Quality Assurance Project Plan For The Study of Neighborhood Air Near Petroleum Sources

Date: May, 2019

Prepared By: MLD

California Air Resources Board
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FOREWORD

This Quality Assurance Project Plan (QAPP) for the California Air Resources Board's (CARB) Study of Neighborhood Air near Petroleum Sources (SNAPS) 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 to all applicable laws and regulations, CARB's Quality Management Plan (QMP) and quality assurance policies. 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. This document is designed to be used in conjunction with applicable SNAPS Monitoring Plans.

APPROVALS		
California Air Resources Board		
	Signature	**Date**
Mike Miguel, Assistant Division Chief Monitoring and Laboratory Division		5/17/19
Kenneth Stroud, Chief Community Air Monitoring Branch		4-10-19
Michael Werst, Chief Northern Laboratory Branch		4.16.19
Manisha Singh, Chief Quality Management Branch		4.26.19
Vacant, Chief Oil & Gas and GHG Mitigation Branch	Acting Carolyn Lozo	4-17-19

SECTION A2 – TABLE OF CONTENTS

LIST OF ACRONYMS	
AMTS	Air Monitoring Techniques Section
AQDA	Air Quality Data Action
ASTM	American Society for Testing and Materials
BAM	Beta Attenuation Monitor
BC	Black Carbon
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CAMB	Community Air Monitoring Branch
CAN	Corrective Action Notification
CARB	California Air Resources Board
CDMS	Community Data Management System
CFR	Code of Federal Regulations
CH4	Methane
CO	Carbon Monoxide
CO2	Carbon Dioxide
COC	Chain of Custody
Cr6+	Hexavalent Chromium
DQA	Data Quality Assessment
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
GC	Gas Chromatography
GCMS	Gas Chromatograph/Mass Spectrometer
GHG	Greenhouse Gas
GIS	Geographical Information System
H2S	Hydrogen Sulfide
ISD	Industrial Strategies Division
LIMS	Laboratory Information Management System
MLD	Monitoring and Laboratory Division
MQO	Measurement Quality Objectives
MS	Mass Spectrometer
NAAQS	National Ambient Air Quality Standard
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLB	Northern Laboratory Branch

NO2	Nitrogen Dioxide
O3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
OGGHGMB	Oil & Gas and Greenhouse Gas Mitigation Branch
OT	Outside Temperature
PAHS	Polycyclic Aromatic Hydrocarbons
PAMS	Photochemical Assessment Monitoring Stations
PAS	Program Assessment Section
PM	Particulate Mater
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Section
QC	Quality Control
QMB	Quality Management Branch
QMP	Quality Management Plan
QMS	Quality Management Section
SLAMS	State and Local Air Monitoring Stations
SNAPS	Study of Neighborhood Air Near Petroleum Sources
SOP	Standard Operating Procedure
SPM	Special Purpose Monitors
SVOC	Semi Volatile Organic Compound
TAC	Toxic Air Contaminant
TTP	Through the Probe Audit
U.S. EPA	United States Environmental Protection Agency
XRF	X-Ray Fluorescence
VOC	Volatile Organic Compound
WD	Wind Direction
WS	Wind Speed

SECTION A3 – DISTRIBUTION LIST

To ensure that California Air Resources Board's (CARB) quality assurance policies are appropriately distributed and inherent in all applicable ambient air quality data collection processes, the Quality Assurance Project Plan (QAPP) for the Study of Neighborhood Air near Petroleum Sources (SNAPS) is distributed to the following:

- Persons listed in APPROVALS section.
- CARB's Monitoring and Laboratory Division (MLD) supervisory and line staff involved in any aspect of the SNAPS Program.
- CARB's Industrial Strategies Division (ISD) supervisory and line staff involved in any aspect of the SNAPS Program.

Distribution is performed by placing this document on CARB's SNAPS website under resources at: https://ww2.arb.ca.gov/our-work/programs/study-neighborhood-air-near-petroleum-sources, sending an email notification via CARB's SNAPS Contact List Serve at: https://public.govdelivery.com/accounts/CARB/subscriber/new?topic_id=oil-gas, and maintaining hard copies at CARB's Industrial Strategies Division Office and Monitoring and Laboratory Division Office. The SNAPS Distribution List will be an excel document with all distributed parties email addresses housed on the Division internal drive. Training of staff within CARB's MLD and ISD will include QAPP content and location of all available quality assurance documents.

Table A.1 – Key Team Members to receive the QAPP

Name	Title	Project Role
Floyd Vergara	Industrial Strategies Division Chief	
Carolyn Lozo	Oil & Gas & GHG Mitigation Branch Chief	Sets study goals for community outreach and community selection.
Vacant/TBD	Program Assessment Section Manager	Community and Stakeholder Outreach, Community Selection and Prioritization, Results Evaluation and Final Report
Jonathan Blufer	Staff	Program Development Staff Lead
Michelle Watterson	Staff	Data Evaluation
Catherine Dunwoody	Monitoring and Laboratory Division Chief	
Mike Miguel	Monitoring and Laboratory Assistant Division Chief	Assist Division Chief
Kenneth Stroud	Community Air Monitoring Branch Chief	Technical and Operational Goals

Walter Ham	Advanced Monitoring Techniques Section Manager	Program monitoring oversight; implementing neighborhood monitoring near oil and gas facilities.
Chris Jakober	Staff	Mobile Monitoring Staff Lead
Tony Simoni	Staff	Assist Manager
Jeremy Smith	Staff	Assist Manager
Yunliang Zhao	Staff	Program Staff Lead
Manisha Singh	Quality Management Branch Chief	Quality Assurance–Certification, Verification, Accuracy and Precision
Ranjit Bhullar	Quality Assurance Section Manager	Assist with performance audits, and certification and verification for calibration standards
Vacant/TBD	Quality Management Section Manager	Oversees Program Quality Assurance, Documents – QAPP, SOPs
Jeannine Berry	Staff	Assist Manager
Michael Werst	Northern Laboratory Branch Chief	Provides laboratory chemical analysis for Program.
Patrick Rainey	Organic Laboratory Section Manager	Oversees Canister Samples Analyses
Leslie Larson	Staff	Assist Manager
Cathleen Roush	Staff	Assist Manager
Brenda Saldana	Inorganic Laboratory Section Manager	Oversees media preparation and supply to staff and performs all inorganic laboratory analyses
Nial Maloney	Staff	XRF analyses

SECTION A4 – PROGRAM/TASK ORGANIZATION

A4.1 – Introduction

California Air Resources Board's (CARB) mission is to protect the public from harmful effects of air pollution. Enhancing community air monitoring near disadvantaged communities and other highly impacted communities enables us to better meet our mission. While communities near oil and gas production and distribution are the initial focus of this program, the program may include monitoring in communities near other petroleum related processes.

CARB currently monitors regional air quality using fixed monitoring stations. This monitoring network can have stations relatively far away from each other since this network is designed to assess regional concentrations. This spatial density and low

sampling frequency makes identifying specific sources of toxic volatile organic compound (VOC) emissions, methane, and other air pollutants at the community-scale challenging. An expansion of CARB's current monitoring efforts is needed to improve CARB's neighborhood/community-level monitoring as well as to quickly respond to events similar to the Aliso Canyon natural gas leak or other oil and gas production-related issues. Conducting such monitoring will enable CARB to better characterize neighborhood concentrations, assess potential health impacts, determine the need for further mitigation, as well as provide timely information to the public living near these sources.

The purpose of this Study of Neighborhood Air near Petroleum Sources (SNAPS/Program) Quality Assurance Project Plan (QAPP) is to document policy and activities and procedures necessary for accomplishing specified program objectives. This QAPP pertains specifically to monitoring ozone (O3), carbon monoxide (CO), methane (CH4), hydrogen sulfide (H2S), black carbon (BC), VOCs – benzene, toluene, ethylbenzene and xylene (BTEX), metals, carbonyls, glycols[*], particulate matter (PM) and polycyclic aromatic hydrocarbons (PAH). This QAPP shall comply with all CARB's quality assurance policies and procedures to ensure the quality of data reported meets all program objectives.

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.

All oil and gas and petroleum source oriented air monitoring activities performed by Program staff within CARB or performed on behalf of CARB shall comply with the quality assurance policies and procedures specified in this QAPP. Each program monitoring staff has the responsibility for ensuring that the operation of the neighborhood air monitoring is conducted in accordance with approved procedures and data are of sufficient quantity and quality to meet intended objectives. CARB's goal is to work cooperatively and collaboratively to consistently produce high quality air monitoring data. The quality assurance system and procedures set forth in this document apply to CARB and all SNAPS Program staff unless alternative quality management documents and procedures are approved by CARB. All substantive deviations to this QAPP must be documented in an Addendum and reviewed by CARB for approval. The Addendum process is described in CARB's Document Repository at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository.

This QAPP has been developed based on recommendations from U.S. EPA QAPP information set forth in the document Guidance for Quality Assurance Project Plans,

[*] *Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species, and the availability of suitable sampling/analytical equipment.*

U.S. EPA QA/G-5, December 2002. This document is divided into the element groups summarized in Table A.2 – QAPP Elements.

Table A.2 – QAPP Elements

	Section A – Program Management		Section B – Data Generation and Acquisition		Section C – Data Verification and Validation
A1	Title and Approval Sheet	**B1**	General 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	Program/Task Organization	**B4**	Quality Control		**Group D – Assessment, Oversight, and Usability**
A5	Program Definition and Background	**B5**	Instrument/Equipment Calibration and Frequency	**D1**	Assessments and Response Actions
A6	Program Description	**B6**	Instrument/Equipment Testing, Inspection, and Maintenance	**D2**	Reports to Management
A7	Quality Objectives and Criteria For Measurement Data	**B7**	Inspection/Acceptance of Supplies and Consumables		**Appendix**
A8	Special Trainings and Certifications	**B8**	Data Management		
A9	Documents and Records				

A4.2 – Program/Task Organization

CARB's organizational structure for the SNAPS Program is displayed in this QAPP, (Section A4.2, Figure A.1). The SNAPS Program is the responsibility of the Monitoring and Laboratory Division (MLD) and the Industrial Strategies Division (ISD) within CARB. The general responsibilities of these two divisions are outlined in this section and can be found on the SNAPS website. (Further reference to the SNAPS Website in the text of this document will be hyperlinked. Appendix 8 contains a list of website links used throughout this document for reference.) The SNAPS website will include a call-out box with the latest updated program news, public meeting schedules, archives with presentations and other documents, real-time information, program contact information and a link for GovDelivery (listserv) subscription. Additionally, all published documents

from the SNAPS Program – QAPP, final reports for each community, Program Questions and Answers – will be posted on the website.

Within MLD, the Community Air Monitoring Branch (CAMB) conducts most of CARB's continuous community-scale ambient air monitoring activities throughout California, which may include seasonal and toxic air monitoring. The Advanced Monitoring Techniques Section (AMTS) within the branch is responsible for the development and operation of mobile monitoring and stationary monitoring within the communities for the SNAPS Program. AMTS conducts community monitoring using mobile air monitoring stations and equipment. All monitoring equipment is assigned to qualified Program staff 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, AMTS staff is responsible for the verification and validation of data obtained and collected. The section supports the SNAPS Program by performing measurements and providing data to help define the nature, extent, and trend of the problem.

The two sections of the Quality Management Branch (QMB) that are involved with the SNAPS Program are the Quality Assurance Section (QAS) and the Quality Management Section (QMS).

QAS has the primary responsibility for conducting performance audits of the field monitoring instrumentation used in support of CARB's regulatory air monitoring program. Audits of special monitoring programs may also be conducted to ensure that data quality meets the purpose and objectives of the monitoring program. QAS will assist AMTS with the performance audits with a focus on criteria pollutants measured. QAS is responsible for issuing corrective action requests and initiating appropriate corrective action responses for issues discovered during performance audits. QAS may also assist Program staff with providing certification and verification services for calibration standards.

QMS is responsible for the development, preparation and review of the SNAPS QAPP as well as the review and approval of other Program quality management documents, such as SOPs, to ensure that consistent practices are performed. QMS also acts as liaison between Divisions within CARB and local monitoring organizations and assists QAS with audits and corrective action processes as needed. These activities are conducted to ensure compliance with applicable requirements pertaining to sample collection and analysis, and validation and reporting of ambient air monitoring data.

Within ISD, the Program Assessment Section (PAS) is responsible for the development and planning of the SNAPS Program. Staff also design studies to determine methane, criteria, and toxic air pollutant emissions from oil and gas extraction. PAS is also responsible for public outreach and education on the SNAPS Program.

Below is an organizational function summary for CARB and SNAPS Program staff. Please note that dotted lines indicate oversight.

Figure A.1 – CARB and SNAPS Organizational Function Summary

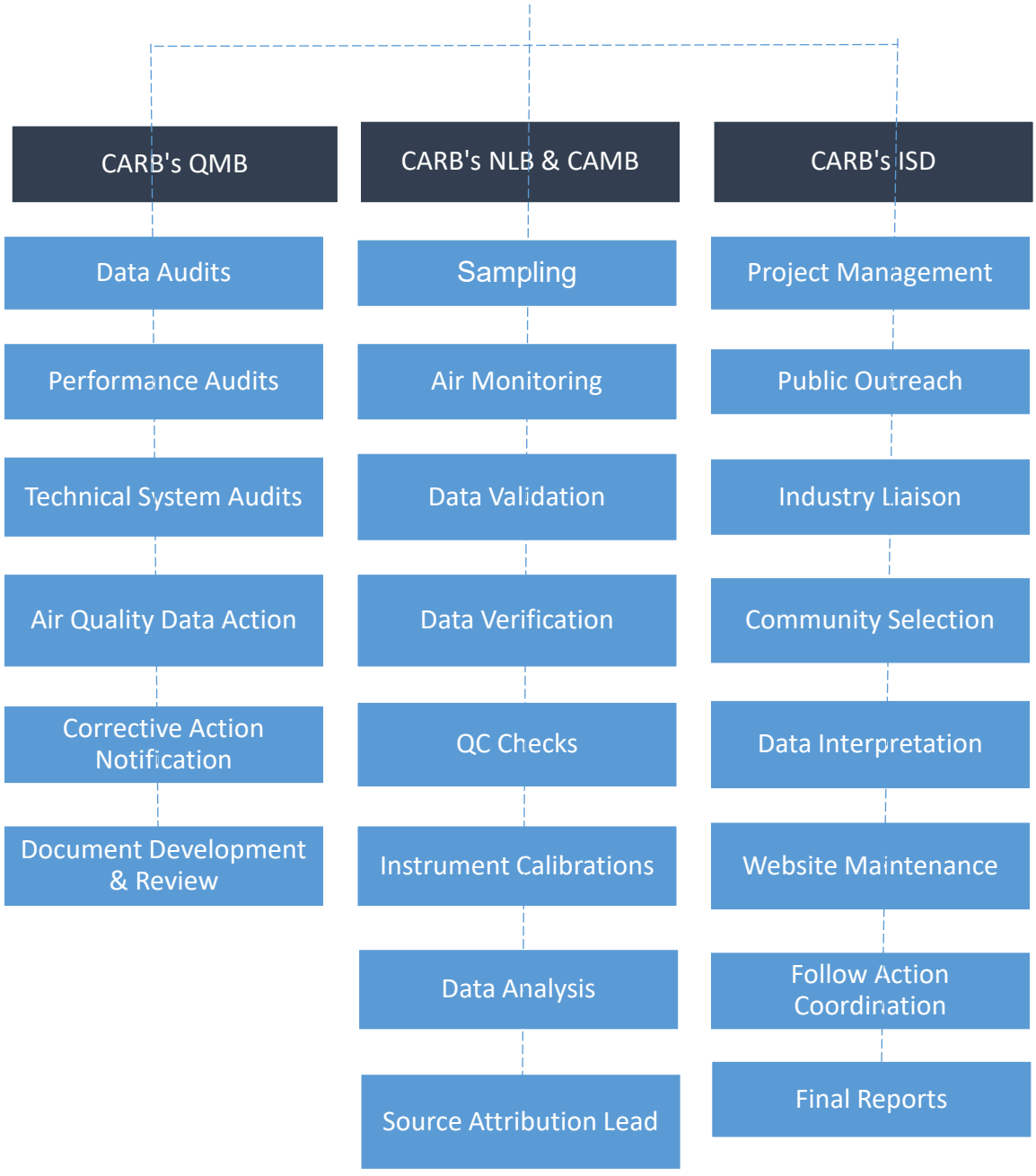

Figure A.1 shows the general functions and lines of communication for the Divisions involved in the SNAPS Program. Responsibilities are outlined in Table A.3, relevant Standard Operating Procedures (SOP), and the SNAPS website.

Specific responsibilities for the SNAPS Program are outlined in the QAPP and will be posted on the SNAPS website.

A4.3 – Responsibilities

Table A.3 shows the general responsibilities and lines of communication for staff involved in the SNAPS Program. More detailed description of specific responsibilities for various positions are identified in related SOPs.

Table A.3 – SNAPS Position Responsibilities

Position	Responsibilities	Reports To
Industrial Strategies Division, Chief	Responsible for the successful oversight of the Program.	Executive Staff
Oil & Gas & GHG Mitigation Branch, Chief	Responsible for development of the Program; development of methane and criteria pollutant control measures from oil and gas extraction and mitigation.	Division Chief
Program Assessment Section, Manager	Responsible for public outreach for Program; oversees staff working on oil and gas analysis including methane leakage, hydraulic fracturing.	Branch Chief
ISD Staff	Program development and public outreach.	Section Manager
Monitoring and Laboratory Division, Chief	Responsible for the successful accomplishment of Program objectives.	Executive Staff
Northern Laboratory Branch, Chief	Develops laboratory and ambient air collection test procedures, performs near source ambient air monitoring, conducts analyses of ambient air samples and consumer products, and provides technical assistance to clients.	Division Chief
Inorganic Laboratory Section, Manager	Responsible for analyzing ambient air quality samples, and managing and reporting analytical data, specifically from particulate matter (PM), metals, and toxic air contaminants (TAC).	Branch Chief
Organic Laboratory Section, Manager	Performs determinations for halogenated organics, aromatics, and carbonyl compounds.	Branch Chief

Quality Management Branch, Chief	Responsible for the quality assurance of the Program; and the timely review, implementation, and assessment of quality management documents and systems for the Program.	Division Chief
Quality Assurance Section, Manager	Responsible for certification services for ozone transfer standards and verification of pollutant concentrations in compressed gas cylinders used for field calibrations of the pollutant analyzers. Provide performance audits for gaseous pollutants; flow checks for PM 2.5.	Branch Chief
Quality Management Section; Manager	Liaisons responsible for communication and coordination of QA/QC information; assist branch chief with the preparation and review of quality management documents for consistent practice with the Program.	Branch Chief
Community Air Monitoring Branch, Chief	Responsible for overseeing air monitoring activities and the verification and validation of air monitoring data.	Division Chief
Advanced Monitoring Techniques Section, Manager	Responsible for Program oversight; implementing neighborhood monitoring near oil and gas facilities.	Branch Chief
CAMB Staff	Responsible for developing and 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 and equipment.	Section Manager

SECTION A5 – PROGRAM DEFINITION AND BACKGROUND

California is one of the largest oil producers in the nation, fourth only to Texas, North Dakota, and Alaska and the Division of Oil, Gas and Geothermal Resources (DOGGR) ranked California in the nation's top 5 for oil production. As of April 16, 2019, DOGGR states that in California there are approximately 73,000 active wells and 122,000 plugged wells some of which have existed for over one hundred years. This aging infrastructure along with the oil and gas extraction activities has the potential to impact nearby communities and current regulatory monitoring sites are not designed for the determination of community air quality. Limited information exists on the impacts that oil and gas operations may have on the air quality in neighboring communities and a need for monitoring is recognized. As a result, CARB has initiated the SNAPS Program in response to community concerns and this Program plans to focus on assessing the cumulative air contaminants in communities of heavily populated neighborhoods residing within miles, some of which are located less than a mile, near oil and gas production facilities.

CARB's motivation for this program is the need to better characterize air pollutants that may be impacting communities near these oil and gas operations. Additional information on the background of the SNAPS Program can be found on the SNAPS website.

A5.1 – Current Air Quality Standards

Current State and Federal regulation defines Air Quality Standards for criteria pollutants, such as particulate matter (PM10 and PM2.5), carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), and metals. The focus of this QAPP is the pollutant concentrations that exist in neighborhoods and communities near petroleum sources. Most pollutants thought to be associated with oil and gas production and storage facilities are not included in the National Ambient Air Quality Standards (NAAQS) and will be studied as part of this Program. These non-criteria pollutants are black carbon, carbonyls, glycols[†], hexavalent chromium, hydrogen sulfide, PAHs, metals, VOCs (including BTEX).

The current ambient air quality standards for each of the criteria pollutants and their effects on health are summarized in the State and Federal Ambient Air Quality Standards Table and footnotes which is located on the CARB website at: https://www.arb.ca.gov/research/aaqs/aaqs2.pdf**.** Additional information can be found in the CARB QAPP for Gaseous Pollutant Air Monitoring Program (Gaseous QAPP) and

[†] *Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species and the availability of suitable sampling/analytical equipment.*

the CARB QAPP for Particulate Matter Pollutant Air Monitoring Program (PM QAPP) located in the CARB's Quality Management Plan (QMP) and QAPP website at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality .

A5.2 – Geographic Extent of Monitoring

The geographic extent of the sampling areas may vary depending upon the results of the site selection phase, the location of contributing emission sources, the meteorology, and the topographic features. Specific details on the monitoring area and the equipment to be used will be further described in site-specific monitoring plans.

SECTION A6 - PROGRAM DESCRIPTION

CARB will start by defining the considerations in selecting the monitoring sites for the study. This is the first phase of the program and an opportunity for the public to inform CARB about areas of concern for residential neighborhoods located near oil and gas operations.

CARB will incorporate community concerns and gather additional air quality data resulting in the selection of communities to be monitored each year. CARB will hold a local meeting in each selected community to provide information about the project and collaborate on where monitoring trailers will be located. A subset of near real-time measurements will be made available on the program's website, where available. Additionally, a final report will be prepared and posted for each monitored community. A follow-up local community meeting will be held to share the results of the report and any follow up actions that are necessary.

A6.1 – Community Selection

Community Selection Process – 3 stages: Identification, Evaluation, Selection. Detailed description can be found on the SNAPS website.

Identification Stage – Staff will develop a list of communities for potential selection based on an evaluation of the following criteria and information.

- Geographical Information System (GIS) analysis to determine areas with significant co-location of oil and gas production and populations
- Public and local air districts input for additional specific communities of concern.

Evaluation Stage – Staff will gather data from communities that may indicate a greater impact from oil and gas production emissions.

Selection Stage – Staff will use a multi-factor prioritization to select a sub-set of communities. Initially, communities identified as meeting four or more factors may be selected for the first round of SNAPS monitoring. Criteria may change as the Program evolves and further information is available and experience is developed.

A6.2 - Monitoring Methods

The SNAPS Program will utilize a variety of air monitoring methods to characterize air quality. These methods include stationary and mobile monitoring. The monitoring equipment used in each selected community will vary based on the phase of the monitoring.

The mobile air quality monitoring phase will utilize a low-emission mobile SUV-based platform for performing an initial survey of potential communities for further monitoring. The SUV will be equipped with a variety of screening-level instrumentation including instruments for continuous methane measurements and an auto-GC for BTEX measurements. The platform will also have the capability to collect discrete summa canister grab samples for subsequent analysis of VOCs by GC/MS, as needed.

The stationary, intensive sampling phase will include trailer-based monitoring platforms that will be deployed for a period of three to four months to gather more comprehensive and extensive information for identified communities through both on-site continuous measurements and discrete samples for laboratory analysis. On-site measurements include ozone, hydrogen sulfide, methane, carbon monoxide and carbon dioxide, VOCs (including BTEX), PM2.5, metals, black carbon, and meteorological parameters - wind speed (WS) and wind direction (WD). Discrete samples collected for laboratory analysis include VOCs, metals, Cr6+, and carbonyls, polycyclic aromatic hydrocarbons (PAH), and glycols[‡]. The pollutants analyzed in each selected community will be specified in the monitoring plan and will be based on information on local sources and historical data if available.

In addition to the above noted SNAPS-specific monitoring activities, data gathered from CARB and local district operated State and Local Air Monitoring Station (SLAMS) or special purpose monitoring (SPM) sites may be used to augment or provide additional data for decision making purposes.

[‡] *Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species, and the availability of suitable sampling/analytical equipment.*

A6.3 – Community Monitoring Site(s)

This program is designed so that each monitoring plan meets the following objectives:

1. Provide air pollution data to the general public in a timely manner.
2. Evaluate effectiveness of data to determine air quality-related cumulative health impacts on communities near petroleum sources.

To meet the two monitoring objectives, each monitoring trailer must be sited so that it is capable of sampling and measuring the air in a way in which the resulting data are representative of the area and appropriate for informing the public and program managers about various aspects of air quality. Staff will make an effort to meet and comply with the siting requirements established in regulations (Appendix E of Title 40, Part 58 of the CFR.) However, this may not be possible due to site availability, obstructions, or other factors.

The SNAPS Program may need to employ additional monitors or utilize additional data due to (1) the complexity of the terrain, (2) meteorology, (3) geographic size of region, (4) adjacent monitors, (5) pollutant formation mechanisms, (6) distribution of emissions and (7) quality control requirements.

Regulatory SLAMS instruments may be used to support monitors in the SNAPS Program.

SECTION A7 - QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data Quality Objectives

Data quality objectives (DQOs) 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.

To ensure data quality, bias/drift are calculated using zero/precision checks for gas monitors and the GC-FID instrument, and the flow rate checks for particulate matter monitors and samplers is used as a proposed metric. Table A.4 outlines all acceptance criteria, audit schedules, and reference materials for SNAPS measurements. It should be noted that all data quality objectives are subject to change based on real-world field conditions.

Table A.4 – Routine QC Checks for SNAPS DQOs

Pollutants	Test	Audit schedule	Acceptance criteria for accuracy/precision	References
Continuous Measurement				
O_3	Zero/precision	Bi-weekly	Zero < 5 ppb; precision drift <7.1% of the calibration point	EPA QA Handbook
H_2S	Zero/precision	Bi-weekly	Zero < 5.1 ppb; precision drift <10.1% of the calibration point	EPA QA Handbook
$CH_4/CO/CO_2$	One-point standard check	Monthly	CH_4< 3 ppb; CO <50 ppb; CO2 < 0.5 ppm	Instrument Specifications
VOCs (PAMS mixture)	One-point standard check	Daily	Less than 20% from the calibration point	MLD SOP 066
$PM_{2.5}$	Flow check	Bi-weekly	Less than 4% of the set flowrate check	MLD NLB SOP 055
Black carbon	Flow check	Bi-weekly	Less than 4% of the set flowrate check	AQSB SOP 400
Discrete Sample				
PAHs (TO-13)	Flow check	Prior and after each sampling period	10% of the set flowrate check	EPA TO-13A
Carbonyls	Flow check	Semi-annual	5% of the set flowrate check	AQSB SOP 801
Glycols*	Flow check			
Metals	Flow check			
VOCs (MLD058 compounds) and sulfur containing compounds	Flow check	Semi-annual	5% of the set flowrate check	AQSB SOP 805

* Please see Table B.4 for each Pollutant SOP.

*DQOs displayed here are proposed for the monitoring in Lost Hills.

Table A.5 shows data completeness targets for all collected data at several time intervals. Data completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. Completeness will be assessed by reviewing field and laboratory data logs and field and laboratory logbooks to ensure that all data are validated within specified DQOs.

Table A.5 – SNAPS Data Completeness Targets

Completeness Target	Relevant to
75% of minute data	5-minute average data
75% of 5-minute data	1-hr average data
75% of hourly data	24-hr daily average data
75% of daily data	Monthly or quarterly average data

In developing DQOs, there are certain measurement quality objective (MQO) indicators that are important to determining uncertainty and reducing errors. All DQOs follow the formal seven step DQO process for the development of an experimental design to meet criteria specified by stakeholders in the decision, based on U.S. EPA QA/G-4, *Guidance for the Data Quality Objectives Process* (U.S. EPA, 1994 - https://www.epa.gov/fedfac/guidance-systematic-planning-using-data-quality-objectives-process), and in Section 3 of the *Quality Assurance Handbook for Air Pollution Measurement Systems* (U.S. EPA, 2011 - https://www3.epa.gov/ttn/amtic/qalist.html).

CARB will adopt DQOs previously developed by the U.S. EPA (e.g., all criteria pollutants, BTEX), and apply developed DQOs for the remaining SNAPS pollutants following U.S. EPA guidelines where appropriate. DQOs will differ based on the pollutant monitored and the equipment utilized. DQOs for non-routine or screening equipment will be routinely evaluated and may be updated as additional experience and data is available. The specific initial DQOs for the SNAPS pollutants can be found in the applicable pollutant SOP located in Section B2 – Monitoring Methods of this QAPP.

For requirements of gaseous criteria pollutants, please see the Gaseous QAPP which can be found on the Quality Management Document Repository website at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository. For continuous PM2.5 data, precision is determined by routine flow rate verification measurements. Please see the PM QAPP located at the Quality Management Document Repository: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality.

SECTION A8 – SPECIAL TRAININGS AND CERTIFICATIONS

A8.1 – Personnel Qualifications

All Program 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 Program staff will receive on-the-job training from AMTS management and senior program staff. A duty statement is developed for each position and a plan for achieving performance objectives is included in an employee development plan. Each new staff member will read and adhere to all Program relative Manuals and SOPs applicable to the position for which they have been hired.

A8.3 – Ongoing Training and Continuing Education

Training needs are assessed on a continual basis by section managers. Each new staff member will be evaluated periodically after initial hire by the appropriate section manager. 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. Additionally, CARB encourages staff to participation in available and relevant training provided by outside agencies such as equipment manufacturers and U.S. EPA.

SECTION A9 – DOCUMENTS AND RECORDS

CARB and SNAPS Program staff generate and maintain a variety of quality management related documents and records. Documents include QAPPs, SOPs, quality control forms, technical bulletins, acceptance test procedures and other program documents and records. Data records include ambient air monitoring data and laboratory analysis results, sample reports, strip charts, and maintenance records and the Laboratory Quality Control Manual.

Effective document management includes a system for generating, updating, maintaining, and disseminating quality management related documents and records. All available documents for CARB SNAPS Program can be found on the SNAPS website. The procedures described below are those followed by SNAPS Program staff 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 and ISD to incorporate a new document, revision or addendum to an existing document (i.e.,

QAPP, SOP, etc.) into the document control system. Only authorized personnel are granted access to edit or modify documents.

SNAPS Program staff within MLD and ISD will be responsible for maintaining a database of all current SNAPS Program quality management related documents. These documents can be found on the SNAPS website.

CAMB is responsible for maintaining a database of quality control documents related to the operation and maintenance of the community air monitoring program (SOPs, field maintenance forms, technical bulletins, acceptance test procedures, ambient air quality data, etc.). These documents are accessible through the SNAPS website.

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, the Department of General Service's (DGS) Records Retention Schedule, or more stringent criteria as required by specific programs. As a general rule, CARB retains documents and records for a period of three years before transferring them to DGS for long term archiving.

A9.3 – SNAPS Program Document Tracking

The documentation format utilized by SNAPS Program 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. 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. The SNAPS Program can utilize the CARB addendum process to describe program specific modifications to the quality management documents. These addendums will be retained with the parent document under the Program section of the CARB Document Repository.

Naming of all other SNAPS documents will have an informative title, SNAPS community name (or abbreviation), and date of last major edits. Documents will be stored on the Oil and Gas and Greenhouse Gas Mitigation Branch drive within the Industrial Strategies Division. The file system will be a hierarchy of folders to store monitoring plans, calibration data, monitoring data, etc.

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 SNAPS website, which is available to CARB personnel and the general public. The contents of the webpages are reviewed on a regular basis, and CARB management is 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 – Archiving of CARB Document and Records

Archiving of quality management documents and records is the responsibility of the Program section generating the document or record. Documents that are created and shared by multiple sections are maintained and archived by CAMB and all reports and records will be maintained by ISD. 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. Quality management documents are archived in digital format unless hardcopy originals are 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 Program staff 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 Program staff. Hardcopy documents and records are archived on-site at CARB facilities or at an off-site secure storage facility contracted by CARB.

Table A.6 lists CARB's QA/QC record keeping, general laboratory, and air monitoring record keeping requirements. CARB implements a data management system for processing data streams from the continuous instruments. CARB has implemented a laboratory information data system for data centralization and sample tracking which can be found on the Laboratory QC Manual at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf .

Table A.6 – Data Record Formats 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	SNAPS Website: https://ww2.arb.ca.gov/our-work/programs/study-neighborhood-air-near-petroleum-sources
SOPs	Current version of all SOPs	Electronic	https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air
Performance Evaluations and Audits	Results of internal and external assessments	Electronic	QAS Audit Information System
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	Program staff; Online Instrument Manuals: https://www.arb.ca.gov/airwebmanual/instrument_manuals/index.php
Calibration Certificates and Records	Includes certificates for gases and other chemicals used for calibration	Hardcopy	Program staff; accompanying instruments
QC Records	Results of instrument blanks, calibrations, standard recoveries, and replicate precision	Hardcopy	Program staff; CARB Headquarters

Document Name	Brief Description	Format	Storage Location
Raw Data Records	Results of instrument analyses (including supporting data that are not uploaded to the database)	Electronic	Stored by CDMS

SECTION B1 – GENERAL SAMPLING PROCESS DESIGN

The SNAPS Program is designed so that sampling, instrument operation and siting criteria procedures and measurement data quality meet Program requirements and Program objectives. For a complete description of the general sampling process design, please refer to the individual monitoring plan for each specific site which can be found on the SNAPS website.

SECTION B2 – MONITORING METHODS

A description of the specific monitoring and analyses methods will be included in the monitoring plan developed for each specific site. These monitoring plans can be found on the SNAPS website.

This section identifies the monitoring methods and associated instrument SOPs for monitors that may be operated by SNAPS personnel during the SNAPS Program. SOPs document methods for analyzing ambient concentrations of air pollutants and include a list of required equipment to measure target pollutants, identify support facilities, and also describe the operation, maintenance, and repair of equipment. They also provide details regarding duties/responsibilities for field operators and QC needed to satisfy monitoring requirements.

The pollutants described in the SNAPS QAPP are analyzed using continuous monitors and discrete media based sampling and analysis. Discrete samples are collected in the field and then transported to a laboratory for analysis. Below is a brief description of the principal of operations for the primary oil and gas non-criteria pollutant monitor types operated in the SNAPS Monitoring Program. For each criteria pollutant, please see the appropriate QAPP at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository. More information on the principles of operation can be found in the SOPs and operation manual for each instrument. The manuals can be found at: https://www.arb.ca.gov/airwebmanual/instrument_manuals/index.php and the Laboratory SOPs can be found at: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air .

On-site Methods

The gaseous and particulate SNAPS pollutants directly measured in the field can be found in Table B.1. The meteorological parameters for the on-site methods can be found in Table B.2.

TABLE B.1 – On-Site Pollutant Methods

Analyte[1]	Principle of Measurement[2]	Manufacturer	Model
Black carbon	Abs. Spec.	Met One	BC-1054
$PM_{2.5}$	Beta-ray Attenuation	Met One	BAM 1020
H_2S/SO_2	UV Fluorescence	Teledyne	API 101
$CH_4/CO_2/CO$	CRDS	Picarro	2401
O_3	UV Abs. Spec.	Teledyne	API T400
Metals	XRF	Xact	625i
PAMS mixture	GC-FID	Markes-Thermo	Air Server-unity & 1300

1. PAMS = photochemical assessment monitoring station, PM = particulate matter
2. Abs. = absorption, CRDS = cavity ring-down spectroscopy, FID = flame-ionization detection, GC = gas chromatography, MS = mass spectrometry, Spec. = spectroscopy, UV = ultraviolet, XRF = X-ray fluorescence

Table B.2 – On-Site Meteorological Condition Measurements

Variable[1]	Principle of Measurement[2]	Manufacturer	Model
WS	Ultrasonic	RM Young	81000
WD	Ultrasonic	RM Young	81000
Barometric Pressure	Piezo-Resistance	Met One	597
RH - Ambient	CRDS	Picarro	2401
RH - Ambient	Thermistor Resistance	Met One	597
T - Ambient	Pt Resistance	Met One	597
T - Trailer	Thermocouple	Hampshire	T° Sentry Model 140

1. RH = relative humidity, T = temperature, WD = cardinal wind direction, WS = wind speed
2. CRDS = cavity ring-down spectroscopy, Pt = Platinum

Laboratory Methods

Discrete samples will be collected for a wide range of compounds. After field sampling, discrete samples will be transported to a laboratory for analysis. Analytes measured via discrete samples and respective laboratory methods for each compound are listed in Table B.3.

Table B.3 – Discrete Analytes and Laboratory Methods

Analyte[1]	Principle of Measurement[2]	Sampling Media[3]	Analytical Method
Carbonyls	HPLC-UV Abs. Spec.	DNPH cartridge	CARB MLD-022
Glycols [a]	GC-FID	XAD-7 tube	NIOSH 5523
Total Metals	XRF	Teflon™ filters	CARB MLD-034
Cr6+ [a]	Ion Chromatography	Cellulose filters	CARB MLD-039
Mercaptans	GC-Chemiluminescence	Canister or Tedlar bag	ASTM D5504
PAHs/SVOCs	GC-MS	PUF	EPA TO-13A
VOCs	GC-MS	Summa Canister	CARB MLD-058

1. Cr6+ = Hexavalent Chromium, PAH = polycyclic aromatic hydrocarbons, VOC = volatile organic compounds
2. Abs. = absorption, FID = flame-ionization detection, HPLC = high=performance liquid chromatography, GC = gas chromatography, MS = mass spectrometry, Spec. = spectroscopy, UV = ultraviolet, XRF = X-ray fluorescence
3. DNPH = 2,4-Dinitrophenyl Hydrazine, PUF = polyurethane foam, XAD = polymeric resin
a = Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species, and the availability of suitable sampling/analytical equipment.

Further detail for the SNAPS pollutants and analytical methods can be found in SOPs and technical documents. Please see Table B.4 for the specific SNAPS pollutant SOPs and their relative technical documents.

Table B.4 – SNAPS Pollutant SOPs and Technical Documents

Pollutant	SOP#	Location of SOP documents
On-site measurement		
Ozone	AQSP SOP 002	https://www.arb.ca.gov/airwebmanual/
PM	AQSP SOP 400	
Hydrogen Sulfide	CAMB SOP 360	https://ww2.arb.ca.gov/resources/documents/study-neighborhood-air-near-petroleum-sources-snaps-monitoring-documents
VOCs (auto GC)	CAMB SOP 260	
Carbon Monoxide, Carbon Dioxide, Methane	CAMB SOP 261	
Metals (Auto XRF)	CAMB SOP 450	
Black Carbon	CAMB SOP 250	
Discrete sample		
Toxic Sampler	CAMB SOP 850	https://ww2.arb.ca.gov/resources/documents/study-neighborhood-air-near-petroleum-sources-snaps-monitoring-documents
Carbonyls	MLD 022	https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air
Metals – XRF*	MLD 034	
VOCs	MLD 058	
Cr6+	MLD 039	

Contract Laboratory		
Glycols*	NIOSH 5523	https://www.cdc.gov/niosh/docs/2003-154/pdfs/5523.pdf
PAHs	TO-13	https://www3.epa.gov/ttnamti1/files/ambient/airtox/to-13arr.pdf
Sulfur Containing Compounds	ASTM D 5504-12	https://www.astm.org/Standards/D5504.htm

***** *Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species and the availability of suitable sampling/analytical equipment.*

Instrument SOPs contain technical instructions for Program monitoring site operators. In the event of a deviation from the procedures or other issues, appropriate documentation of action will be made. One time procedural changes should be documented in the data record. Permanent or recurring changes should be recorded in an addendum to the SOP, which would then be approved by Program management. Table B.5 is a list of initial equipment and supplies used during the SNAPS Program. Additional information can be found on the SNAPS website.

Table B.5 – SNAPS QA Equipment

Manufacturer	Model	Parameter	Principle of Operation
Alicat	MWB-20SLPM-D	Mass Flow Rate	Differential Pressure
Alicat	MWB-2SLPM-D	Mass Flow Rate	Differential Pressure
Alicat	MWB-500SCCM-D	Mass Flow Rate	Differential Pressure
Alicat	MWB-20SCCM-D	Mass Flow Rate	Differential Pressure
BGI	deltaCal	PM2.5 Sample Flow Rate	Venturi Differential Pressure
BGI	deltaCal	Ambient Temperature	Thermistor Resistance
BGI	deltaCal	Barometric Pressure	Pressure Transducer
Sabio	2010D	Response Calibration	Dilution using Mass Flow Controllers
Teledyne	701H	Response Calibration	Compression/Purification of Ambient Air
Dwyer	475-0 Mark III	Hi-Vol Flow Rate	Differential Pressure

Thermo Andersen	Lo Hi Vol	Hi-Vol Flow Rate	Critical Orifice
Thermo Scientific	GLD Pro	Gas Leak Detector	Electrical Conductivity

Standard Operating Procedures for SNAPS pollutant instruments are available in Table A, on the MLD Air Monitoring Web Manual website at: https://www.arb.ca.gov/airwebmanual/index.php and the SNAPS website.

Mobile Monitoring

The mobile monitoring vehicle is equipped with instrumentation to measure CH_4, CO_2, CO, BTEX, a global positioning system (GPS), and a video camera to record the vehicle's location and surroundings. All real time data are collected using a data logger which synchronizes data from the GPS and instruments into a central file that can be used for data analysis. The mobile monitoring vehicle is also capable of collecting grab samples for more comprehensive analytical analyses as needed. The instruments installed on mobile monitoring vehicle are listed in Table B.6.

Table B.6 – Mobile Vehicle Monitoring Parameters

Parameter	Analyzer	Measurement Method
Methane, Carbon dioxide, Carbon monoxide	Picarro G2401	CRDS
BTEX (Benzene, Toluene, Ethylbenzene, Xylenes)	Tricorn GC-PID	GC-PID
VOCs (Grab samples)	GC-MS	MLD 058

SECTION B3 – SAMPLE HANDLING AND CUSTODY

Gaseous, particulate matter and meteorological parameters may be sampled using either continuous or discrete sampling methods. Continuous sampling instruments test and record sample results in real time and require no additional sample handling or custody forms. Discrete instruments collect samples on various media, which must then be handled and transported to a laboratory for analysis.

B3.1 – Sampling Media Hold Time and Temperature Requirements

General sample media SOPs stipulate specific time frames and environmental conditions for the collection and storage of discrete samples at various stages in the sampling program. If these time frames and conditions are not met, samples may be flagged or invalidated. Our current policy is to analyze any viable sample and allow data users to invalidate as appropriate. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample media, or anything else which may come in contact with the sample media.
The sample handing conditions of the discrete analytes studied in the SNAPS Program can be found in Table B.7. Refer to applicable SOPs for additional sample handling procedures for each Program pollutant which can be found in Table B.4, Page 30, of this QAPP.

Table B7 – Discrete Analyte Sample Handling Conditions

Analyte	Method Reference	Sample Media	Analytical Technique	Sample Duration	Holding Time
PAH	EPA TO-13A	PUF/XAD	GC/MS	24 hours	7/40 day analysis
Carbonyls	CARB MLD-022	DNPH silica gel tube	HPLC/UV	24 hours	14 days at 4°C, 30 day analysis
VOC	CARB MLD-058 & MLD-066	Canister	GC/MS	Grab or 24 hours	30 days
Sulfurs	CARB ASTM-D5504	Canister	GC – Chemiluminescence	24 hours	5-7 days
Metals	CARB MLD-034	Teflon Filters	XRF	24 hours	Stored at 0-4°C, indefinite
Glycols	NIOSH 5523	XAD-7 tube	GC/FID	0.5 + 2.0 L/min for total max 60L	28 days at 5°C

B3.2 – Chain of Custody Requirements

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

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

Laboratory staff shall sign and date the COC indicating the laboratory has received the sample and is now responsible for sample control and custody. All completed, signed, and dated COCs shall be stored and archived appropriately according to program needs or requirements.

It is expected that any analysis performed by a contract laboratory providing support for the SNAPS Program will be conducted under similar controls as described in the relevant sampling media SOP.

B3.3 – Security

Monitoring Site Security

Monitoring stations are secure sites which are kept locked when CARB personnel are not present. Locked fencing and security cameras are additionally used where possible. The trailers will be equipped with Global Positioning Systems (GPS) to track any unauthorized movement. Only authorized CARB representatives have access to the site keys. Personnel activity at CARB sites are documented in the station logbooks. Computer access and security at the monitoring sites is discussed in detail in Section B8.

Any monitoring site break-in occurrences are logged by the site operator and reported in a timely manner to program management. In addition, California Highway Patrol is notified and requested to complete a report on such an incident.

Laboratory Security

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

MLD site building entrances are monitored with cameras and protected by a security system that alerts police to potential break-ins. Unauthorized access or break-ins are reported to police and all incidences are documented.

Laboratory data is stored on computers and in the Laboratory Information Management System (LIMS). Access to LIMS is managed by the LIMS administrator, and data access privileges are provided based on staff duties and needs. Computer and LIMS access and security is discussed in detail in Laboratory QC Manual at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf and in section B8 in this QAPP.

It is expected that any analysis performed by a contract laboratory providing support for the SNAPS Program will be done under similar controls as described in the relevant sampling media SOP.

SECTION B4 – QUALITY CONTROL

Monitoring for criteria pollutants at stationary monitoring sites will be performed in accordance with the criteria described in the applicable gaseous and particulate matter QAPPs, instrument or method SOPs, and the Laboratory QC Manual. The gaseous and PM QAPPs can be found on the CARB website at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality. The Laboratory QC Manual can be found at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf. These same criteria will be used as guidelines for determining data quality for criteria pollutants monitored in the SNAPS trailers. Preliminary quality control criteria for non-criteria pollutants will be described in the applicable SOPs, see Section B2, Table B.4, and will be evaluated, and possibly updated, periodically as more experience and data are available.

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

For SNAPS instruments, CARB conducts QC checks using a variety of techniques. For gaseous pollutants these may include automated or manual calibration system checks to confirm Program instruments' ability to respond to known concentrations of pollutants. In addition, these QC checks are used to generate control charts to assess instrument drift and verify that instruments are operated within acceptable control limits.

For particulate matter pollutant instruments, flow rate checks are performed periodically to confirm that reliable, accurate flow rates and total flow are obtained. These QC checks should ideally be performed using calibration equipment and standards separate from those used for the multi-point calibration. Flow rate QC checks are not used to make any adjustments to analyzers. Doing so will invalidate the multi-point calibration of

the instrument. In addition, ambient data are not invalidated solely based on automated QC check results. Please see specific SOPs for further details of gaseous and PM pollutants.

The degree of variability in each of these measurements is computed as the precision of those instruments' measurements. Routine QC checks should be performed using calibration equipment and standards separate from those used for the multi-point calibrations whenever possible (refer to section A7 for more details). Station operators, air monitoring management, and data reviewers monitor the results of these checks and will take action if the results fall outside of acceptable limits.

Quality Control Limits

To assess the quality of QC checks, CARB has established QC limits for routine analyses (warning, action and upper/lower limits) based on the results of automated QC checks. See applicable QAPPS and Laboratory QC Manual as mentioned in the beginning of Section B4. CARB has also developed advisory limits for non-routine analyses, which will be evaluated and updated as necessary based on additional experience and data. Please see the links to applicable SOPs, Table B.4 on Page 31.

The goal is to generate data that is comparable to regulatory data, considering the potential challenges of semi-permanent monitoring, when using the same method. All data which is produced by on-site measurements will be reviewed daily. After daily review, any data outliers or abnormal diurnal trends will be investigated and corrective action performed to address any anomalous data. 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 should 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. This process is discussed further in Section B6.

Performance of the instruments may be further validated or assessed via the performance evaluation program for gaseous and particulate matter pollutants. Details of this program are discussed in the QAPP, Section D1.

Pollutant instruments used in the Program should be maintained within environmentally controlled shelters, as applicable, with the shelter temperature and humidity checked daily. The acceptable range for monitoring shelters is typically between 20°C and 30°C for regulatory programs. However, per manufacturers' specifications, many analyzers have been tested, qualified, and designated to operate at wider temperature ranges. To assess the allowable operating temperature of an instrument a wider range may be used if specified by the manufacturer. Should the operating temperature range of instruments be exceeded, it is important to closely evaluate other instrument diagnostic

parameters. If it is determined that data is valid, but collected when operating temperature limits are exceeded, data should be flagged to indicate the issue. 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. The program will try to meet these goals, but may not always be able to do so.

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 and the monitoring plan for each selected community.
For particulate matter pollutant instruments, flow rate checks may be performed monthly, or more frequently, to confirm that reliable, accurate flow rates and total flow are obtained. Station operators, air monitoring management, and data reviewers monitor the results of these checks and will take action if the results fall outside of acceptable limits.

The response of the thermal desorption GC-FID will be checked using zero air and VOC standards. If the response of the zero air and/or VOC standards do not meet established acceptance criteria for two consecutive days, the instrument will be diagnosed, repaired, and a new calibration will be conducted, as required.

The response of the ozone and hydrogen sulfide gas monitors will be checked using zero air and gas standards on a biweekly schedule. CH4, CO and CO2 instrument responses will be checked monthly. If the zero/span response does not meet established acceptance criteria, corrective actions will be performed and the instrument will be recalibrated.

The sampling flow rate, temperature, and pressure of instruments measuring the mass of atmospheric particles will be checked biweekly. If the measured sampling flow rate does not meet established acceptance criteria, the instrument will be diagnosed and corrected. Following the diagnosis, calibrations will be performed.

On-site particle instruments will have sampling tape checks bi-weekly and the filter tapes will be replaced as needed. The cylinder pressure of helium and nitrogen used for GC instruments will be checked bi-weekly. The water level of the hydrogen generator will also be checked bi-weekly.

While reviewing data against validation criteria, data is expected to be reported as initially measured or invalidated. Adjustments based on QC checks are not intended to correct data previously collected at the monitor, which would be considered post-processing of the data. The implementation of a comprehensive corrective action system 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 Program required control limits appropriate action will be taken and a corrective action process will be employed as needed.

B4.1 – Precision and Bias

A check of instrument diagnostic data and concentration data will be performed during each site visit. Additionally, flow rate QC check information and error messages will be reviewed and addressed. Additional info on these routine service checks can be found in the individual instrument SOPs, listed in QAPP, Section B4.
When method acceptance limits are exceeded, SNAPS Program operators will begin the process of evaluating the situation and developing an appropriate corrective action, including an instrument verification and calibration process. This process is discussed in QAPP, Section B5. Since frequent adjustments to instruments can cause additional uncertainty, certain tolerances have been developed. As long as the instrument is within these tolerances or acceptance criteria, adjustments do not need to be made.

B4.2 – Laboratory QC

The Laboratory Quality Control samples and criteria are discussed in the applicable SOP and Laboratory QC Manual available, respectively, at:
https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air and at
https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf .

SECTION B5 – 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. Calibrations will be conducted with instruments having independent National Institute of Standards and Technology (NIST) traceable standards and adhere to established acceptance criteria.

Prior to implementation of any ambient air monitoring or laboratory activities, in support of the SNAPS Program, SNAPS pollutant monitoring instruments are required to be calibrated against known concentrations of pollutant standards where appropriate. Once an instrument's calibration relationship is established, periodic calibration verifications 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 SNAPS air monitoring program, all instruments used in the Program must be calibrated:

- During initial installation and at the prescribed frequency outlined in the applicable equipment SOP,
- Following physical relocation,
- Prior to instrument shut-down,
- After any major maintenance or repair,
- After an instrument has drifted outside of acceptable QC limits.

CARB has the responsibility to perform timely certification, calibration, and verification activities for all equipment. The SNAPS Program has the responsibility to utilize these services in order to maintain properly calibrated instruments to generate accurate and defensible data. All necessary calibration methods, applications, and frequencies are outlined within individual instrument SOPs (Table B.4), the Gaseous QAPP, and the PM2.5 QAPP. Both the Gaseous and PM2.5 QAPP can be found at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository.

SECTION B6 – INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

CARB uses various types of instruments in support of air monitoring activities, which include both field and laboratory instrumentation. To ensure data collected by SNAPS Program instrumentation is valid, credible and defensible, it is critical to properly test, inspect, and maintain air monitoring instrumentation.

B6.1 – Acceptance Testing and Inspection

CARB has documented processes for acceptance testing, inspection and maintenance of equipment used in its SNAPS Program. Acceptance testing is performed on newly purchased equipment prior to deployment to verify that equipment meets purchase or performance specifications. The testing is performed by trained staff and generally includes a physical inspection, operational checks, performance checks, and configuration for use.

Acceptance criteria for field and continuous instrumentation are defined in acceptance test procedures located on the SNAPS website. Equipment returning from a vendor or following major on-site repair may undergo an abbreviated acceptance test procedure, prior to deployment as appropriate. For laboratory instrumentation, acceptance procedures are described in the Laboratory QC Manual which can be found at this link: https://www.arb.ca.gov/aaqm/sop/nlbqcm.pdf.

B6.2 – Maintenance

Monitoring and analytical equipment used by SNAPS Program are generally designed

to operate without major maintenance or repair 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 continuous monitors and laboratory instrumentation 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 as established by the SNAPS Program staff. Clear documentation of instrument maintenance is required to confirm instrumentation operation, to aid in troubleshooting, and assist with data validation.

Maintenance procedures specific to SNAPS Program operations are listed in detail in the instrument SOPs referenced in Section B4. 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 on the SNAPS website. A list of initial supplies for the SNAPS Program can be found in Table B.5 in this QAPP and in the Laboratory SOPs at: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air .

For specific maintenance frequency, duration and milestones for SNAPS Program equipment, please see the laboratory specific SOPs listed above.

For preventative maintenance task and frequency please refer to the applicable pollutant SOPs which can be found in QAPP, Section B2, and on the CARB website at https://www.arb.ca.gov/airwebmanual/index.php .

SECTION B7 – 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. Item and service requirements are typically based on program or project needs. SNAPS will maintain a max/min supply of frequently used spare parts and consumable materials through our MLD warehouse operations.
Air monitoring supplies and consumables are directed to Program staff for inspection, acceptance, and inventorying. Parts and supplies are inventoried and tracked in a computer database in order to ensure continuous operation of the SNAPS Program.

Acceptance criteria for supplies and consumables are 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 SNAPS Program staff.

MLD maintains a supply of certified gas standards for performance evaluations and

equipment verification. These gas standards are supplied and certified by the vendor in accordance with specified Traceability Protocol for Assay and Certification of Standards. Information, including ID number, Standard composition and concentration, certification expiration date are entered into the appropriate database. This database is maintained by the applicable operational section and available to SNAPS Program staff.

SECTION B8 – DATA MANAGEMENT

Data management describes the overall process for analytical data generation, review, and reporting. Laboratory, field, and management staff are all integral parts of data management. Air quality data measurements made by SNAPS field and laboratory instrumentation are captured by CARB's data acquisition and management systems. At the time of this writing, the data acquisition system is a PC based variation of the CARBLogger system. Data management will be accomplished using the Community Data Management System (CDMS) and the Laboratory Information Management System (LIMS) for automated and laboratory data, respectively. A more in-depth description of these data management systems can be found in the Laboratory QC Manual at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf

B8.1 – Data Acquisition

SNAPS obtains information from four different data sources: on-site measurements, MLD laboratory analysis, offsite laboratory analysis, and mobile monitoring.

- On-site measurements include any measurements made with instruments designed to run autonomously. Instruments, except for auto GC, used for on-site measurements will be connected to CARBLogger and sent to the Community Data Management System (CDMS) in Data Management System (DMS) pipe delimited format. For on-site measurements made with auto GC, no direct data ingest will take place by CARBLogger because the identification and quantification of targeted compounds measured by auto GC require confirmation by CARB staff. CARBLogger therefore will be used to automate data export. The follow-up analysis will be conducted by CARB staff to confirm the measurements.
- Offsite laboratory analysis includes the collection of canister or filter samples from monitoring sites and physically shipping the media to laboratories (both MLD operated and contractor operated). In the case of MLD laboratory analyses, an automated mechanism will be implemented to aggregate and transfer data directly from LIMS into CDMS. Pending feedback from the MLD laboratory, results from contractor laboratories may or may not be transmitted in a similar fashion. All laboratory data will be uploaded to CDMS once it is delivered to MLD.
- Mobile monitoring includes special analysis methods and rapid data streams which report parameter values and GPS coordinates in a continuous fashion.

Unlike other systems, this data will be reported by the CODAS system directly to CDMS.

The following datagram, Figure B.1, describes the overall system command and data acquisition system and illustrates the SNAPS data management from one trailer and one mobile monitoring station.

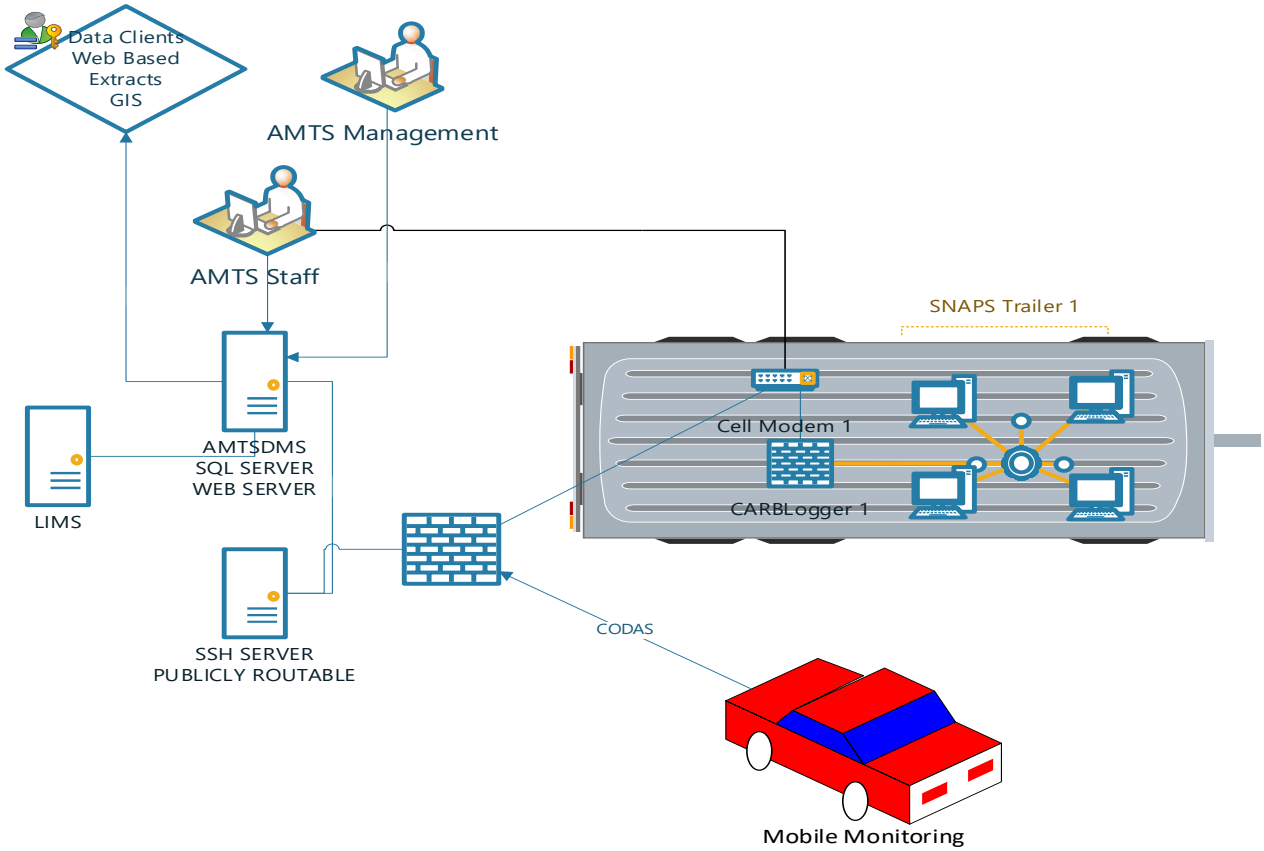

Figure B.1 – SNAPS Data Management

This data management system can be expanded to accommodate the needs to deploy more trailers and platforms if necessary. The SNAPS trailer and mobile platform will each have dedicated cell modem for network connectivity. This network connectivity allows AMTS staff to remotely connect to each platform, administer instrumentation, and for data to be transmitted back to AMTS staff using four primary mechanisms.

1) Unix Secure Copy Protocol (SCP) or Secure File Transfer Protocol (SFTP) will be used to pull data from each trailer (on a public network) into the CARB network for CDMS ingest.

2) Secure Shell(SSH) will allow AMTS staff to remotely connect to CARBLogger Data Acquisition and control/interact with their instrumentation.
3) Emails from GMAIL will be sent to CARB based email addresses for diagnostic alerts, until such time that an SMS gateway is contracted.
4) Data from mobile platforms will be directly streamed to CDMS via CODAS.

Instrument-specific data acquisition mechanisms are detailed in Table B.8. All data produced by on-site continuous measurements are uploaded to the Community Data Management System (CDMS) for review. Deployed GC instrumentation will be remotely programmed and operated using the CARBLogger as a terminal proxy. Chromatograms generated from these runs will be transmitted back to CARB where staff will complete their analysis using vendor specific software (i.e., Chromeleon), the results of which will be stored inside the CDMS system.

Table B.8 – Instrument Specific Data Acquisition Mechanisms

Instrument/Method	Data Acquisition	Timing and Data Acquisition Protocol
API T101 H2S Analyzer	CARBLogger Platform	NTP, Synchronous, ModBUS over Privately Addressed Ethernet
API T400 Ozone Analyzer	CARBLogger Platform	NTP, Synchronous, ModBUS over Privately Addressed Ethernet
Hampshire Indoor Temperature Sensor	CARBLogger Platform	NTP, Synchronous, Serial
Met One BAM 1020 PM2.5	CARBLogger Platform	NTP, Synchronous, Serial
Met One Aethalometer	CARBLogger Platform	NTP, Synchronous, Serial
Picarro G2401	CARBLogger Platform	NTP, Synchronous, file sharing over Privately Addressed Ethernet
RMYoung 81000 Met Sensor	CARBLogger Platform	NTP, Synchronous, Serial
Thermo-Markes auto GC	Chromeleon	NTP, Synchronous, Real Time Streaming to CDMS over Cell Modem
TO13A PAH Analysis	CARB LIMS to CDMS	Asynchronous, Post Analysis Manual Transmission and Entry from MLD laboratory, Direct to CDMS
Metals Analysis (XRF)[a]	CARB LIMS to CDMS	Asynchronous, Post Analysis Manual Transmission and Entry from MLD laboratory, Direct to CDMS

Glycols-NIOSH 5523[a]	CARB LIMS to CDMS	Asynchronous, Post Analysis Manual Transmission and Entry from Contract laboratory, Direct to CDMS

[a] *Measurement of the analyte(s) will be dependent on local emission sources, initial field measurements of other related chemical species and the availability of suitable sampling/analytical equipment.*

B8.2 – Data Management for Discrete Sampling

Data generated by CARB's laboratory from discrete samples is managed by a Laboratory Information Management System (LIMS), which is password protected with controlled access to authorized users only. Data processed by LIMS is stored in a database and managed through front end LIMS software. Other software is utilized along with LIMS to aid in data reporting and electronic data transfer. The database automatically backs up data files onto the server on a weekly basis. In addition, the database is in ARCHIVELOG mode meaning that changes made within the database are archived, rather than overwritten. This ensures that all committed transactions can be recovered in the event of an operating system failure.

LIMS hardware and software are managed in-house by the system administrator. The database includes trace files, which are used to ensure acceptable performance as required. Trace files contain a log produced by the database debugger program. The log includes a record of errors found and corrective action taken. The log runs automatically and sends an email notification to the system administrator when errors occur. In addition, the system administrator manually checks trace files on a weekly basis. The LIMS database information including additional functionality, accessibility and security can be found in its entirety in the Laboratory QC Manual at https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf .

LIMS also facilitates the recording, verification and validation, transmittal, reduction, analysis, management, storage, retrieval, and reporting of analytical data generated by the laboratory. LIMS is maintained by the LIMS administrator.

LIMS administrator creates and/or modifies approved laboratory staff access to LIMS; creates and modifies LIMS methods, data templates and transfers, and data reports; and is able to modify data in LIMS.

All sample and analysis information shall be entered into LIMS or recorded in bound or electronic notebooks. Changes to any data in LIMS must be made by authorized individuals only. Management's approval may be required.

It is expected that any information or data generated by SNAPS Program staff in support of the SNAPS Program will incorporate a similar data review, verification, and validation process with comparable detail and intensity as described in this section and in the SNAPS Monitoring Plan.

B8.3 – Data Security

The following security assurances have been put in place:

- Data Fidelity will be ensured by (where possible) maintaining backup copies of data at various phases in the data collection process. Most data producers will retain data internally. This data will in turn be collected by the data acquisition system, time stamped, and stored in raw text and/or database format. This data is subsequently summarized and emailed to the site operator. After initial automated QC checks have been performed, data is reported to CDMS where it is reviewed by the operator, averaged, interpolated (if needed) and reported to data clients. Any changes made on CDMS are recorded inside the CDMS chain of custody. At any point in time, any of these data steps (Figure B.2) can be retraced to prove data fidelity.

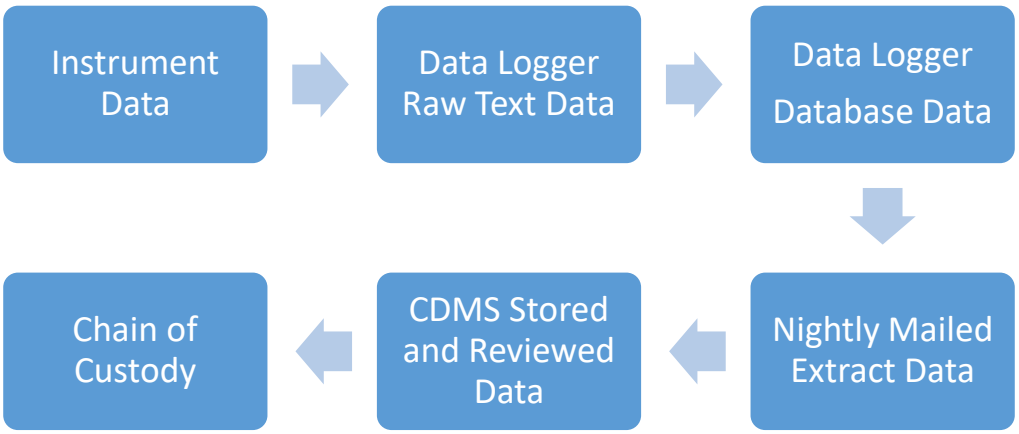

Figure B.2 – Data Review Process

- Data Privacy is safeguarded by requiring account access privileges to access the CDMS system, and the data acquisition systems upstream.
- Data Logger security will follow the due diligence of using a firewall, updating public facing applications, running antivirus, periodic log review, and external inspection by IT security.

SECTION C1 – DATA REVIEW, VERIFICATION AND VALIDATION

The SNAPS program collects real-time pollutant values and discrete samples from areas near petroleum sources. The goal of the SNAPS data collection activities is to collect data of sufficient quantity and quality to meet the goals of the Program. This information is outlined in individual instrument SOPs, the document 'Standard Operating Procedures for Data Review and Validation', Method SOP 610 and the Laboratory QC Manual.

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.

C1.1 – Data Review

The SNAPS 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 and in applicable SOPs. The objectives reviewed include data capture (amount of discrete and continuous 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.

Method SOP 610 – Data Review and Validation – may be used as a guidance for the specific steps utilized in the SNAPS Program data review and validation process for continuous data and are located in the Data Acquisition and Quality Control Section of the AirWeb Manual website at: https://www.arb.ca.gov/airwebmanual/. The steps of the method for discrete samples are detailed in the Laboratory QC Manual and individual SOPs located at: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air. In all cases, data validation procedures should be documented. The following is a summary of items a SNAPS monitoring operator should be aware of in order to perform a data review:

- Preliminary data available near real time
- Monthly concentration variations associated with SNAPS 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 SNAPS pollutant parameter to another

The following data review steps ensure timely identifications of performance issues for field or laboratory activities:

- Frequent review of zero/span/precision and other QC checks indicating performance shifts
- Frequent review of mobile and stationary (discrete and continuous) data
- Frequent review of automated CDMS and CARBLogger emails for indications of alarm conditions
- Daily monitoring and recording of abnormal local events which may impact data quality or completeness
- Review of graphical data displays for recognition of data spikes
- Review of data reporting to ensure completeness criteria are met
- Inspection of sample collection media before and after sampling to identify possible issues of concern
- Comparison of data against historical or expected results

It is expected that any information or data generated by a contract laboratory in support of the SNAPS Program will incorporate a similar data review, verification, and validation process with comparable detail and intensity as described in this section.

C1.2 – Automated Data Quality Control

Automated data quality control is programmed into the overall data transmission process (on the instrument, the data logger, or the CDMS) so that data from faulty instruments are not automatically included into otherwise valid data streams. Operational states of an instrument which result in automatic data flagging, or data qualifiers to be assigned by CARBLogger, CODAS, or alternative data flagging

mechanisms occur when:

1) An instrument has been running outside the manufacturer or CARB specified tolerances. For instance, if the instruments box temperature exceeds the maximum allowable temperature range.
2) An operator has been performing maintenance on the instrument or sampling system, precluding validity of the data being collected. CARBLogger has a menu of flags an onsite operator can choose to apply to data generated at the time of their service call.
3) The instrument or system is in a state of calibration.
4) "Sticking values" commonly caused by instrument malfunction will be automatically flagged invalid.
5) Values above or below the theoretical range of the instrument will be flagged invalid.

Data flagging will not preclude an operator or manager from reviewing and marking data valid at a later time if deemed appropriate. All changes of data flagging states, however, will be recorded into the CDMS data chain of custody for future inspection.

C1.3 – Manual Data Review

Manual data review involves the human review of all data for anomalous behavior that may or may not be reflected by contrary diagnostic parameters. Using tools provided by CDMS, the operator may look for the diurnal patterns of pollutants and wind direction fluctuations to ensure that the instrument appears to be functioning nominally. An example is given in Figure B.3.

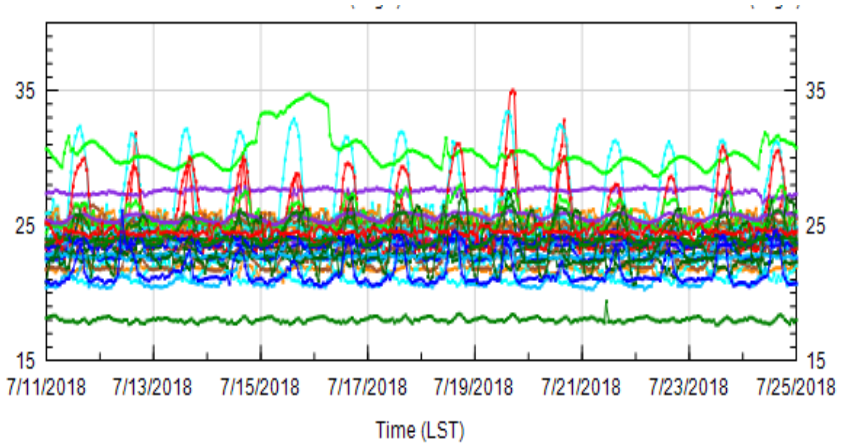

Figure B.3 – Diurnal temperature fluctuations can be quickly assessed to identify areas for improvement. The air conditioning system for the station with the light green trace, for instance, is having AC problems which could be repaired prior to data loss.

The community data management system will allow site operators and supervisors to confirm the overall functioning of the trailer, as well as individual instruments.

Unless otherwise determined by management, all data will receive two levels of technical review by the site operator and site calibrator, and one level of management review prior to data release. Upon final review, the data will be locked and reviewed for data reporting.

SECTION C2 – VERIFICATION AND VALIDATION METHODS

The SNAPS Program has a multi-level data review process which incorporates the concept of review, verification, and validation. A summary of the process, review levels and staff positions typically responsible for the review of the SNAPS pollutant data can be found in the Monitoring Plan. These review levels should be completed, documented, and submitted to the next level of review according to the data reporting schedule.

For a description of the separate review levels followed for continuous data please see Section 13 – Data Analysis and Interpretation, of the Monitoring Plan, on the SNAPS website. For additional information see Section 14.8 – Data Review and Approval, of the Laboratory QC Manual, at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf and see SOP 610, Data Review and Validation, on the AirWeb Manual website at: https://www.arb.ca.gov/airwebmanual/ .

C2.1 – 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 and the initial reviewer will inform the second level reviewer to determine if follow up actions are needed (i.e., calibrations, etc.). First level reviewers should view QC data daily, if possible.

If encountering an issue, a second level reviewer will contact the site 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 site logbook and maintenance check sheet and also documented in the corrective action on CDMS's Editor's Notes only if data is affected. Second level reviewers should view QC data daily, if possible, and weekly, at a minimum, and follow up by reviewing the Monthly Calibration Control Chart webpage to confirm that the edits were incorporated into CDMS.

There are several tools that may be used to correct the data already submitted as final: 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 and in the Quality Assurance Manual, Volume 1, Section 9: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-manual.

C2.2 – LIMS Verification and Validation

There are separate review levels followed for the laboratory analysis of discrete samples by CARB. The data review and approval process consists of a series of checks to ensure the analytical data generated by the laboratory and transferred to LIMS meets all the method specific QC criteria. The multi-step process includes at a minimum, analyst review, peer review, then management review and approval prior to submittal to clients. All levels of review and approval are initialed and dated on the data package and/or document. Finalized and approved data may be amended in LIMS per management approval. After the request is approved, lab staff and management must follow the data review and approval process. If changes to the finalized data are made, the client must be notified and sent a revised report.

The laboratory data review process is described in the Section 14.8, Data Review and Approval, of the Laboratory QC Manual, which can be found at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf.

LIMS has been programmed to automatically verify and validate data entered into the database. Any data outside QC criteria is highlighted for analyst, peer, and management review and comment. QC parameters programmed into LIMS come from federal regulations, QCM, and SOPS. All programming has been tested and verified by the LIMS administrator.

It is expected that any information or data generated by a contract laboratory in support of the SNAPS Program will incorporate a similar data review, verification, and validation process with comparable detail and intensity as described in this section.

SECTION D1 – ASSESSMENT AND RESPONSE ACTIONS

The information in this section, along with the information available on the SNAPS Program website, provides an overview of the SNAPS compliance status with the assessment and response of state and local requirements.

D1.1 – Quality Assessment and Quality Control

CARB's quality assurance program is comprised of quality assessment and quality control activities. Quality assessment is a set of external tasks that are performed outside of normal routine operations to provide certainty that the quality assurance system is generating data of sufficient quantity, quality, and meets or exceeds all

applicable requirements. Quality assessment is independent from the data generation activities. Quality control activities are internal tasks that are performed during sample collection, handling, analysis, and data reporting to ensure data accuracy and precision. For additional CARB Quality Control information please see the Northern Laboratory QC Manual at: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf .

For the SNAPS Program, AMTS is responsible for quality control which includes instrument calibration and 1 point QC checks and to oversee the program objectives. QAS and QMS perform various quality assessment activities to verify that the data collected comply with procedures and can be considered good quality data and data of appropriate quality for its end use. Quality assessment activities are achieved through various audits and data quality assessments which are independent from the ambient air monitoring program responsibilities and appropriate quantity for the end user.

AMTS Program monitoring staff will review data and take corrective action when the results exceed Program requirements. These processes are explained in further detail in QAPP, section D2.

D1.2 – Monitoring Station Audits

Please see audit SOPs at: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-performance-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 applicable requirements. Audits are conducted by using independent NIST traceable standards and adhere to established acceptance criteria.

For CARB's regulatory ambient air monitoring network, 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.

Please see Table D.1 below for the audit acceptance criteria for SNAPS pollutants.

Table D.1 – SNAPS Pollutant Audit Acceptance Criteria (Accuracy)

Instrument/Criteria	Control Limit	Warning
Gaseous Analyzers (Criteria and Non-Criteria, except Ozone)*	± 15%	± 10%
Ozone Analyzers*	± 10%	± 7%
PM2.5 (Filter Based, Continuous)	± 4% of Transfer Standard ± 5% from Design flow rate	None
ATEC Sampler	± 10%	± 7%

* Audit levels 1 and 2 are subject to the following acceptance criteria based on EPA guidance:
  - For O3, and NO2: ± 1.5 ppb difference or ± 15 percent difference, whichever is greater.
  - For CO: ± 0.03 ppm difference or ± 15 percent difference, whichever is greater.

* Annual Performance Evaluations are operational criteria, and exceedances (especially at lower levels) do not automatically invalidate the data.

** Criteria based on data usage

QAS conducts through-the-probe (TTP) audits for continuous gaseous analyzers to meet applicable requirements. TTP audits of the gaseous analyzers, which monitor for criteria pollutants and hydrogen sulfide, are conducted in accordance with Program requirements. 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 Program requirements. Many of the siting challenges result from the presence of vegetation or other

obstructions. The height of any obstacles and vegetation above probe height inlets is also determined.

QAS will perform sampler flow audits on continuous PM2.5 samplers for the SNAPS Program. NIST traceable flow measurement instruments will be used to compare the sampler's measured and actual flow rate. Flow audits will be conducted as required by Program needs using independent certified equipment.

QAS will document situations where audit, quality control, or siting goal are not met. Below is a link to the Gaseous QAPP which has the applicable SOPs describing performance and siting audit acceptance criteria and frequencies: https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality .

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

D1.3 – Performance Audit Assessment

QAS may conduct similar performance audit assessments for the SNAPS parameters. Specific procedures, frequencies and acceptance criteria would be determined as additional experience and data is available.

D1.4 – Performance Audit Report Summary

Each of CARB's permanent air monitoring stations is audited by QMB. The information provided in the audit contains 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. Similar information may be available for trailer locations utilized in the SNAPS Program

The results of CARB audits and audit reports are available internally. A similar process for audit information in the SNAPS Program may be available for mobile monitoring trailer locations as well.

It is expected that quality assessment, quality control and performance audit procedures performed by QAS and the SNAPS Program staff will incorporate similar methods and requirements with comparable detail and intensity as described in this section.

D1.5 – Troubleshooting

During a performance audit, if a parameter fails to meet audit acceptance criteria a corrective action request may be issued to the site operator.

For CARB's regulatory monitoring network, an Air Quality Data Action (AQDA) process is utilized. An 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 based upon review of field calibrations or audit results that show air monitoring equipment operating outside required control limits or not meeting appropriate siting conditions. A further description of the AQDA process can be found in Section 9, of the Quality Assurance Manual, at: https://www.arb.ca.gov/aaqm/qa/pqao/repository/qmp_final.pdf.

Other issues identified outside of the audit process, but which may still impact or potentially impact data quality will be documented and the site operator(s) will be informed. The objective of this 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, this process improves data quality and ensures compliance with Program requirements.

It is expected that SNAPS Program staff will follow similar guidance in corrective action procedures as described in the Quality Assurance Manual and correction action notice (CAN) SOPs. For a detailed description of the CAN process please see the CAN SOP in Appendix AN, of the Air Monitoring Quality Assurance Manual, Volume V, at: https://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/vol5.htm.

SECTION D2 – REPORTS TO MANAGEMENT

In addition to CARB's oversight responsibilities of the SNAPS program, CARB will prepare periodic reports. CARB will compile a final report for each community, which includes validated data collected within each community. This report may include analysis and interpretation of the data, and may provide attempts to determine sources and/or source categories contributing to the measured pollutant concentrations.

Other reports, such as progress updates (i.e., newsletters, bulletins) may be issued by CARB, and would be tailored to each community's specific needs.

Additionally, CARB will develop a Program Data Quality Report on a bi-monthly basis to provide a summary of the quality of measurement data in quantifiable terms. The program specific report may present an overview of various QA/QC activities, in relation to measurement quality objectives established for the Program. The report may focus primarily on the precision and bias/accuracy of measurements from the monitoring

trailers and the amount of related data collected and reported. A summary of data quality statistics will be available in a final report which is expected to be released approximately six months following the end of each selected site's monitoring cycle.

SECTION D3 – RECONCILIATION WITH USER REQUIREMENTS

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

The DQA process requires a familiarity of the DQOs and sample design goals when reviewing data reports. The information listed in Section D2, Reports to Management, will be used to make this assessment.

It should be noted that either achieving or not achieving measurement DQOs does not equate to certainty that every decision will lead to a correct decision. 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 SNAPS Program staff is scientifically valid and of sufficient quality and quantity to meet or exceed all applicable requirements. It is the responsibility of Program Management to ensure that CARB's mission and policies as specified in this document are followed. This is accomplished by implementation and management of a Program that emphasizes and promotes continuous quality improvement, utilizes a consistent process of assessing the Program quality system, encouraging recommendations, identifying and implementing improvements to the Program 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 the SNAPS Program through routine meetings, conference calls, 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).

APPENDICES

Appendix 1 – Glossary of Terms

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents.

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (Quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned operations and whether these operations are implemented effectively and are suitable to achieve objectives.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of Custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective Action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Data of known quality — Data that have the qualitative and quantitative components associated with their derivation documented appropriately for their intended use, and when such documentation is verifiable and defensible.

Data Quality Assessment (DQA) — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA Process include: 1) reviewing the DQOs and sampling design, 2) conducting a preliminary data review, 3) selecting the statistical test, 4) verifying the assumptions of the statistical test, and 5) drawing conclusions from the data.

Data Quality Indicators — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy, comparability, completeness, representativeness.

Data Quality Objectives (DQO) — The qualitative and quantitative statements derived from the DQO Process that clarify a study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

- state the problem,
- identify the decision,
- identify the inputs to the decision,
- define the boundaries of the study,
- develop a decision rule,
- specify tolerable limits on decision errors, and
- optimize the design for obtaining data

DQOs are the qualitative and quantitative outputs from the DQO Process.

Design — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Distribution — 1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; 2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document — Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Environmental conditions — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Holding time — The period of time a sample may be stored prior to its required analysis.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Laboratory Information Management Systems (LIMS) — A database used to record and store sample information and analytical results as well as perform workflow and data tracking and reporting.

Management System — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

National Institute of Standards and Technology (NIST — An agency of the U.S. Department of Commerce. The Material Measurement Laboratory is a metrology laboratory within NIST that serves as the national reference laboratory for measurements in the chemical, biological, and material sciences. NIST supplies industry, academia, government, and other users with Standard Reference Material (SRM).

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Organization structure — The responsibilities, authorities, and relationships, arranged in a pattern, through which an organization performs its functions.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Performance Evaluation — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Precision — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation.

Quality Assessment — The overall system of activities whose purpose is to provide assurance that the quality control activities are done effectively. It involves a continuing evaluation of performance of the production system and the quality of the products produced.

Quality Assurance — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client. It consists of two separate but related activities, quality control and quality assessment.

Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Program Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

Quality Control — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring the results are of acceptable quality.

Quality Control Sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intralaboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality Management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) — A formal document that describes the quality system in terms of the organization’s structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality System — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

Reporting Limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Sample Media — Air sampling is done to capture a sample of the contaminants present within the air. The container or substrate used to capture the air sample is the sample media. Membrane filters made of cellulose, glass fiber, quartz fiber, Teflon© or polytetrafluoroethylene (PFTE), etc., sorbent tubes containing charcoal, silica gel, tenax, XAD, etc., and containers such as flasks, canisters (summa polished or silco lined). tedlar bags, etc., are all examples of sample media.

Sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Standard – (Calibration or Control Standard) — a substance or material with properties believed to be traceable with sufficient accuracy to permit its use to evaluate the same property of another. It is a solution or substance commonly prepared by the analyst to establish a calibration curve or the analytical response function of an instrument.

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Traceability — The ability to trace the source of uncertainty of a measurement or a measured value through an unbroken chain of comparisons.

Validation —The process by which a sample, measurement method, or a piece of data is deemed useful for a specific purpose.

Sources:

CARB Northern Lab QCM
https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf

CARB QA Manual Volume 5
https://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/v5apxy.pdf?_ga=2.49986466.561973974.1548715571-12075214.1541712919

APPENDIX 2 – CDMS AUTO QC ROUTINE VALUES

The CDMS Auto QC Routine Values are found in the AirNow and DMS tables below.

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
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 CARB implemented in DMS which is a deviation from AIRNow QC Criteria.

DMS Auto-QC Criteria

Parameter	Duratio	QC Check	Start	End	Value	Data	QC Code	Description
Ozone	1 Hr	Range (<)	0	23	-5		43- Value below	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	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
O3 Box	1 Hr	Range (>)	0	23	39.		32-Shelter Temp	Flags hourly O3 value if box temp more than 39.9

Parameter	Duration	QC Check	Start Hou	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	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
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 -4		43- Value below MDL	Flags values < negative MDL
BAM(1)	1 Hr	Range (>)	0	23	700		9 - Invalid	Flags hourly values > Value as invalid
BAM(1)	1 Hr	Sticking	0	23	0	4	5 - Suspect	Will flag if hourly value same for 4 consecutive hours
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 limits	Flags BAM_FEM values if Qtot > .703 m3/min
Qtot(2)	1 Hr	Range (<)	0	23	<.600		40-Sample flow out of limits	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 limits	Flags BAM values if Qtot > .700 m3/min
Qtot (3)	1 Hr	Range (>)	0	23	>.837		40-Sample flow out of limits	Flags BAM values if Qtot > .837 m3/min

(1) This includes BAM25, BAM25_a, b,c (collocated BAMs), BAM25_FEM, BAMPMC,
(2) Applies to BAM25 FEM samplers
(3) Applies to Non-FEM BAM25 samplers

REMINDER: When copying QC checks from sites, Verify POC settings within QC Checks.

Source:

AQSB SOP 606
https://www.arb.ca.gov/airwebmanual/aqsbdocs1/AQSB%20SOP%20606%20(Data%20Management%20System).pdf

APPENDIX 3 – CALCULATIONS FOR PRECISION AND BIAS

Calculations for Precision and Bias – Gas/PM QAPP

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

Data Quality Indicators Calculated for Each Measured Criteria Pollutant

Pollutant	Gaseous Assessments (Precision or Bias)	One-Point Flow Rate Bias Estimate	PM2.5 Bias	Semiannual Flow Rate Audits	Precision Estimate from Collocated Samples
O3	Precision Estimate/ Bias Estimate				
SO2	Precision Estimate/ Bias Estimate				
CO	Precision Estimate/ Bias Estimate				
PM2.5		One-Point Flow Rate	Bias Estimate, including PEP	Semi-Annual Flow Rate	Precision Estimate

Gaseous Criteria Precision and Bias Assessments

Applies to: CO, O3, SO2

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.**

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 40 CFR Pt. 58, App. A, Section 4, “Calculations for Data Quality Assessment”. For each single point check, calculate the percent difference, di, 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 or the audit instrument being used in the Annual Performance Evaluation.

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

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

where χ2 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 SO2, O3, 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; *t0.95,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 *di*'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 *di*'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 (*di*'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).

Precision Estimates from Collocated Samples

Applies to: PM2.5

40 CFR, Part 58, Appendix A References:

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

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

Minimum Concentration Levels for Particulate Matter Precision Assessments

Pollutant	Minimum Concentration Level (in µg/m^3)
PM2.5	3

Precision is aggregated at the monitoring organization level quarterly, annually, and at the 3-year level. For each collocated data pair, the relative percent difference, d_i, is calculated by Equation 6.

Equation 6

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

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

The precision upper bound statistic, CV_{ub}, is a standard deviation on d_i with a 90 percent upper confidence limit (Equation 7).

Equation 7

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

where, n is the number of valid data pairs being aggregated, and $\chi^2_{0.1,n-1}$ is the 10th

percentile of a chi-squared distribution with n-1 degrees of freedom. The factor of 2 in the denominator adjusts for the fact that each d_i is calculated from two values with error.

PM2.5 Bias Assessment

Applies to: PM2.5

40 CFR Part 58 Appendix A Reference:

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

The bias estimate is calculated using the Performance Evaluation Program (PEP) audits described in CFR, section 4.1.3 of Part 58, Appendix A. The bias estimator is based on upper and lower probability limits on the mean percent differences. The mean percent difference, *D*, is calculated by Equation 8 below.

Equation 8

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

Confidence intervals can be constructed for these average bias estimates in Equation 9 of this document using equations 9 and 10 below:

Equation 9

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

Equation 10

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

Where, $t_{0.95,df}$ is the 95th quantile of a t-distribution with degrees of freedom $df=n_j-1$ and s_d is an estimate of the variability of the average bias and is calculated using Equation 11 below:

Equation 11

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

Flow Rate Audits (Semi-Annual)

Applies to: PM2.5, PM10-2.5

40 CFR Part 58 Appendix A References:

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

The flow rate audits are used to assess the results obtained from the one-point flow rate verifications and to provide an estimate of flow rate acceptability. For each flow rate audit, calculate the percent difference in volume using Equation 12 of this Appendix where meas is the value indicated by the sampler's volume measurement and audit is the actual volume indicated by the auditing flow meter.

Equation 12

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

To quantify this annually at the site level and at the 3-year primary quality assurance organization level, probability limits are calculated from the percent differences using equations 13 and 14 of this document where m is the mean and k is the total number of one-point flow rate verifications for the year

Equation 13

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

Equation 14

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

where, m is the mean (equation 15):

Equation 15

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

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 16) as follows:

Equation 16

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

References for Bias

(2) EPA Requirements for Quality Management Plans. EPA QA/R-2. EPA/240/B-01/002. March 2001, Reissue May 2006. Office of Environmental Information, Washington, DC 20460. *http://www.epa.gov/quality/agency-wide-quality-system-documents* .

(3) EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations. EPA QA/R-5. EPA/240/B-01/003. March 2001, Reissue May 2006. Office of Environmental Information, Washington, DC 20460. *http://www.epa.gov/quality/agency-wide-quality-system-documents* .

(4) EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards. EPA-600/R-12/531. May, 2012. Available from U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Research Triangle Park NC 27711. *http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=245292* .

(5) Guidance for the Data Quality Objectives Process. EPA QA/G-4. EPA/240/B-06/001. February, 2006. Office of Environmental Information, Washington, DC 20460. *http://www.epa.gov/quality/agency-wide-quality-system-documents* .

(6) List of Designated Reference and Equivalent Methods. Available from U.S. Environmental Protection Agency, National Exposure Research Laboratory, Human Exposure and Atmospheric Sciences Division, MD-D205-03, Research Triangle Park, NC 27711. *http://www3.epa.gov/ttn/amtic/criteria.html* .

(7) Transfer Standards for the Calibration of Ambient Air Monitoring Analyzers for Ozone. EPA-454/B-13-004 U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, October, 2013. *http://www3.epa.gov/ttn/amtic/qapollutant.html* .

(8) Paur, R.J. and F.F. McElroy. Technical Assistance Document for the Calibration of Ambient Ozone Monitors. EPA-600/4-79-057. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, September, 1979. *http://www.epa.gov/ttn/amtic/cpreldoc.html* .

(9) Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 1—A Field Guide to Environmental Quality Assurance. EPA-600/R-94/038a. April 1994. Available from U.S. Environmental Protection Agency, ORD Publications Office, Center for Environmental Research Information (CERI), 26 W. Martin Luther King Drive, Cincinnati, OH 45268. *http://www3.epa.gov/ttn/amtic/qalist.html* .

(10) Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program Quality System Development. EPA-454/B-13-003. *http://www3.epa.gov/ttn/amtic/qalist.html* .

(11*)* National Performance Evaluation Program Standard Operating Procedures. *http://www3.epa.gov/ttn/amtic/npapsop.html* .

e-CFR, Title 40, Part 58, Appendix A

Appendix 4 – Target Analyte List

This is a list of possible Target Analytes selected for monitoring in the SNAPS Program and the applicable measurement method. Measurements of samples may be discrete, on-site or both.

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
Benzene	x							x					
Ethylbenzene	x							x					
Styrene	x							x					
Toluene	x							x					
Xylene (o)	x							x					
Xylenes (m & p)	x							x					
1,1,1-Trichloroethane	x												
1,3-Butadiene	x												
Acetone	x												
Acetonitrile	x												
Acrolein	x												
Acrylonitrile	x												
Bromomethane	x												
Carbon tetrachloride	x												
Chloroform	x												
cis-1,3-Dichloropropene	x												
Dichloromethane	x												
Ethanol	x												
Freon 11	x												
Freon 113	x												
Freon 12	x												
Perchloroethylene	x												
trans-1,3-Dichloropropene	x												
Trichloroethylene	x												
Vinyl chloride	x												
2-Methylnaphthalene		x	x										
Acenaphthene		x	x										
Acenaphthylene		x	x										

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
Anthracene		x	x										
Benzo[a]anthracene		x	x										
Benzo[a]pyrene		x	x										
Benzo[b]fluoranthene		x	x										
Benzo[g.h,i]perylene		x	x										
Benzo[k]fluoranthene		x	x										
Chrysene		x	x										
Dibenz[a,h]anthracene		x	x										
Fluoranthene		x	x										
Fluorene		x	x										
lndeno[1,2,3-cd]pyrene		x	x										
Naphthalene		x	x										
Phenanthrene		x	x										
Pyrene		x	x										
1, 3-Dichlorobenzene			x										
1,2,4-Trichlorobenzene			x										
1,2-Dichlorobenzene			x										
1,4-Dichlorobenzene			x										
2,4,5-Trichlorophenol			x										
2,4,6-Tribromophenol			x										
2,4,6-Trichlorophenol			x										
2,4-Dichlorophenol			x										
2,4-Dimethylphenol			x										
2,4-Dinitrophenol			x										
2,4-Dinitrotoluene			x										
2,6-Dinitrotoluene			x										
2-Chloronaphthalene			x										
2-Chlorophenol			x										
2-Fluorobiphenyl (Surr)			x										
2-Fluorophenol			x										
2-Methylphenol			x										
2-Nitroaniline			x										
2-Nitrophenol			x										

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
3 & 4 Methylphenol			x										
3,3'-Dichlorobenzidine			x										
3-Nitroaniline			x										
4,6-Dinitro-2-methylphenol			x										
4-Bromophenyl phenyl ether			x										
4-Chloro-3-methylphenol			x										
4-Chloroaniline			x										
4-Chlorophenyl phenyl ether			x										
4-Nitroaniline			x										
4-Nitrophenol			x										
Benzoic acid			x										
Benzyl alcohol			x										
Bis (2-chloroisopropyl) ether			x										
Bis(2-chloroethyl)ether			x										
Bis(2-ethylhexyl) phthalate			x										
Bis(2-chloroethoxy)methane			x										
Butyl benzyl phthalate			x										
Dibenzofuran			x										
Diethyl phthalate			x										
Dimethyl phthalate			x										
Di-n-butyl phthalate			x										
Di-n-octyl phthalate			x										
Hexachloro-1,3-cyclopentadiene			x										
Hexachlorobenzene			x										
Hexachlorobutadiene			x										
Hexachloroethane			x										
lsophorone			x										
Nitrobenzene			x										
N-Nitrosodimethylamine			x										
N-Nitrosodi-n-propylamine			x										
N-Nitrosodiphenylamine			x										
Pentachlorophenol			x										
Phenol			x										

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
Aluminum				x									
Antimony Compounds				x									
Arsenic				x									
Barium				x									
Bromine				x									
Calcium				x									
Chlorine				x									
Chromium				x									
Cobalt				x									
Copper				x									
Iron				x									
Lead				x									
Manganese				x									
Mercury				x									
Molybdenum				x									
Nickel				x									
Phosphorus				x									
Potassium				x									
Rubidium				x									
Selenium				x									
Silicon				x									
Strontium				x									
Sulfur				x									
Tin				x									
Titanium				x									
Vanadium				x									
Yttrium				x									
Zinc				x									
1,3-Butylene glycol					x								
Diethylene glycol					x								
Ethylene glycol (or 1,2-ethanediol)					x								
Propylene glycol					x								
Tetraethylene glycol					x								

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
Triethylene glycol					x								
Acetaldehyde						x							
Formaldehyde						x							
Methyl Ethyl Ketone, MEK (or 2-Butanone)						x							
Hydrogen Sulfide							x					x	
2,5-Dimethylthiophene							x						
2-Ethylthiophene							x						
3-Methylthiophene							x						
Carbon Disulfide							x						
Carbonyl Sulfide							x						
Diethyl Disulfide							x						
Diethyl Sulfide							x						
Dimethyl Disulfide							x						
Dimethyl Sulfide							x						
Ethyl Methyl Sulfide							x						
Ethyl Mercaptan							x						
lsobutyl Mercaptan							x						
lsopropyl Mercaptan							x						
Methyl Mercaptan							x						
n-Butyl Mercaptan							x						
n-Propyl Mercaptan							x						
tert-Butyl Mercaptan							x						
Tetrahydrothiophene							x						
Thiophene							x						
PM2.5									x				
Black Carbon										x			
Carbon dioxide											x		
Carbon monoxide											x		
Methane											x		
Ozone													x
1,2,3-trimethylbenzene								x					
1,2,4-trimethylbenzene								x					

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
1,3,5-Trimethylbenzene								x					
1-Butene								x					
1-Hexene								x					
1-Pentene								x					
2,2,4-trimethylpentane								x					
2,2-dimethylbutane								x					
2,3,4-trimethylpentane								x					
2,3-dimethylbutane								x					
2,3-dimethylpentane								x					
2,4-dimethylpentane								x					
2-Ethyltoluene (or o-Ethyltoluene)								x					
2-methylheptane								x					
2-methylhexane								x					
2-methylpentane (isohexane)								x					
3-Ethyltoluene (or m-Ethyltoluene)								x					
3-methylheptane								x					
3-methylhexane								x					
3-methylpentane								x					
4-Ethyltoluene (or p-Ethyltoluene)								x					
Acetylene (or ethyne)								x					
Butane (or n-Butane)								x					
Cis-2-butene								x					
cis-2-pentene								x					
Cumene (or Isopropylbenzene)								x					
Cyclohexane								x					
Cyclopentane								x					
Decane (n-Decane)								x					
Diethylbenzene - M (m-Diethylbenzene)								x					
Diethylbenzene - P (p-Diethylbenzene)								x					
Dodecane (or n-Dodecane)								x					
Ethane								x					

	Discrete Samples							On-site Measurements					
Compound Name	MLD058	TO-13 SIM mode	TO-13 Scan mode	XRF	NIOSH 5523	MLD022	ASTM D5504	PAMS	Beta-ray Attenuation	Light Absorption	CRDS	UV Fluorescence	UV Absorption
Ethylene (or Ethene)								x					
Heptane (or n-Heptane)								x					
Hexane (or n-Hexane)								x					
Isobutane (or 2-Methylpropane)								x					
Isopentane (or 2-Methylbutane)								x					
Isoprene (or 2-methyl-1,3-butadiene)								x					
Methylcyclohexane								x					
Methylcyclopentane								x					
Nonane (or n-Nonane)								x					
Octane (or n-Octane)								x					
Pentane (or n-Pentane)								x					
Propane								x					
Propylbenzene								x					
Propylene (or Propene)								x					
Trans-2-butene								x					
Trans-2-pentene								x					
Undecane (or n-Undecane)								x					

Appendix 5 – PAH Summary of Information

Table 1 - US EPA Priority PAHs

PAH	Ring Size	CAS number	PAH	Ring Size	CAS number
Naphthalene	2	91-20-3	Chrysene	4	218-01-9
Acenaphthene	3	83-32-9	Pyrene	4	129-00-0
Acenaphthylene	3	208-96-8	Benzo(a)pyrene	5	50-32-8
Anthracene	3	120-12-7	Benzo(b)fluoranthene	5	205-99-2
Phenanthrene	3	85-01-8	Benzo(k)fluoranthene	5	207-08-9
Fluorene	3	86-73-7	Dibenz(a,h)anthracene	6	53-70-3
Fluoranthene	4	206-44-0	Benzo(g,h,i)perylene	6	191-24-2
Benzo(a)anthracene	4	56-55-3	Indeno[1,2,3-cd]pyrene	6	193-39-5

Table 2 - PAHs with OEHHA values (not on our list of target test analytes for community monitoring.)

PAH	CAS number	Highest Detected Conc. (ng/m^3)	OEHHA Cancer Unit Risk (ug/m^3)	Can be tested	Method
Benzo(j)fluoranthene *#	205-82-3	0.19*	$1.1E^{-4}$	N	-
7,12-Dimethylbenz(a)anthracene *#	57-97-6	0.30*	$7.1E^{-2}$	Y	TO-13 Full Scan
3-Methylcholanthrene *	56-49-5	0.014*	$6.3E^{-3}$	Y	TO-13 Full Scan
5-Methylchrysene &	3697-24-3	-	$1.1E^{-3}$	N	-
5-Nitroacenaphthene	602-87-9	-	$3.7E^{-5}$	N	-
2-Nitrofluorene	607-57-8	-	$1.1E^{-5}$	N	-
Dibenz(a,h)acridine	226-36-8	-	$1.1E^{-4}$	N	-
Dibenz(a,j)acridine	224-42-0	-	$1.1E^{-4}$	N	-
Dibenzo(a,e)pyrene #	192-65-4	0.0019#	$1.1E^{-3}$	Y	TO-13A Method Devolvement
Dibenzo(a,h)pyrene *	189-64-0	0.018*	$1.1E^{-2}$	Y	TO-13A Method Devolvement
Dibenzo(a,i)pyrene *#	189-55-9	0.019*	$1.1E^{-2}$	Y	TO-13A Method Devolvement
Dibenzo(a,l)pyrene *#	191-30-0	0.022*	$1.1E^{-2}$	Y	TO-13A Method Devolvement
7H-Dibenzo(c,g)carbazole	194-59-2	-	$1.1E^{-3}$	N	-
1,6-Dintiropyrene	42397-64-8	-	$1.1E^{-2}$	N	-
1,8-Dinitropyrene	42397-65-9	-	$1.1E^{-3}$	N	-
6-Nitrochrysene	7496-02-0	-	$1.1E^{-2}$	N	-
1-Nitropyrene	5522-43-0	-	$1.1E^{-4}$	N	-
4-Nitropyrene	57835-92-4	-	$1.1E^{-4}$	N	-

Table 3 - Suggested PAHs to test (fund dependent)

PAH	CAS number	Highest Detected Conc. (ng/m^3)	OEHHA Cancer Unit Risk (ug/m^3)	Can be tested	Method
7,12-Dimethylbenz(a)anthracene *#	57-97-6	0.30*	$7.1E^{-2}$	Y	TO-13 Full Scan
3-Methylcholanthrene *	56-49-5	0.014*	$6.3E^{-3}$	Y	TO-13 Full Scan
Dibenzo(a,e)pyrene #	192-65-4	0.0019#	$1.1E^{-3}$	Y	TO-13A Method Devolvement
Dibenzo(a,h)pyrene *	189-64-0	0.018*	$1.1E^{-2}$	Y	TO-13A Method Devolvement
Dibenzo(a,i)pyrene *#	189-55-9	0.019*	$1.1E^{-2}$	Y	TO-13A Method Devolvement
Dibenzo(a,l)pyrene *#	191-30-0	0.022*	$1.1E^{-2}$	Y	TO-13A Method Devolvement

APPENDIX 6 – References for Routine QC Checks of SNAPS DQOs

REFERENCE LIST		
POLLUTANT	**REFERENCE SOURCE**	**WEBSITE LINK**
Black Carbon	CARB AQSB SOP 400 – Met One Instruments Beta Attenuation Mass Monitor (BAM – 1020)	https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring
$CH_4/CO/CO_2$	CARB CAMB SOP – Picarro G2401 Analyzer for CO2/CO/CO4	https://ww2.arb.ca.gov/sites/default/files/2018-12/SOP261%20for%20PICARRO%202401%20%20CO-CO2-CH4.pdf
Carbonyls	CARB AQSB SOP 801 – Xontech Model 924 Sampler	https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring
Glycols	CARB AQSB SOP 801 – Xontech Model 924 Sampler	https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring
H2S	EPA QA Handbook	https://www3.epa.gov/ttn/amtic/qalist.html
Metals	CARB AQSB SOP 801 – Xontech Model 924 Sampler	https://ww2.arb.ca.gov/resources/documents/standard-operating-procedures-ambient-air-monitoring
Ozone	EPA QA Handbook	https://www3.epa.gov/ttn/amtic/qalist.html
PAHs	EPA TO-13A – Determination of Polycyclic Aromatic Hydrocarbons in Ambient Air using GC/MS	https://www3.epa.gov/ttnamti1/files/ambient/airtox/to-13arr.pdf
PM2.5	CARB MLD 055 – SOP for Determination of PM2.5 and PM Coarse Mass by Gravimetric Analysis	https://www.arb.ca.gov/aaqm/sop/mld055.pdf
VOCs (sulfur containing compounds)	CARB SOP MLD 058 – Determination of Halogenated Compounds in Ambient Air by GC/MS	https://www.arb.ca.gov/aaqm/sop/mld058.pdf
VOCs (PAMS mixture)	CARB SOP MLD 066 – Determination of Oxygenates and Nitriles in Ambient Air by GC/MS	https://www.arb.ca.gov/aaqm/sop/mld066.pdf

APPENDIX 7 – REFERENCES

CARB REFEENCES	
Title	**Website Link**
Air Web Manual	https://www.arb.ca.gov/airwebmanual/vol2.php
-Data Review and Validation	https://www.arb.ca.gov/airwebmanual/index.php
-Instrument Manuals and SOPs (Vol 2-AQSB, Vol 3-NLB, Vol 4-QMB)	https://www.arb.ca.gov/airwebmanual/instrument_manuals/index.php
-Ozone SOP and Technical Documents	https://www.arb.ca.gov/airwebmanual/amwmn.php?c=0
Laboratory Equipment SOPs	https://www.arb.ca.gov/aaqm/sop/nlbqcm.pdf
Laboratory QC Manual	https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf
Laboratory SOPs	https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air
Quality Assurance Manual	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-manual
Quality Assurance Manual – Volume I	https://www.arb.ca.gov/aaqm/qa/pqao/repository/qmp_final.pdf
Quality Assurance Manual – Air Monitoring Audit Procedures	https://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/vol5.htm
QA Performance Audits	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-performance-audits
QM Document Repository	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository
QM Document Repository – QMP and QAPP	https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality
SNAPS LIST SERVE	https://www.arb.ca.gov/cc/oil-gas/snaps/snaps.htm#ListServe
SNAPS Program Main Page	https://ww2.arb.ca.gov/our-work/programs/study-neighborhood-air-near-petroleum-sources
State and Federal Ambient Air Quality Standards Table	https://www.arb.ca.gov/research/aaqs/aaqs2.pdf

OTHER REFERENCES	
Title	**Website**
Code Of Federal Regulation, (Appendix E of Title 40, Part 58)	https://www.ecfr.gov/cgi-bin/text-idx?SID=3df9fefa50d07e9173fd9f354eb41328&mc=true&node=pt40.6.58&rgn=div5
U.S. Environmental Protection Agency QA/G-4, Guidance for the Data Quality Objectives Process, U.S. EPA, 1994	https://www.epa.gov/fedfac/guidance-systematic-planning-using-data-quality-objectives-process
U.S. Environmental Protection Agency QAPP Guidance, Guidance for Quality Assurance Project Plans, U.S. EPA QA/G-5, December 2002	https://www.epa.gov/quality/guidance-quality-assurance-project-plans-epa-qag-5
U.S. Environmental Protection Agency, Section 3 - Quality Assurance Handbook for Air Pollution Measurement Systems, U.S. Environmental Protection Agency, 2011	https://www3.epa.gov/ttn/amtic/qalist.html

APPENDIX 8 – WEBSITE LINKS IN SNAPS QAPP

CARB AirWeb Manual: https://www.arb.ca.gov/airwebmanual/vol2.php

CARB AirWeb Manual – Ambient Air Monitoring Instrument Manuals:
https://www.arb.ca.gov/airwebmanual/instrument_manuals/index.php

CARB AirWeb Manual Technical Documents – Ozone SOPs:
https://www.arb.ca.gov/airwebmanual/amwmn.php?c=0

CARB AirWeb Manual MLD Instrument SOPs - Data review and validation:
https://www.arb.ca.gov/airwebmanual/index.php

CARB Document Repository:
https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-management-document-repository

CARB Quality Assurance Manual Main Page:
https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-manual

CARB Quality Assurance Manual, Volume I – Quality Management Plan:
https://www.arb.ca.gov/aaqm/qa/pqao/repository/qmp_final.pdf

Quality Assurance Manual, Volume 1, Section 9 – Performance Audits
https://ww2.arb.ca.gov/our-work/programs/quality-assurance/quality-assurance-performance-audits

CARB Quality Assurance Manual, Volume V, Audit Procedures for Air Quality Monitoring:
https://www.arb.ca.gov/aaqm/qa/qa-manual/vol5/vol5.htm

CARB Quality Management Plans and Quality Assurance Project Plans: Gaseous and PM QAPP
https://ww2.arb.ca.gov/our-work/programs/quality-assurance/qm-document-repository/quality-management-plans-and-quality

CARB Laboratory SOP: https://ww2.arb.ca.gov/laboratory-standard-operating-procedures-ambient-air

CARB Laboratory Quality Control Manual: https://ww2.arb.ca.gov/sites/default/files/2018-10/nlbqcm.pdf

CARB SNAPS ListServe - https://public.govdelivery.com/accounts/CARB/subscriber/new?topic_id=oil-gas

CARB SNAPS Program Main Page - https://ww2.arb.ca.gov/our-work/programs/study-neighborhood-air-near-petroleum-sources

California State and Federal Ambient Air Quality Standards Table and footnotes, Section A5.1, Page 17 - https://www.arb.ca.gov/research/aaqs/aaqs2.pdf

Code of Federal Regulations, Appendix E of Title 40, Part 58 of the CFR. - Siting Requirements Page 19: https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=0f3bfa16342b3e5b858743bbbbdcfa4f&r=PART&n=40y6.0.1.1.6

U.S. EPA, 2011, Section 3 of the Quality Assurance Handbook for Air Pollution Measurement Systems: https://www3.epa.gov/ttn/amtic/qalist.html

U.S. EPA QA/G-4, Guidance for the Data Quality Objectives Process (U.S. EPA, 1994 - https://www.epa.gov/fedfac/guidance-systematic-planning-using-data-quality-objectives-process

U.S. EPA QAPP Guidance for Quality Assurance Project Plans, U.S. EPA QA/G-5, December 2002: https://www.epa.gov/quality/guidance-quality-assurance-project-plans-epa-qag-5