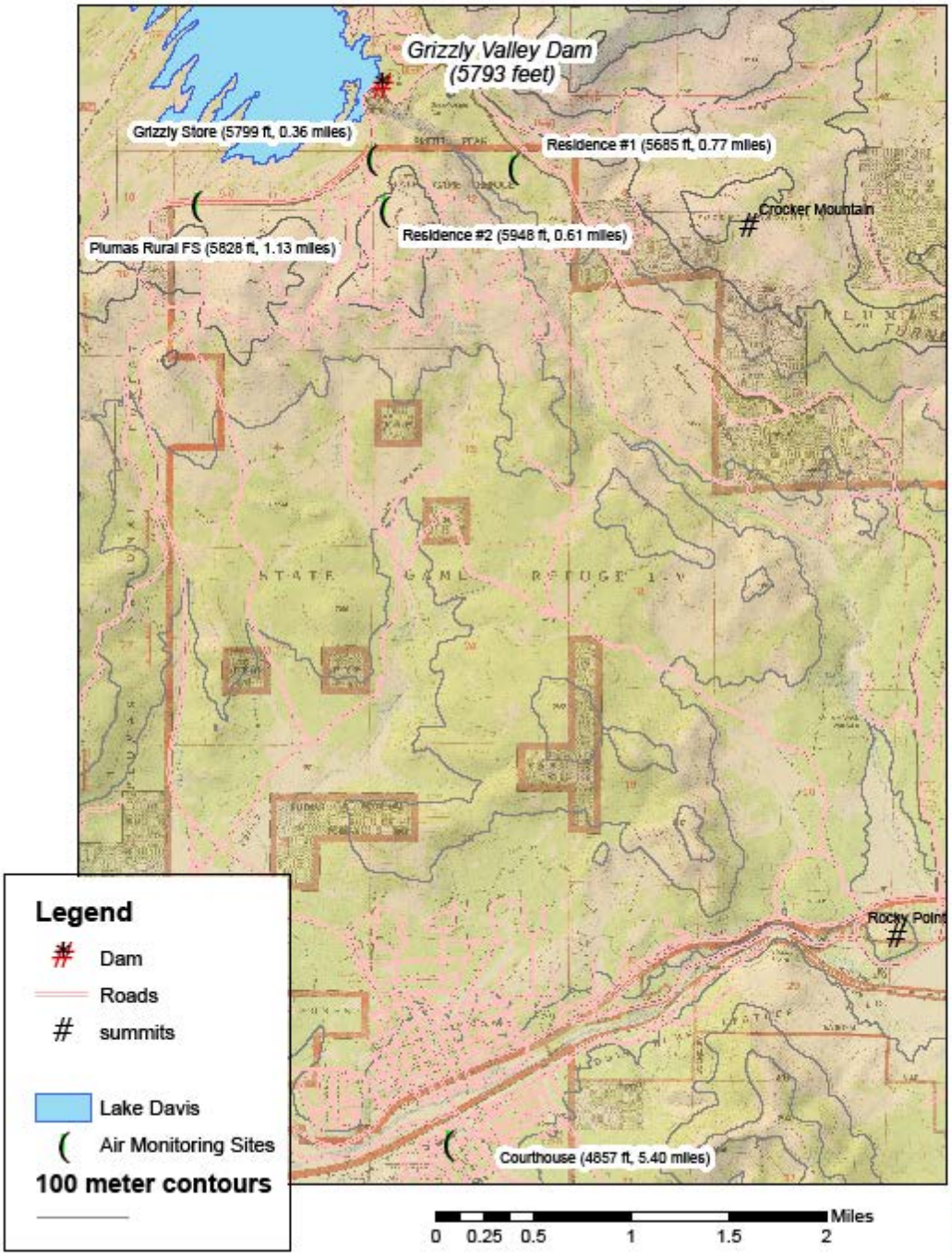
Site 5
Address

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

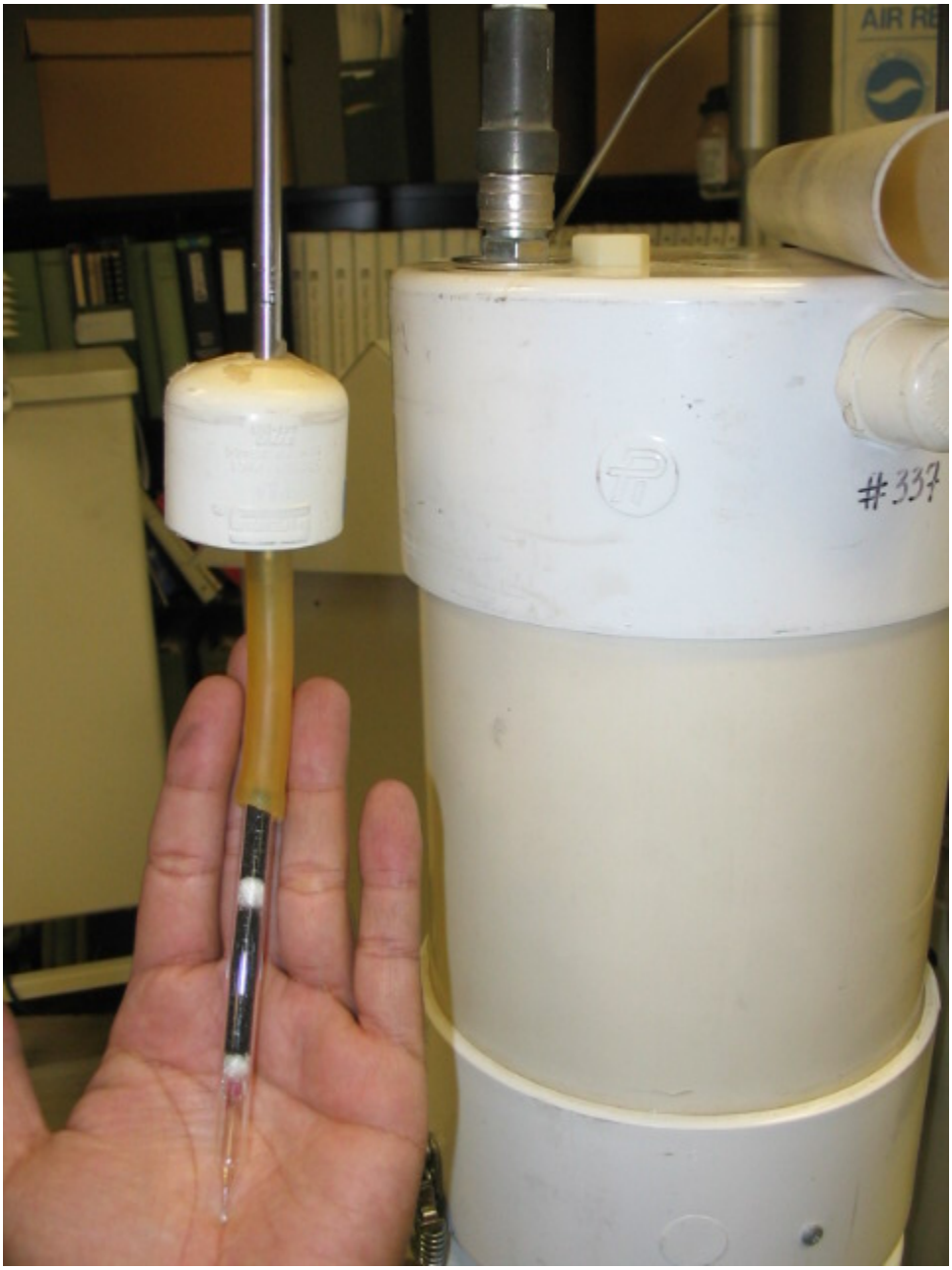


FIGURE 4: MINI-VOL WITH ACTIVATED CARBON TUBE

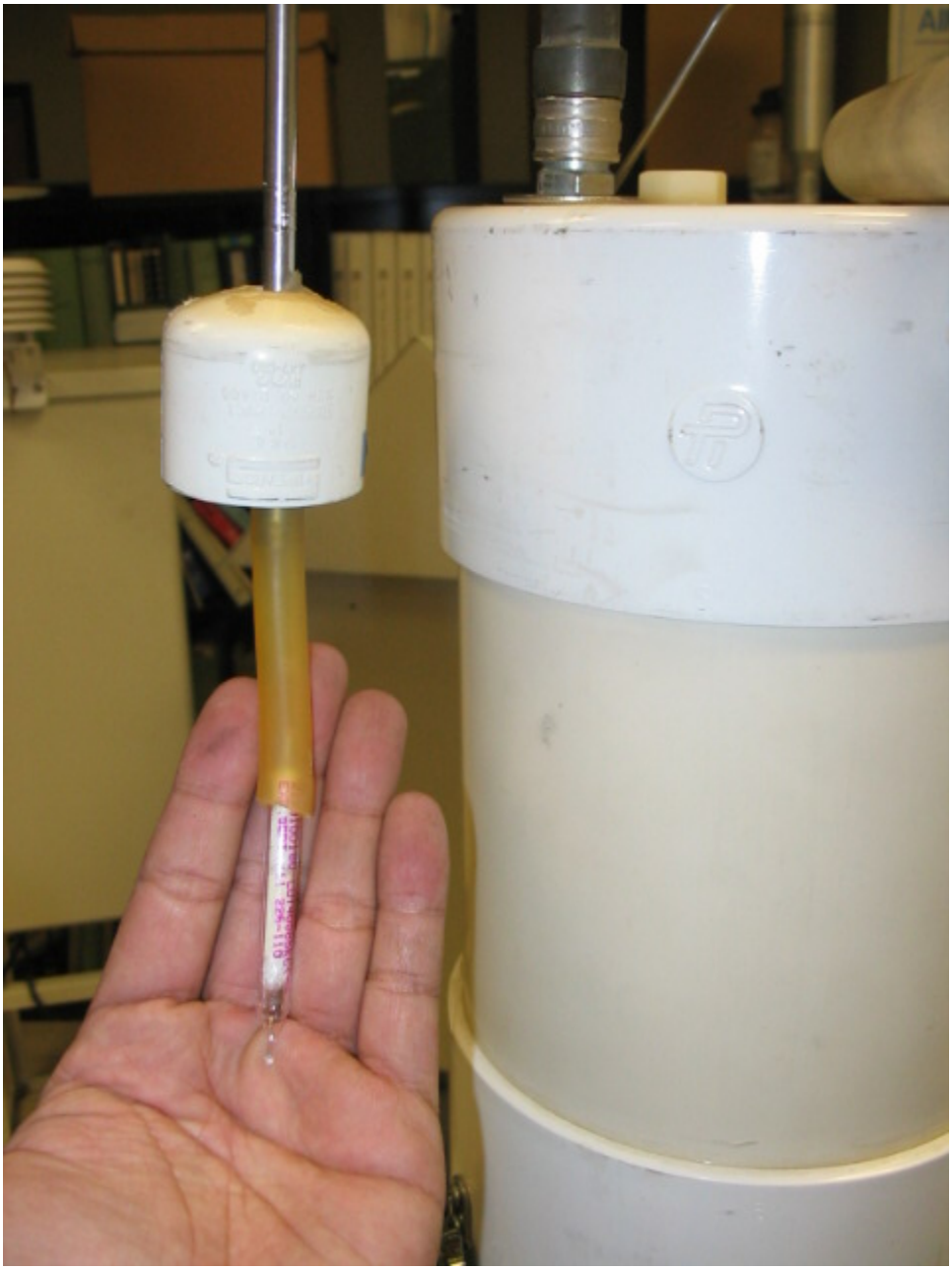


FIGURE 5: MINI-VOL WITH CHROMOSORB TUBE

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	
	ID	Entry Example (6/14/07 13:42)		Display		Meter Display		Average	Commer
lame	Number	Start	End	Start	End	Start	End	Flow	Numbe
M Used #:		Slope:		Intrcpt:					

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy

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

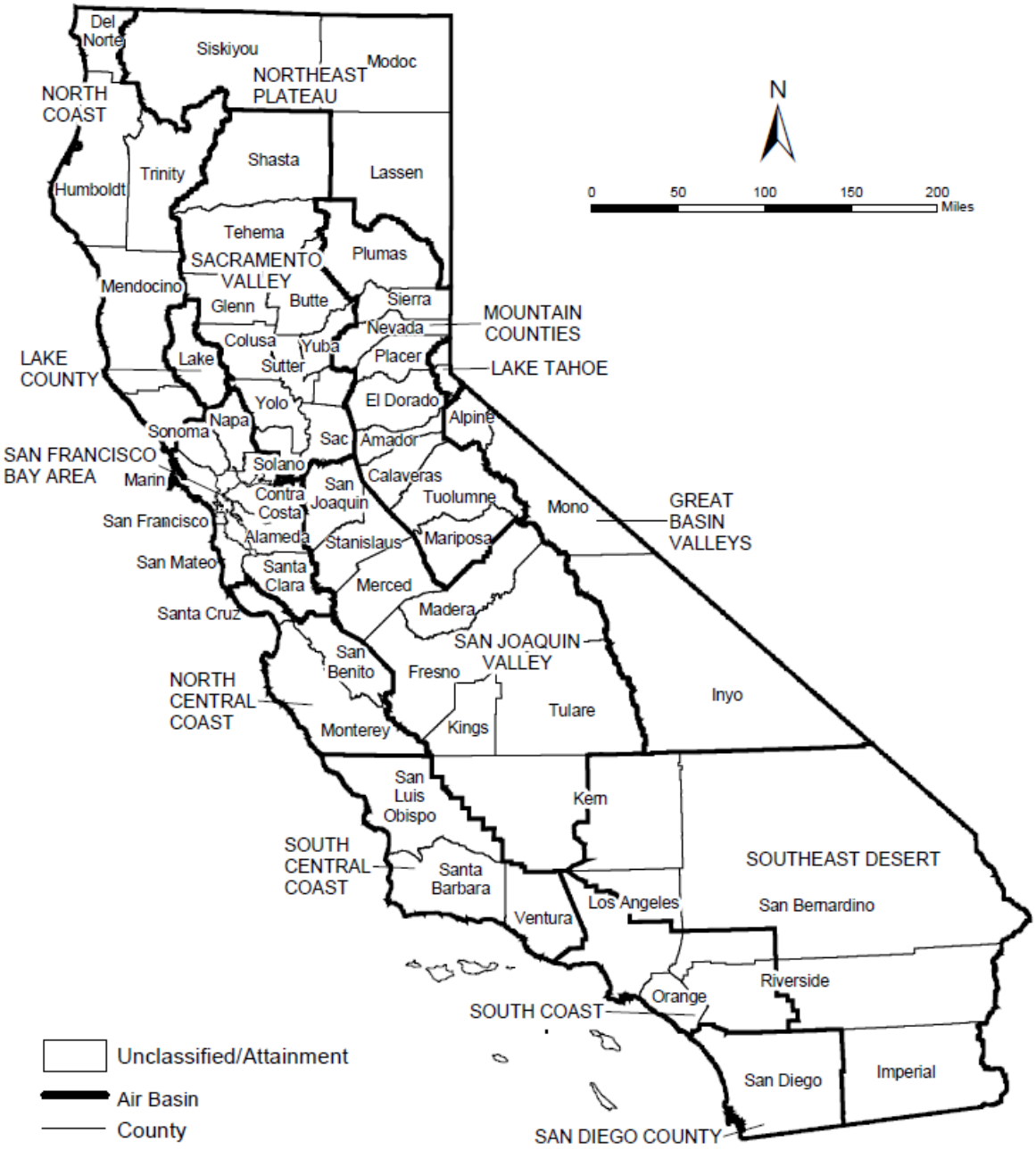
Within 30 days from the last day of analysis, the NLB will provide SPM with a report that will include the following topics:

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

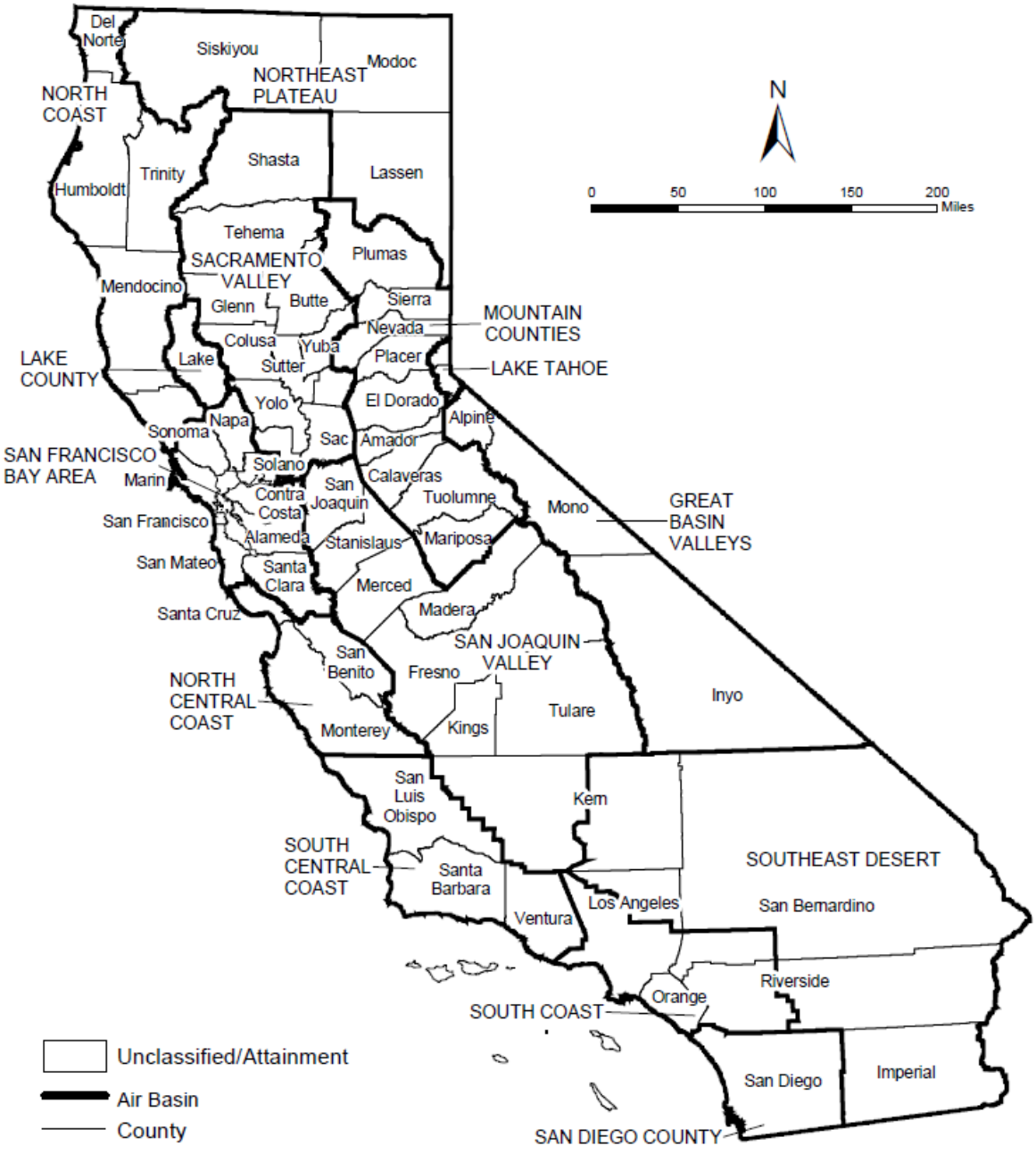
State and Federal Designation Maps

Area Designations for National Ambient Air Quality Standards: Carbon Monoxide



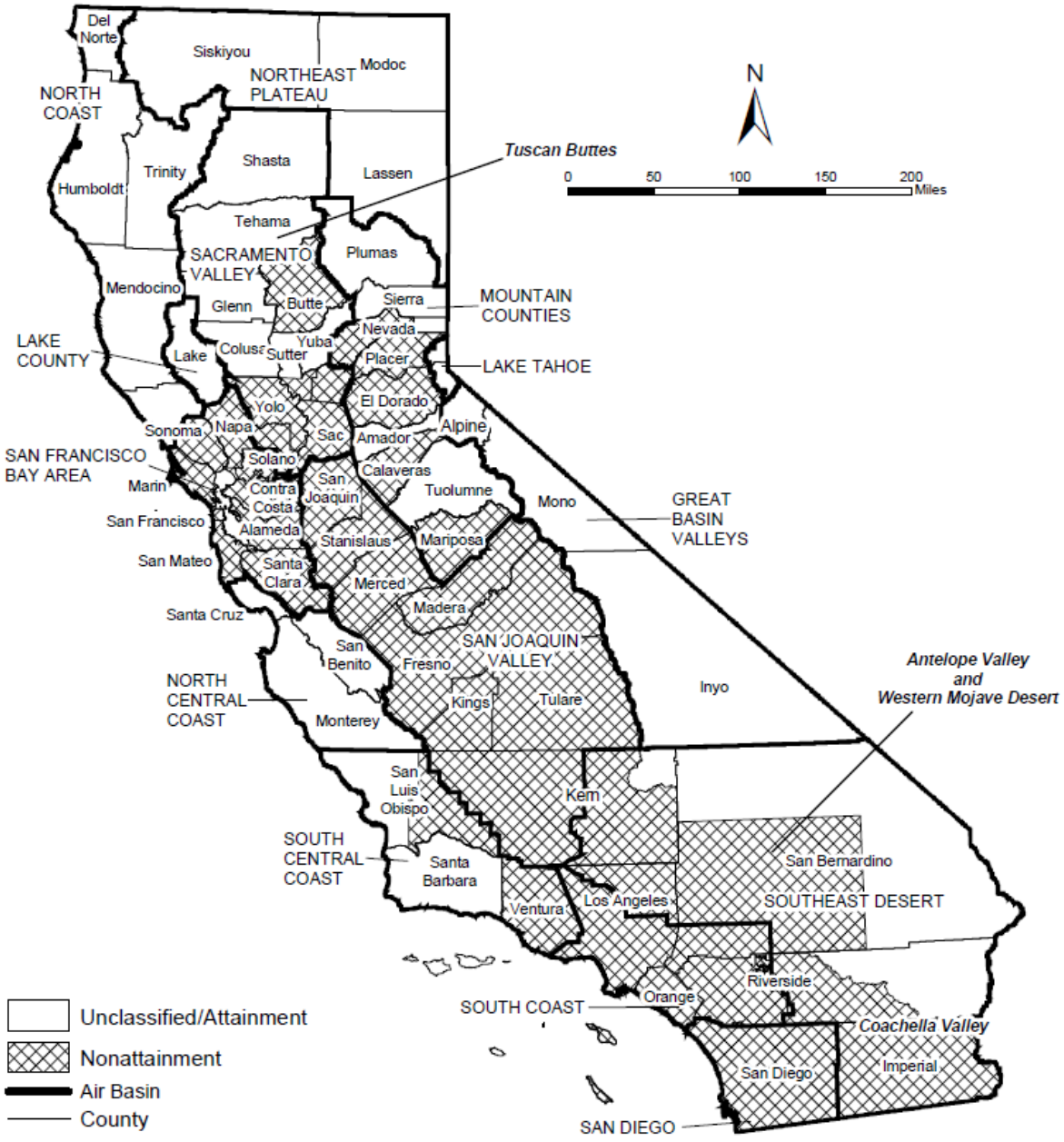
Last Reviewed: December 2015

Area Designations for National Ambient Air Quality Standards: Nitrogen Dioxide



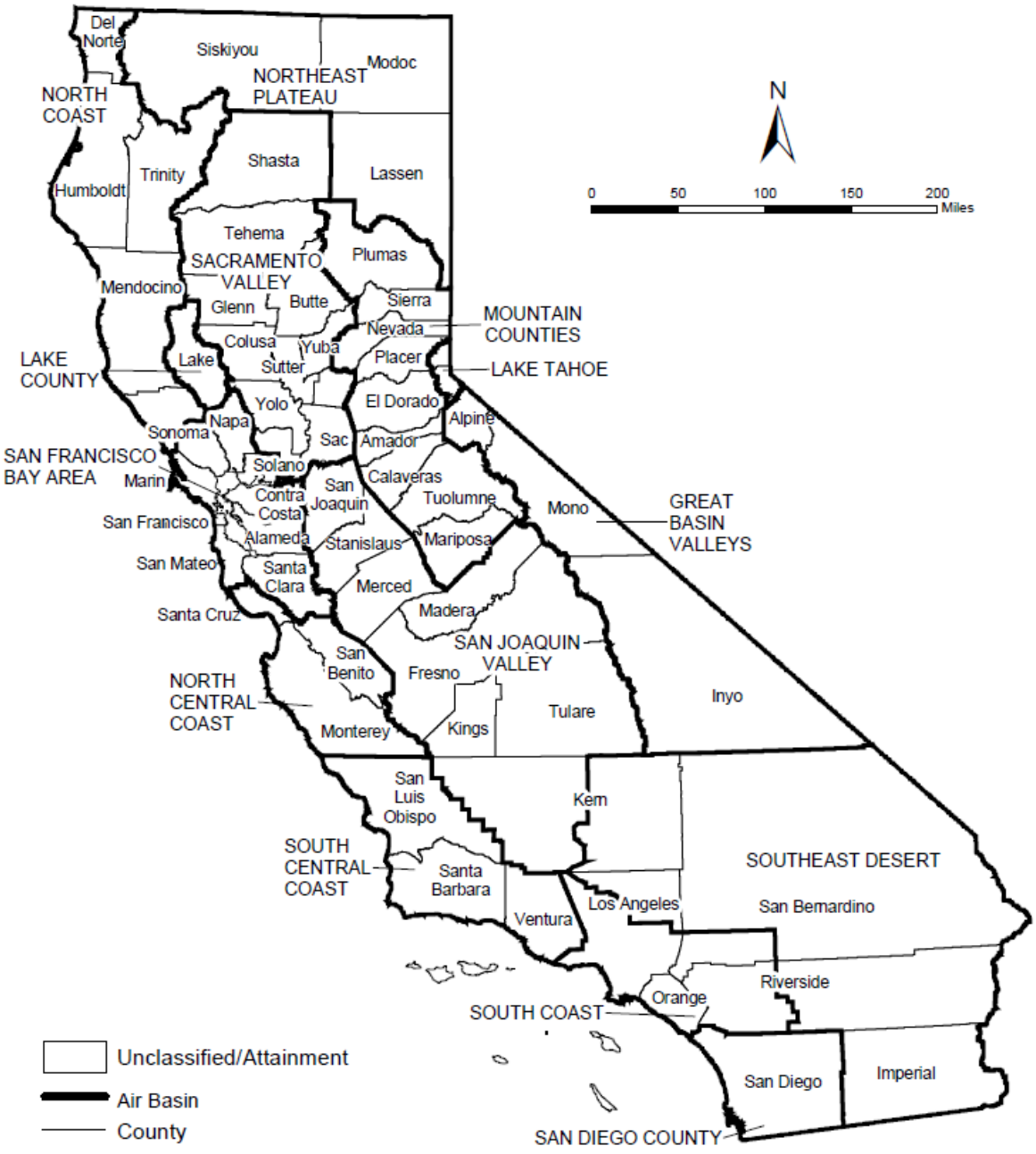
Last Reviewed: December 2015

Area Designations for National Ambient Air Quality Standards: 8-Hr Ozone



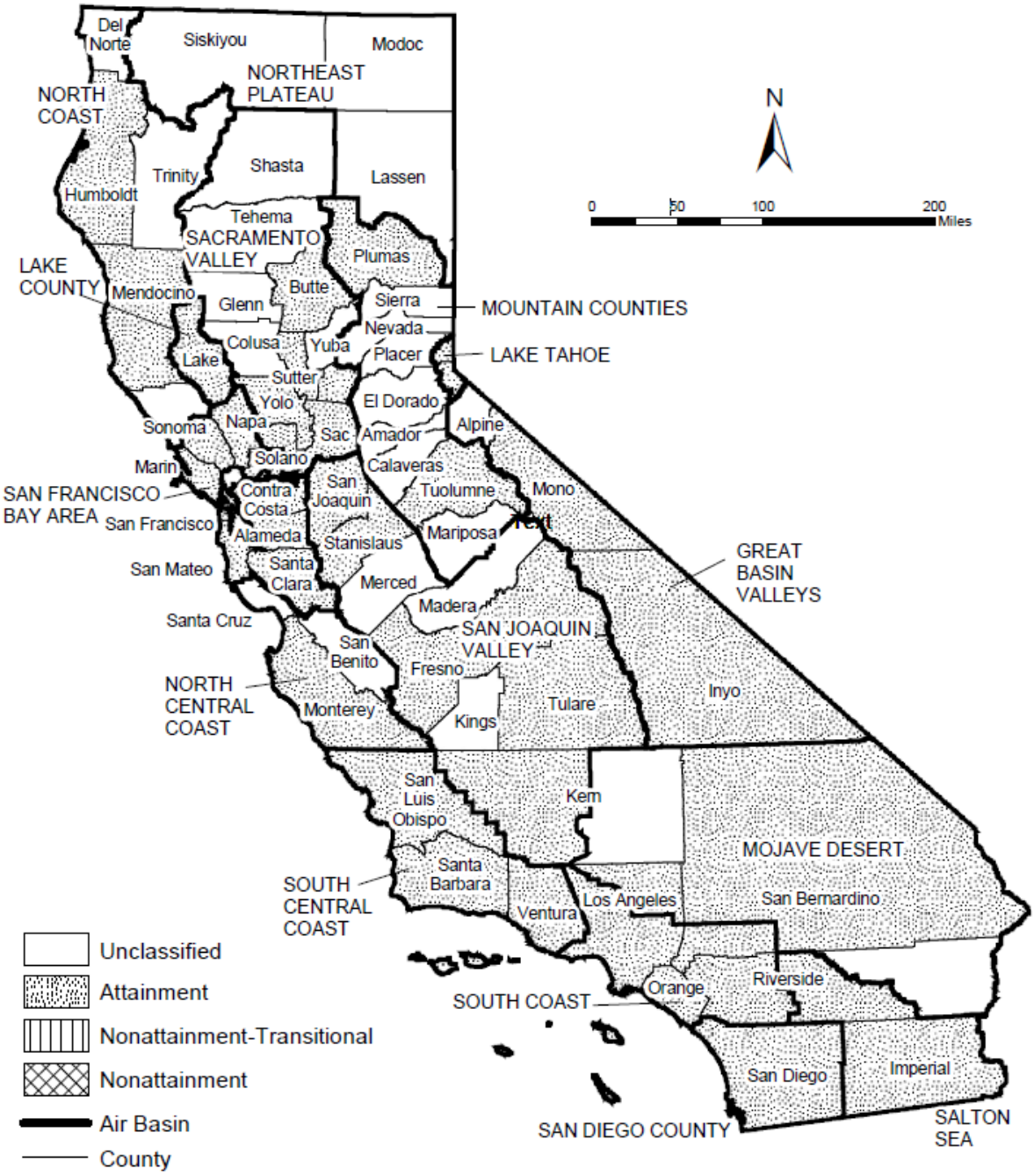
Last Reviewed: December 2015

Area Designations for National Ambient Air Quality Standards: Sulfur Dioxide



Last Reviewed: December 2015

Area Designations for State Ambient Air Quality Standards: Carbon Monoxide

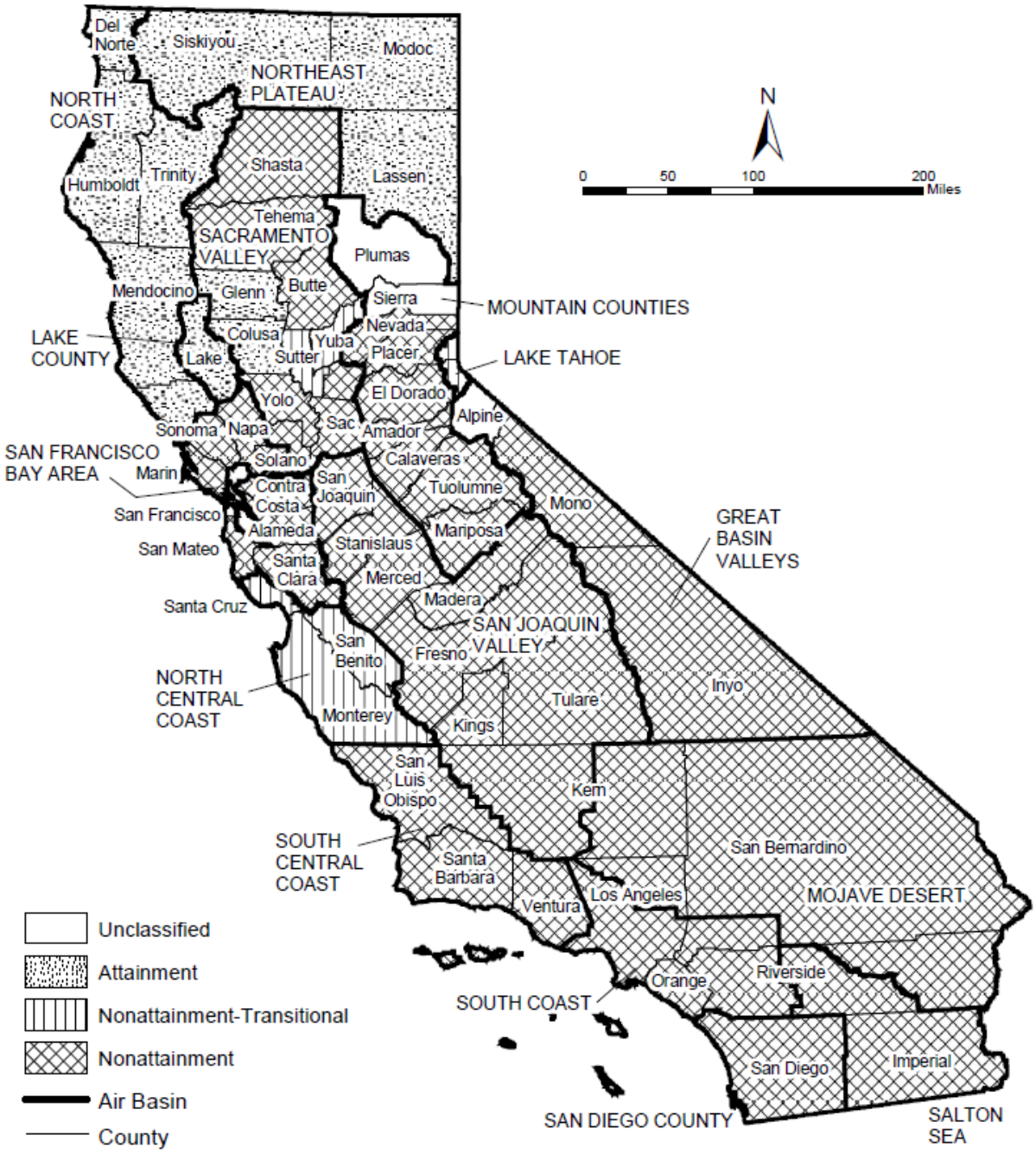


Last Reviewed: December 2015

Area Designations for State Ambient Air Quality Standards: Nitrogen Dioxide

Last Reviewed: December 2015

Area Designations for State Ambient Air Quality Standards: Ozone



Last Reviewed: December 2015

Area Designations for State Ambient Air Quality Standards: Sulfur Dioxide

Last Reviewed: December 2015

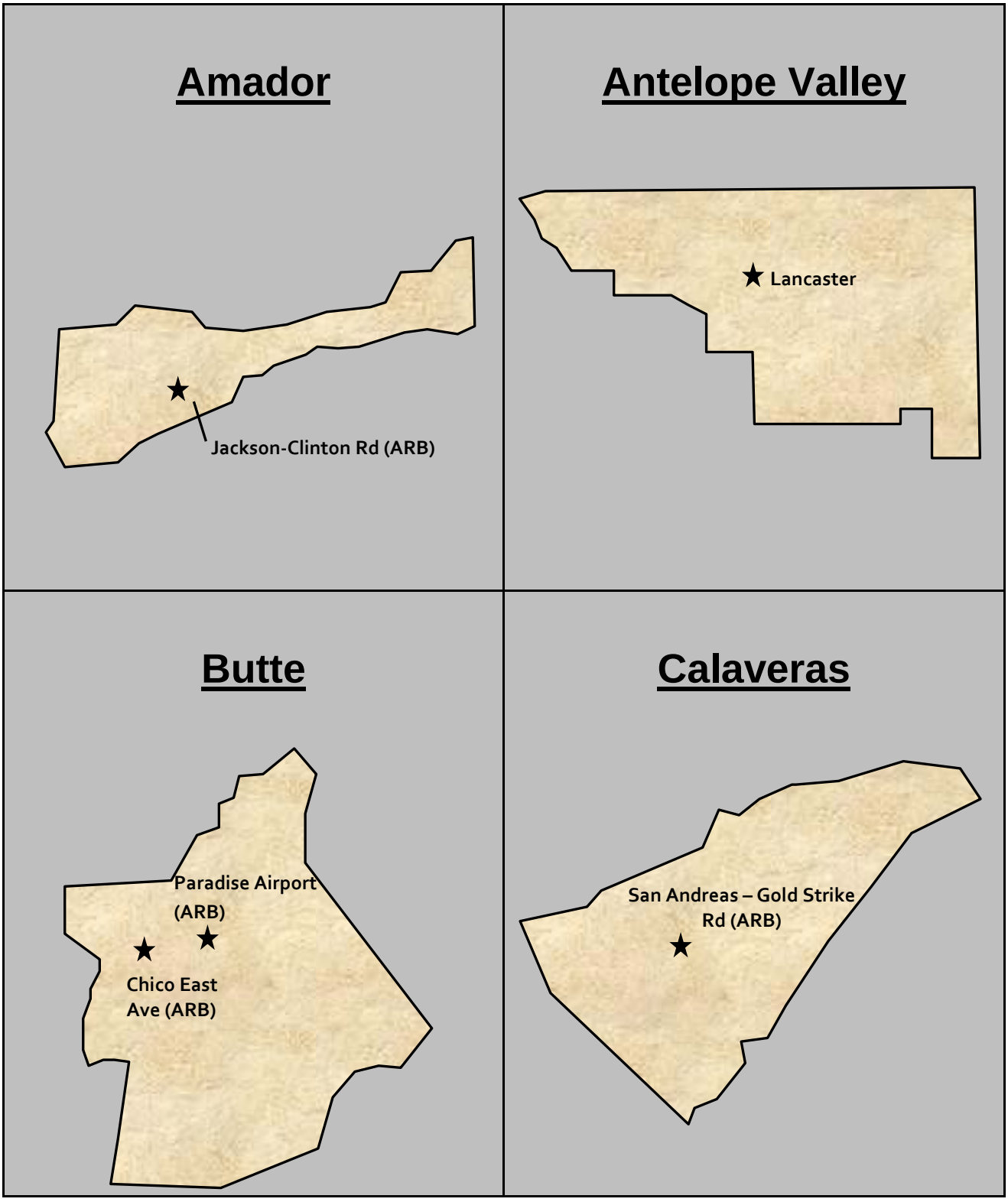
Appendix A.5

PQAO Monitoring Organization Map

ARB PQAO Monitoring Organization Map

Appendix A.6

Gaseous Air Monitoring Site Distribution Maps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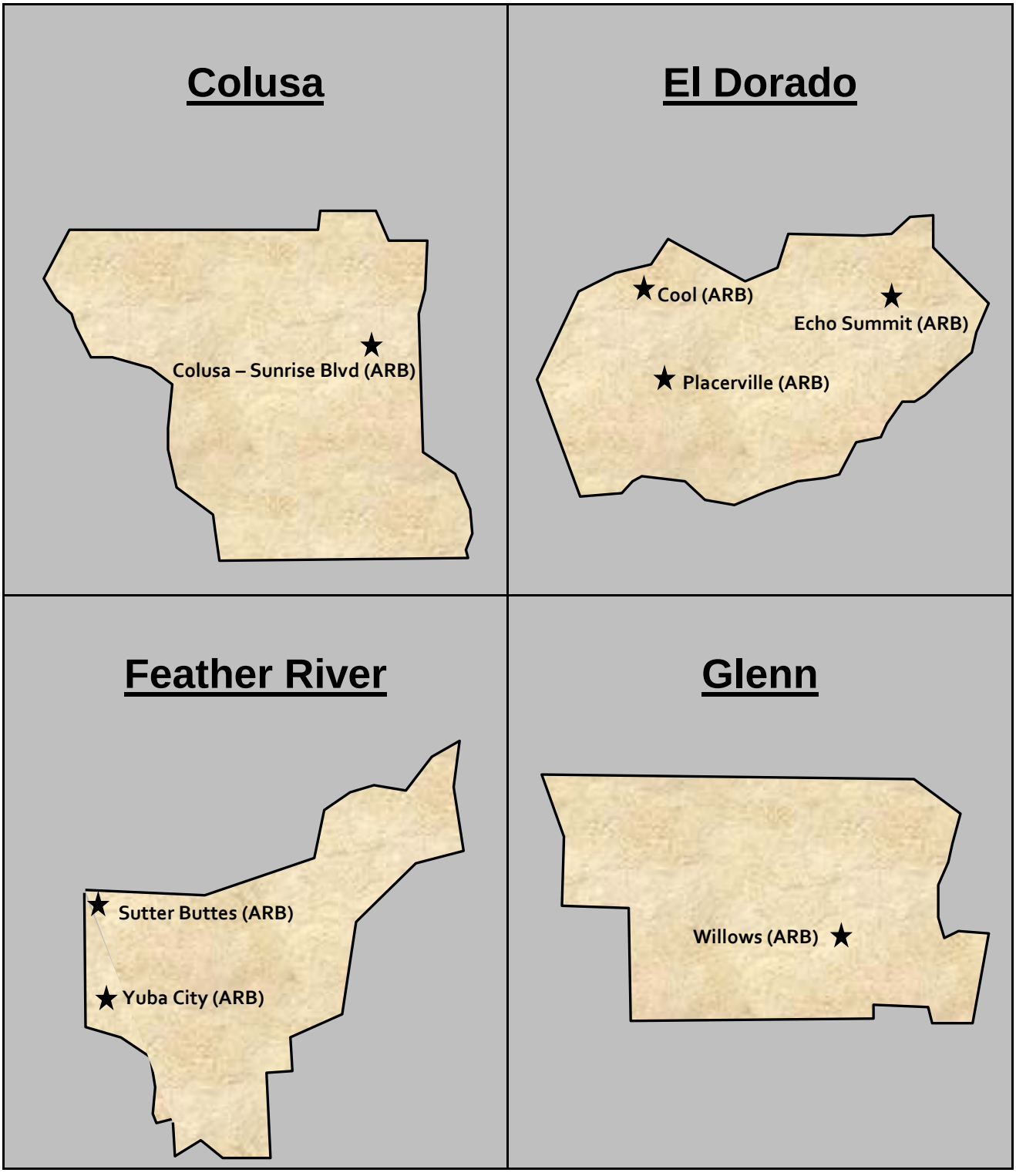
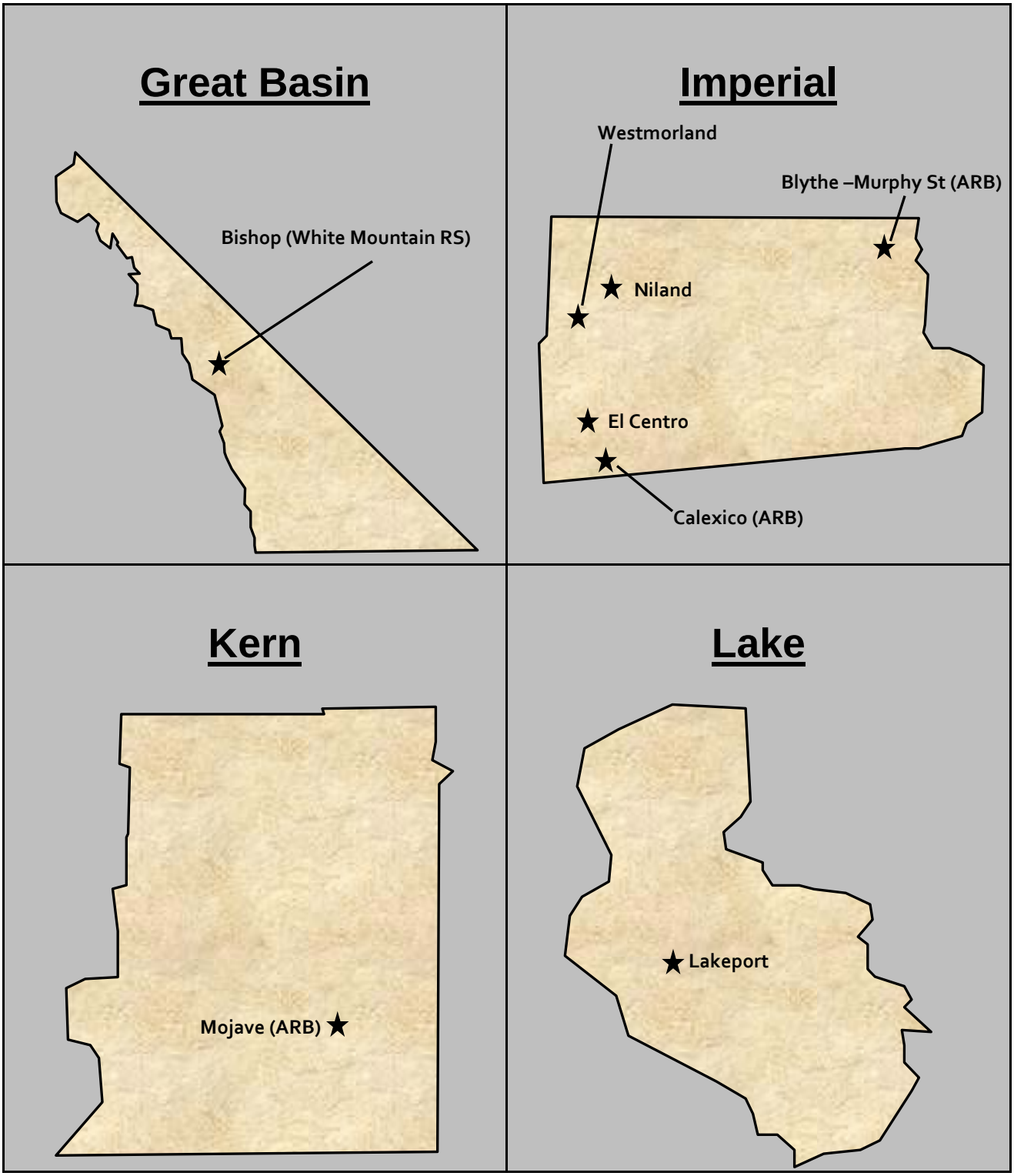
Lancaster
Butte
Paradise Airport (ARB)
Chico East Ave (ARB)
Calaveras
San Andreas – Gold Strike Rd (ARB)


Colusa
Colusa – Sunrise Blvd (ARB)
El Dorado
Cool (ARB)
Echo Summit (ARB)
Placerville (ARB)
Feather River
Sutter Buttes (ARB)
Yuba City (ARB)
Glenn
Willows (ARB)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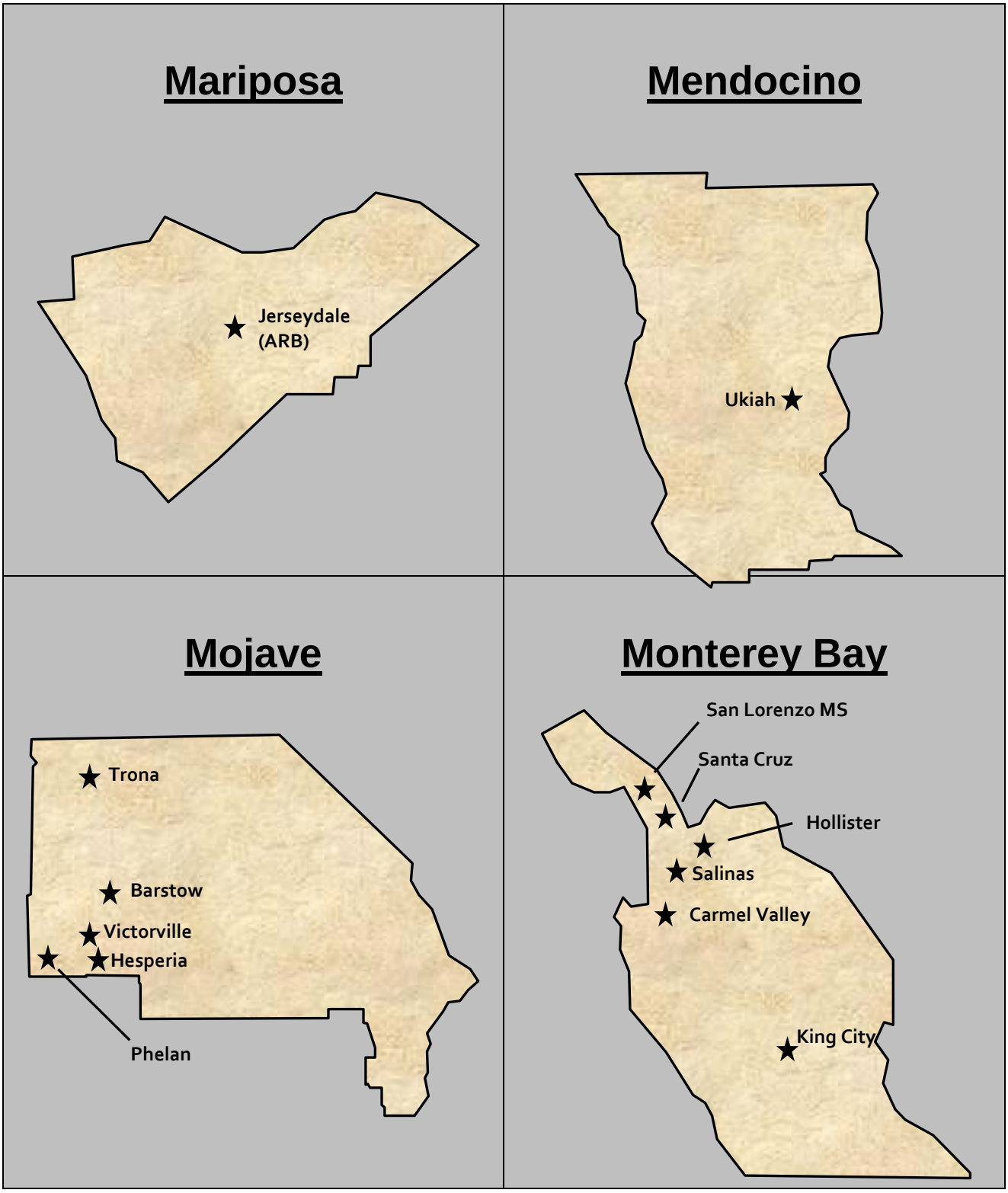
Imperial
Westmorland
Blythe –Murphy St (ARB)
Niland
El Centro
Calexico (ARB)
Kern
Mojave (ARB)
Lake
Lakeport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Jerseydale
(ARB)
Mendocino
Ukiah
Mojave
Trona
Barstow
Victorville
Hesperia
Phelan
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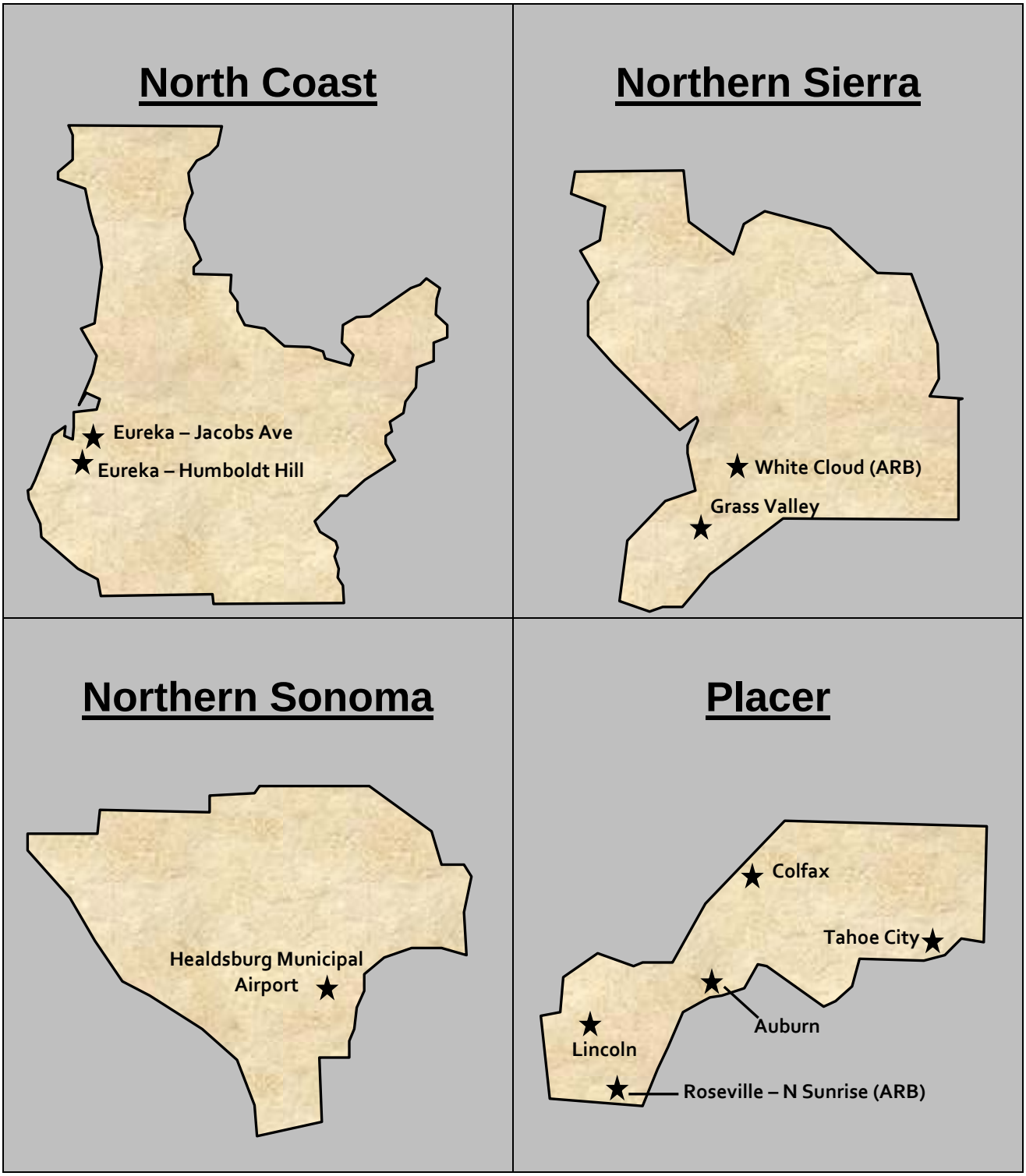
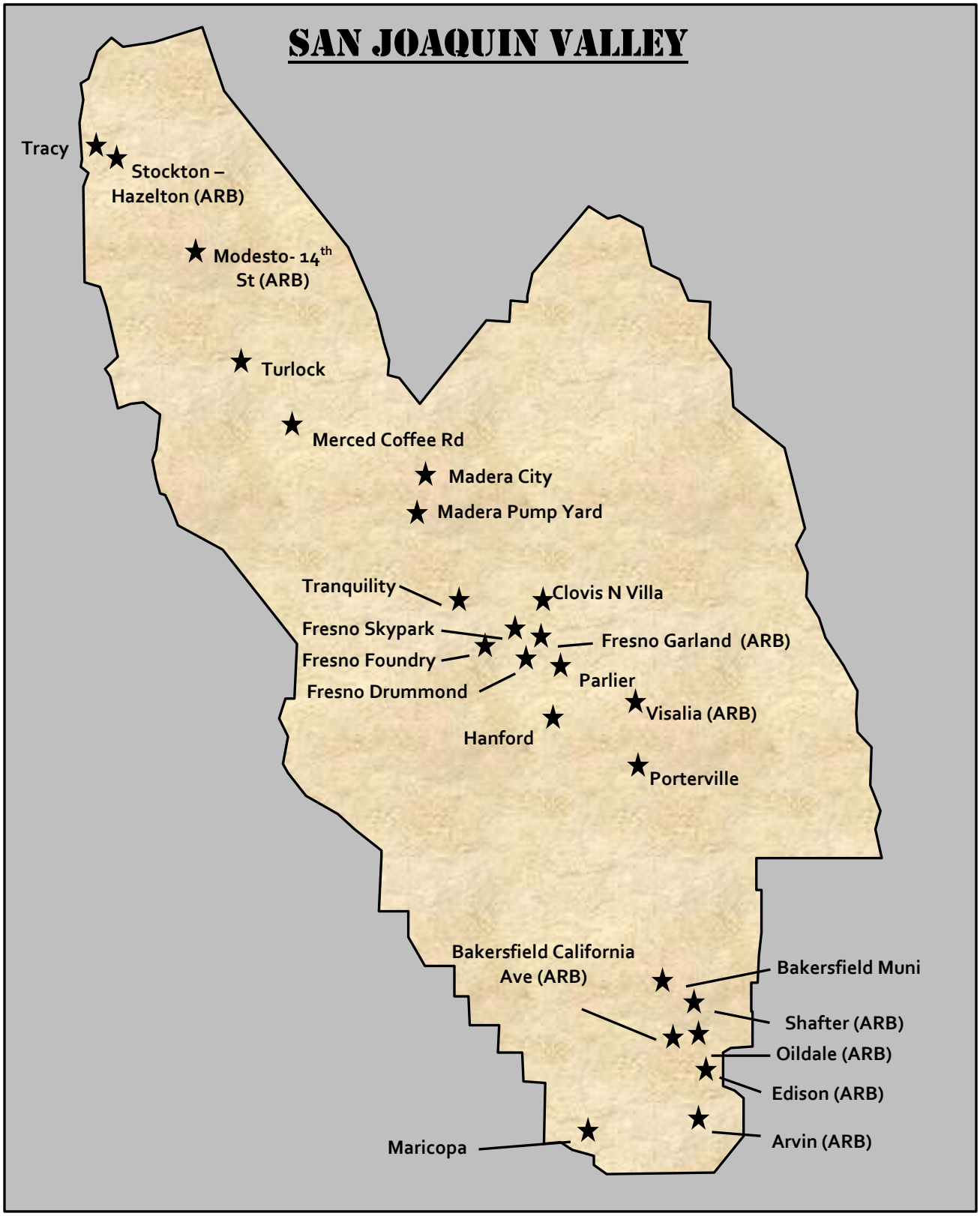
San Lorenzo MS
Santa Cruz
Hollister
Salinas
Carmel Valley
King City


North Coast
Eureka – Jacobs Ave
Eureka – Humboldt Hill
Northern Sierra
White Cloud (ARB)
Grass Valley
Northern Sonoma
Healdsburg Municipal Airport
Placer
Colfax
Tahoe City
Auburn
Lincoln
Roseville – N Sunrise (ARB)

Sacramento Metro


SAN JOAQUIN VALLEY
Tracy
Stockton – Hazelton (ARB)
Modesto- 14th St (ARB)
Turlock
Merced Coffee Rd
Madera City
Madera Pump Yard
Tranquility
Clovis N Villa
Fresno Skypark
Fresno Garland (ARB)
Fresno Foundry
Parlier
Fresno Drummond
Visalia (ARB)
Hanford
Porterville
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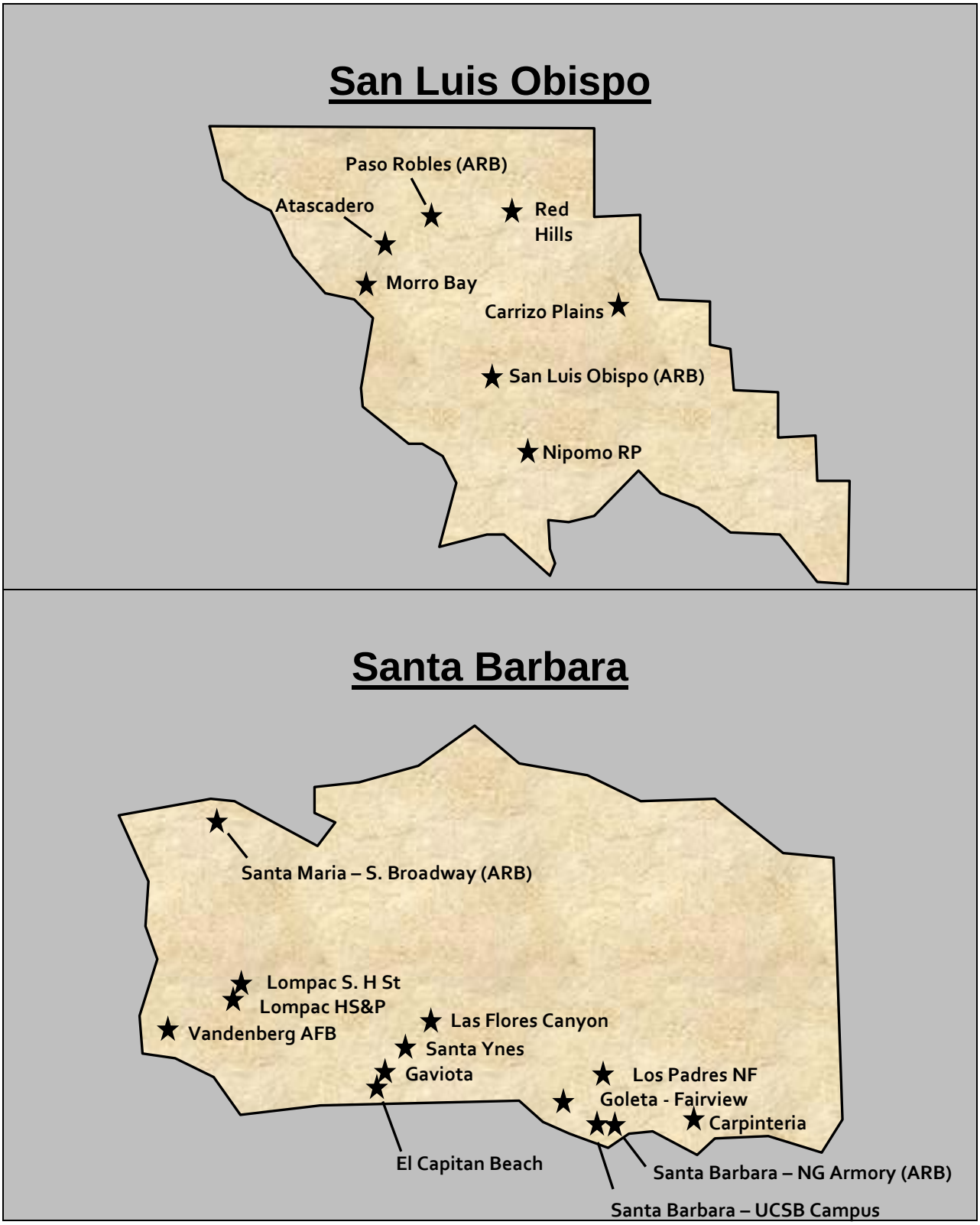
Oildale (ARB)
Edison (ARB)
Arvin (ARB)
Maricopa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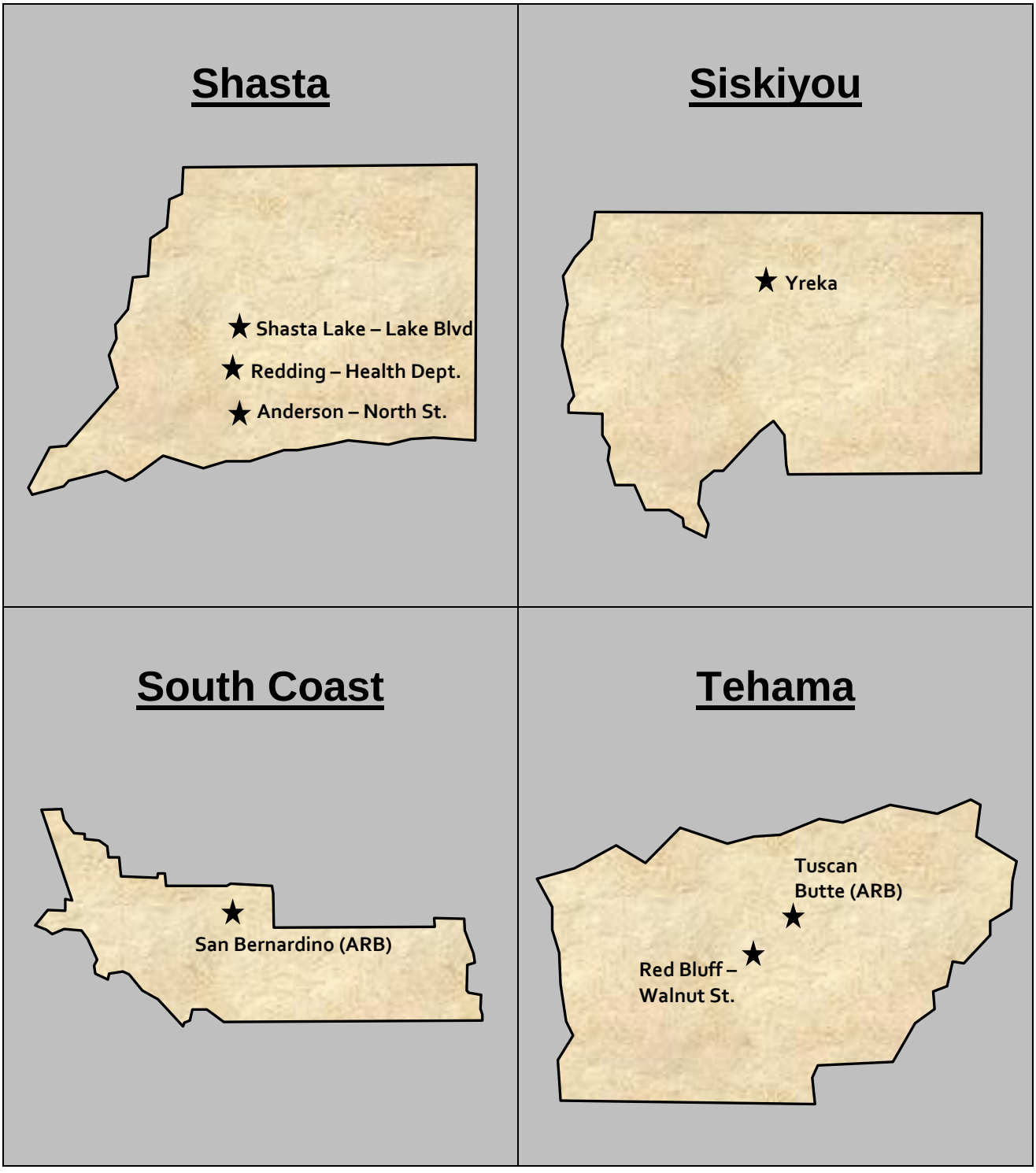
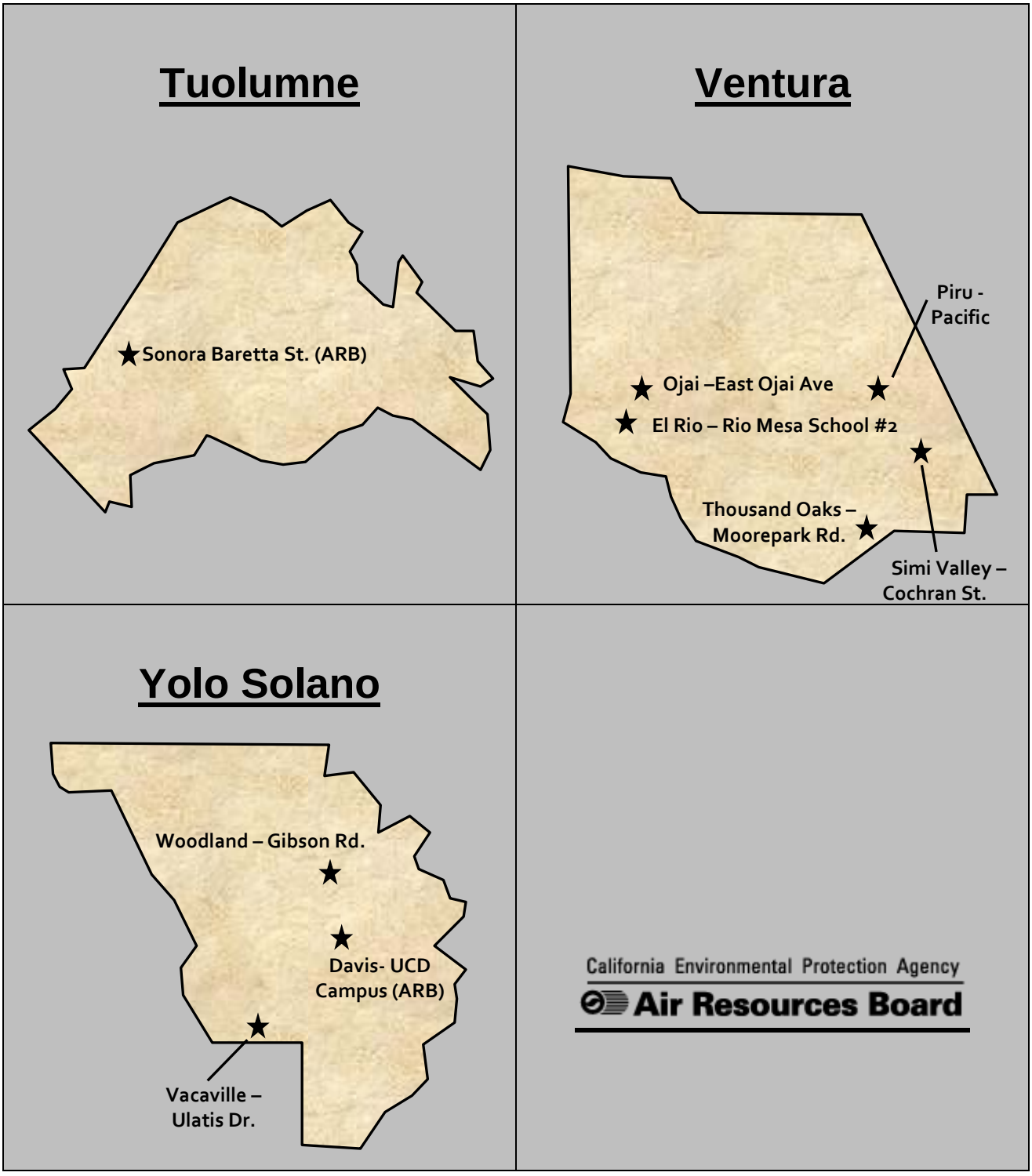
Paso Robles (ARB)
Atascadero
Red Hills
Morro Bay
Carrizo Plains
San Luis Obispo (ARB)
Nipomo RP
Santa Barbara
Santa Maria – S. Broadway (ARB)
Lompac S. H St
Lompac HS&P
Vandenberg AFB
Las Flores Canyon
Santa Ynes
Gaviota
Los Padres NF
Goleta - Fairview
Carpinteria
El Capitan Beach
Santa Barbara – NG Armory (ARB)
Santa Barbara – UCSB Campus


Shasta
Shasta Lake – Lake Blvd
Redding – Health Dept.
Anderson – North St.
Siskiyou
Yreka
South Coast
San Bernardino (ARB)
Tehama
Tuscan
Butte (ARB)
Red Bluff –
Walnut St.


Tuolumne
Sonora Baretta St. (ARB)
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.
Davis- UCD Campus (ARB)
Vacaville – Ulatis Dr.
California Environmental Protection Agency
Air Resources Board

Appendix A.7

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 otherwise0F. The cause of not operating in the acceptable range for each of the violated criteria must be 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.

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

Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration of standard of higher level Every 182 day and 2/ calibration year if manual zero/span performed biweekly Every 365 day and 1/ calibration year if continuous zero/span performed daily	~~All points < ± 2.1 % or < ±1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 ± .05~~	1) 40 CFR Part 50 App D 2) Recommendation 3) 40 CFR Part 50 App D Sec 4.5.5.6 Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	~~Concentrations below LDL~~	1) 40 CFR Part 50 App D Sec. 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			

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

	Valid Daily Max	***≥ if valid 8-hour averages are available for at least 13 of the 17 consecutive 8-hour periods starting from 7:00 a.m. to 11:00 p.m***	1) 40 CFR Part 50 App U 2,3) 40 CFR Part 50 App U Sec. 3(d)
Sample Residence Time Verification	Every 365 days and 1/calendar year	***≤ 20 Seconds***	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation

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

1) Requirement (CO)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-CO			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One Point QC Check Single analyzer	***Every 14 days***	< ±10.1% (percent difference)	1 and 2) 40 CFR Part 58 App A Sec. 3.1.1 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1. QC Check Conc range 0.5 – 5 ppm
Zero/span check	Every 14 days	Zero drift < ± 0.41 ppm (24 hr) < ± 0.61 ppm (>24hr-14 day) Span drift < ± 10.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation
OPERATIONAL CRITERIA-CO			
Shelter Temperature range	Daily (hourly values)	20.0 to 30.0° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2 Generally, the 20-30.0 °C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30 °C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	< 2.1° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Shelter Temperature Device Check	Every 182 days and 2/ calendar year	< ± 2.1° C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Annual Performance Evaluation Single Analyzer	***Every site every 365 days and 1/ calendar year***	Percent difference of audit levels 3-10 < ±15.1% Audit levels 1&2 < ± 0.031 ppm difference or < ±15.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) Recommendation- 3 audit concentrations not including zero. AMTIC Technical Memo
Federal Audits (NPAP)	***20% of sites audited in a calendar year***	Audit levels 1&2 < ± 0.031 ppm difference all other levels percent difference < ± 15.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving Every 182 day and 2/ calendar year if manual zero/span performed biweekly Every 365 days and 1/ calendar year if continuous zero/span performed daily	~~All points < ± 2.1 % or < ± 0.03 ppm difference of best-fit straight line, whichever is greater, and Slope 1 ± .05~~	1) 40 CFR Part 50 Appendix C Sec. 4 2 and 3) Recommendation See details about CO2 sensitive instruments Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation

1) Requirement (CO)	2) Frequency	3) Acceptance Criteria	Information /Action
Gaseous Standards	All gas cylinders	~~**NIST Traceable**~~ ~~(e.g., EPA Protocol Gas)~~	) 40 CFR Part 50 Appendix C Sec. 4.3.1 2) NA Green Book) 40 CFR Part 50 Appendix C Sec. 4.3.1 See details about CO2 sensitive instruments Gas producer used must participate in EPA Ambient Air Protocol Gas Verification Program 40 CFR Part 58 App A Sec. 2.6.1
Zero Air/Zero Air Check	Every 365 days and 1/ calendar year	***< 0.1 ppm CO***	1) 40 CFR Part 50 App C Sec. 4.3.2 2) Recommendation 3) 40 CFR Part 50 App C Sec. 4.3.2
Gas Dilution Systems	Every 365 days and 1/ calendar year or after failure of 1 point QC check or performance evaluation	Accuracy < ± 2.1 %	1, 2 and 3) Recommendation based on SO2 requirement in 40 CFR Part 50 App A-1 Sec. 4.1.2
Detection (FEM/FRMs) Noise and Lower Detectable Limits (LDL) are part of the FEM/FRM requirements. It is recommended that monitoring organizations perform the LDL test to minimally confirm and establish the LDL of their monitor. Performing the LDL test will provide the noise information.			
Noise	Every 365 days and 1/ calendar year	***≤ 0.2 ppm (standard range)*** ***≤ 0.1 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Lower detectable level	Every 365 days and 1/ calendar year	***≤ 0.4 ppm (standard range)*** ***≤ 0.2 ppm (lower range)***	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA-CO			
Standard Reporting Units	***All data***	***ppm (final units in AQS)***	1, 2 and 3) 40 CFR Part 50.8 (a)
Rounding convention for design value calculation	***All routine concentration data***	***1 decimal place***	1, 2 and 3) 40 CFR Part 50.8 (d) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
Completeness	***8-hour standard***	***75% of hourly averages for the 8-hour period***	1) 40 CFR Part 50.8(c) 2) 40 CFR Part 50.8(a-2) 3) 40 CFR Part 50.8(c)
Sample Residence Time Verification	Every 365 days and 1/ calendar year	≤ 20 Seconds	1, 2, and 3) Recommendation. CO not a reactive gas but suggest following same methods other gaseous criteria pollutants.

Sample Probe, Inlet, Sampling train	All Sites	Borosilicate glass (e.g., Pyrex®) or Teflon®	1, 2, and 3) Recommendation. CO not a reactive gas but suggest following same methods other gaseous criteria pollutants. FEP and PFA have been accepted as a equivalent material to Teflon. Replacement/cleaning is suggested as 1/year and more frequent if pollutant load dictate.
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
Precision (using 1-point QC	***Calculated annually and as***	***90% CL CV < 10.1%***	1) 40 CFR part 58 App A Sec. 3.1.1

1) Requirement (CO)	2) Frequency	3) Acceptance Criteria	Information /Action
checks)	***appropriate for design value estimates***		2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
Bias (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	***95% CL < ± 10.1%***	1) 40 CFR Part 58 App A Sec. 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3

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

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

Completeness	***Annual Standard***	***≥ 75% hours in year***	1) 40 CFR Part 50 App S Sec. 3.1(b) 2) 40 CFR Part 50 App S Sec. 3.1(a) 3) 40 CFR Part 50 App S Sec. 3.1(b)
	1-hour standard	***1) 3 consecutive calendars years of complete data*** ***2) 4 quarters complete in each year*** ***3) ≥75% sampling days in quarter*** ***4) ≥ 75% of hours in a day***	1) 40 CFR Part 50 App S Sec. 3.2(b) 2) 40 CFR Part 50 App S Sec. 3.2(a) 3) 40 CFR Part 50 App S Sec. 3.2(b) More details in 40 CFR Part 50 App S

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

1) Requirement (SO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- SO_2			
Sampler/Monitor	NA	***Meets requirements listed in FRM/FEM designation***	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One Point QC Check Single analyzer	***Every 14 days***	< ±10.1% (percent difference) or < ± 1.5 ppb difference whichever is greater	1 and 2) 40 CFR Part 58 App A Sec. 3.1.1 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.2 QC Check Conc range 0.005 - 0.08 ppm and 05/05/2016 Technical Note on AMTIC
Zero/span check	Every 14 days	Zero drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14 day) Span drift < ± 10.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA- SO_2			
Shelter Temperature Range	Daily (hourly values)	20.0 to 30.0° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2 Generally, the 20-30.0 °C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30 °C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	< 2.1° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Shelter Temperature Device Check	every 180 days and 2/calendar year	< ± 2.1° C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Annual Performance Evaluation Single Analyzer	***Every site every 365 days and 1/ calendar year***	Percent difference of audit levels 3-10 < ±15.1% Audit levels 1&2 < ± 1.5 ppb difference or < ±15.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) Recommendation - 3 audit concentrations not including zero. AMTIC Technical Memo
Federal Audits (NPAP)	20% of sites audited in calendar year	Audit levels 1&2 < ± 1.5 ppb difference all other levels percent difference < ± 15.1%	1&2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving Every 182 day and 2/ calendar year if manual zero/span performed biweekly Every 365 day and 1/ calendar year if continuous zero/span performed daily	~~All points < ± 2.1 % or < ± 1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 ± .05~~	1) 40 CFR Part 50 App A-1 Sec. 4 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation

Gaseous Standards	***All gas cylinders***	***~~NIST Traceable~~ ~~(e.g., EPA Protocol Gas)~~***	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.1 2) NA Green Book 3) 40 CFR Part 50 App F Sec. 1.3.1 Producers must participate in Ambient Air Protocol Gas

1) Requirement (SO_2)	2) Frequency	3) Acceptance Criteria	Information /Action
			Verification Program 40 CFR Part 58 App A Sec. 2.6.1
Zero Air/ Zero Air Check	Every 365 days and 1/ calendar year	~~Concentrations below LDL~~ ~~< 0.1 ppm aromatic hydrocarbons~~	) 40 CFR Part 50 App A-1 Sec. 4.1.6.2) Recommendation) Recommendation and 40 CFR Part 50 App A-1 Sec. 4.1.6.2
Gas Dilution Systems	Every 365 days and 1/ calendar year or after failure of 1point QC check or performance evaluation	***Accuracy < ± 2.1 %***	1) 40 CFR Part 50 App A-1Sec. 4.1.2 2) Recommendation 3) 40 CFR Part 50 App A-1 Sec. 4.1.2
Detection (FEM/FRMs) Noise and Lower Detectable Limits (LDL) are part of the FEM/FRM requirements. It is recommended that monitoring organizations perform the LDL test to minimally confirm and establish the LDL of their monitor. Performing the LDL test will provide the noise information.			
Noise	Every 365 days and 1/ calendar year	***≤ 0.001 ppm (standard range)*** ***≤ 0.0005 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Lower detectable level	Every 365 days and 1/ calendar year	***≤ 0.002 ppm (standard range)*** ***≤ 0.001 ppm (lower range)***	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA- SO_2			
Standard Reporting Units	***All data***	***ppb (final units in AQS)***	1, 2 and 3) 40 CFR Part 50 App T Sec. 2 (c)
Rounding convention for design value calculation	***All routine concentration data***	***1 place after decimal with digits to right truncated***	1, 2 and 3) 40 CFR Part 50 App T Sec. 2 (c) The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
Completeness	***1 hour standard***	Hour – 75% of hour ***Day- 75% hourly Conc Quarter- 75% complete days Years- 4 complete quarters*** ***~~5-min value reported only for valid hours~~***	1, 2 and 3) 40 CFR Part 50 App T Sec. 3 (b), (c) More details in CFR on acceptable completeness. 5-min values or 5-min max value (40 CFR part 58.16(g)) only reported for the valid portion of the hour reported. ~~If the hour is incomplete no 5-min or 5-min max reported.~~
Sample Residence Time Verification	Every 365 days and 1/ calendar year	***≤ 20 Seconds***	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 9 (c)
Sample Probe, Inlet, Sampling train	***All sites***	***Borosilicate glass (e.g., Pyrex®) or Teflon®***	1, 2 and 3) 40 CFR Part 58 App E Sec. 9 (a) FEP and PFA have been accepted as equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	Every 365 days and 1/ calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6

Precision (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	***90% CL CV < 10.1%***	1) 40 CFR Part 58 App A Sec. 2.3.1.6 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
1) Requirement (SO_2)	**2) Frequency**	**3) Acceptance Criteria**	**Information /Action**
Bias (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	***95% CL < ± 10.1%***	1) 40 CFR Part 58 App A Sec. 2.3.1.6 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3

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
O3 (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
NO2 (ppb)	150	250	50	10	0	2.7 ppb
TCO (ppm)	8 (3)	12 (5)	5 (1.5)	15	0	.02 ppm
TSO2 (ppb)	150 (50)	200 (100)	100 (25)	5	5 (0)	.2 ppb
PM25 (ug/m3)	100	200	50	4	10 (0)	2 ug/m3 (3 ug/m3 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 O3 value if same for 5 consecutive hours
O3 Box Temp	1 Hr	Range (>)	0	23	39.9		32-Shelter Temp	Flags hourly O3 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
NO2	1 Hr	Range (<)	0	23	-2.7		43- Value below MDL	Flags values < negative MDL
NO2	1 Hr	Range (>)	0	23	250		9-Invalid	Flags hourly values > Value as invalid
NO2	1 Hr	Range (>)	0	23	150		5-Suspect	Flags hourly values > Value as suspect
NO2[4]	1 Hr	Rate of Change	0	23	30		5-Suspect	Flags hourly value if rate of change is more than 30 ppb***
NO2	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly NO2 value if same for 5 consecutive hours

Parameter	Duration	QC Check	Start Hour	End Hour	Value (ppb	Data Points	QC Code	Description
SO2	1 Hr	Range (<)	0	23	-0.2		43- Value below MDL	Flags values < negative MDL
SO2	1 Hr	Range (>)	0	23	100		9-Invalid	Flags hourly values > Value as invalid
SO2	1 Hr	Range (>)	0	23	50		5-Suspect	Flags hourly values > Value as suspect
SO2	1 Hr	Rate of Change	0	23	25		5-Suspect	Flags hourly value if rate of change is more than 25
SO2	1 Hr	Sticking	0	23		5	5-Suspect	Flags hourly SO2 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 -		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 m3/min
Qtot[2]	1 Hr	Range (>)	0	23	>.703		40-Sample flow out of	Flags BAM_FEM values if Qtot > .703 m3/min
Qtot[2]	1 Hr	Range (<)	0	23	<.600		40-Sample flow out of	Flags BAM_FEM values if Qtot < .600 m3/min
Qtot [3]	1 Hr	Range (<)	0	23	<.830		4 - Suspect Flow	Flags BAM values if Qtot < .830 m3/min
Qtot [3]	1 Hr	Range (<)	0	23	0.7		40-Sample flow out of	Flags BAM values if Qtot > .700 m3/min
Qtot [3]	1 Hr	Range (>)	0	23	>.837		40-Sample flow out of	Flags BAM values if Qtot > .837 m3/min

[1] This includes BAM25, BAM25_a, b,c (collocated BAMs), BAM25_FEM, BAMPMC, BAM10 (Actual Conditions), BAM10_S (Local Conditions - units: ug/m3 25C)
[2] Applies to BAM25 FEM samplers
[3] Applies to Non- FEM BAM25 samplers
[4] NOx, NO2, 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".

Gaseous Precision and Bias Assessments

Applies to: CO, O_3, NO_2, SO_2

40 CFR Part 58 Appendix A References:

- ***4.1.1 Percent Difference***
- ***4.1.2 Precision Estimate***
- ***4.1.3 Bias Estimate***
- ***4.1.3.1 Assigning a sign (positive / negative) to the bias estimate.***
- ***4.1.3.2 Calculate the 25th and 75th percentiles of the percent differences for each site.***
- ***4.1.4 Validation of Bias Using the one-point QC Checks***

Precision and bias estimates are based on 1-point Q/C checks. Then, bias estimates are validated using the annual performance evaluations (audits).

Percent Difference

Equations from this section come from *CFR Pt. 58, App. A, Section 4, "Calculations for Data Quality Assessment"*. For each single point check, calculate the percent difference, d_i, as follows:

Equation 1

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

where *meas* is the concentration indicated by the monitoring organization's instrument and *audit* is the audit concentration of the standard used in the QC check being measured.

Precision Estimate

The precision estimate is used to assess the one-point QC checks for gaseous pollutants described in section 3.2.1 of CFR Part 58, Appendix A. The precision estimator is the coefficient of variation upper bound and is calculated using Equation

2 as follows:

Equation 2

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

where $x^2_{0.1,n-1}$ is the 10th percentile of a chi-squared distribution with *n-1* degrees of freedom.

Bias Estimate

The bias estimate is calculated using the one point QC checks for SO_2, NO_2, O_3, or CO described in CFR, section 3.2.1. The bias estimator is an upper bound on the mean absolute value of the percent differences as described in Equation 3 as follows:

Equation 3

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

where *n* is the number of single point checks 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 1) and is expressed as Equation 4 as follows:

Equation 4

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

and the quantity *AS* is the standard deviation of the absolute value of the d_i's and is calculated using Equation 5 as follows:

Equation 5

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

Since the bias statistic as calculated in Equation 3 of this Appendix uses absolute values, it does not have a tendency (negative or positive bias) associated with it. A sign will be designated by rank ordering the percent differences (d_i's) 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).

Validation of Bias

The annual performance evaluations (audits) for SO_2, NO_2, O_3, or CO are used to verify the results obtained from the one-point QC checks and to validate those results across a range of concentration levels. To quantify this annually at the site level and at the
3-year primary quality assurance organization level, probability limits will be calculated from the one-point QC checks using equations 6 and 7:

Equation 6

$$\text{Upper Probability Limit} = m + 1.96 \cdot S$$

Equation 7

$$\text{Lower Probability Limit} = m - 1.96 \cdot S$$

where, $\underline{m}$ is the mean (equation 8):

Equation 8

$$m = \frac{1}{k} \cdot \sum_{i=1}^{k} d_i$$

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 9) as follows:

Equation 9

$$S = \sqrt{\frac{k \cdot \sum_{i=1}^{k} d_i^2 - \left(\sum_{i=1}^{k} d_i\right)^2}{k(k-1)}}$$

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 Air Resources Board (ARB) 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 ARB, as well as for a number of local air districts in California. In addition, ARB submits quality assurance data to AQS for some California districts that are within the Primary Quality Assurance Organization managed by ARB. ARB also submits data for all particulate matter filters weighed and analyzed by ARB'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 ARB 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 ARB 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 ARB submits some or all of the data.

Sincerely,

(Name and Title)
Air Resources Board
Enclosures (3)

cc: Appropriate Region 9 Staff
Agencies/Departments submitting letters supporting certification

Appendix D.1

Van Audit Diagram

Van Audit Diagram