Quality Assurance Project Plan

Air Monitoring & Quality Assurance Program

State of Alaska
Department of Environmental Conservation
Division of Air Quality

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Prepared by Rochele Rodman

July 26, 2023

A. PROJECT MANAGEMENT ELEMENTS

1. QA PROJECT PLAN IDENTIFICATION & APPROVAL

Title: ***Quality Assurance Project Plan for the State of Alaska Ambient Air Quality Monitoring Program***

The attached Quality Assurance Project Plan for the State of Alaska Ambient Air Quality Monitoring Program is hereby recommended for approval and commits the Alaska Department of Environmental Conservation to follow the elements described within.

Alaska Department of Environmental Conservation

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ABBREVIATIONS, TERMS, AND DEFINITIONS

Abbreviation/Term	Definition
AAAQS	Alaska Ambient Air Quality Standards
ADEC	Alaska Department of Environmental Conservation - The department of state government with primary responsibility for management and oversight of provisions of the Clean Air Act, including EPA's National Ambient Air Quality Standards.
Air Quality Index (AQI)	The AQI is an index for reporting daily air quality and what associated health concerns the public should be aware of. The AQI focuses on health effects that might happen within a few hours or days of breathing polluted air. The AQI rates the air quality in 6 steps from good to hazardous.
AMQA	Air Monitoring and Quality Assurance Program of ADEC - Responsible for coordinating all aspects (quality assurance, data collection, and data processing) with respect to ambient air quality and meteorological monitoring of the ADEC Division of Air Quality.
BAM 1020	Met-One Inc. Beta Attenuation Monitor model 1020 continuous monitoring sampler - This sampler can sample for coarse and fine particulate matter.
Criteria Pollutant	Any air pollutant for which the EPA has established a National Ambient Air Quality Standard for regulation under the Clean Air Act.
Coarse particulate matter - PM_{10}	Particulate matter less than or equal to 10 microns in size.
Fine particulate matter - $PM_{2.5}$	Particulate matter less than or equal to 2.5 microns.
Performance Audit	An audit of one or more monitors within a monitoring network using certified calibration standards to evaluate monitor accuracy. Performance audits are conducted by an independent auditor using calibration standards provided by the auditor rather than those that are used for routine precision and accuracy checks. The ADEC QA Officer performs regular performance audits for each criteria pollutant monitored by ADEC.
NAMS	National Air Monitoring Station - The NAMS are a subset of the SLAMS network with emphasis on urban and multi-source areas. There are no current NAMS-designated monitors in the monitoring network.
NAAQS	National Ambient Air Quality Standards
National Performance Audits	A type of audit in which 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 or measurement system. EPA conducts these audits through the National Performance Audits Program (NPAP) for the purpose of establishing nationally comparable measurements.
QAPP	Quality Assurance Project Plan- A plan which identifies data quality goals and identifies pollutant-specific data quality assessment criteria.

QMP	Quality Management Plan - A plan which describes the roles and responsibilities for maintaining a Quality System within a program or organization.
SLAMS	State and Local Monitoring Station - SLAMS consist of a network of roughly 4,000 monitoring stations nationwide. Distribution depends largely on the needs of the State and local air pollution control agencies to meet their respective State Implementation Plan (SIP) requirements. The SIPs provide for the implementation, maintenance, and enforcement of the NAAQS in each air quality control region within a state. The State of Alaska monitoring network currently has eight SLAMS sites for carbon monoxide and PM.
SPMS	Special Purpose Monitoring Station - Special Purpose monitoring stations are not permanently established and can be adjusted to accommodate changing needs and priorities for special studies needed by the State and local agencies. The SPMS are used to supplement the fixed monitoring network as circumstances require.
System Audit	An evaluation of an entire monitoring program including guidance documents, policies and procedures, data and site records, and components of the monitoring network.
T640X	Teledyne Polychromatic Broadband Spectroscopy Light Emitting Diode (LED) continuous mass measurement particulate monitor, PM2.5/PM10/PM Coarse measurements.
$\mu g/m^3$	Micrograms per cubic meter
$\mu g/sm^3$	Micrograms per standard cubic meter

3. DISTRIBUTION LIST

An electronic copy of this Quality Assurance Project Plan for the State of Alaska $PM_{2.5}$ Ambient Air Quality Monitoring Program has been distributed to the individuals listed in **Table A1**. The document is also available via the Department's Division of Air Quality, Monitoring & Quality Assurance Program web page (https://dec.alaska.gov/air/air-monitoring/).

Table A1. Distribution List

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4. PROJECT/TASK ORGANIZATION

This document presents the Quality Assurance Project Plan (QAPP) for the Ambient Air Monitoring and Quality Assurance Program that has been implemented by the State of Alaska. The monitoring program is being administered by the Alaska Department of Environmental Conservation (ADEC). The major responsibility of the ADEC is the implementation of a satisfactory monitoring program which includes an appropriate quality assurance program. It is the responsibility of the ADEC to ensure that the quality assurance programs for the field, laboratory, and data processing phases of the monitoring program are implemented.

The ADEC is organized into five main divisions: Division of Administrative Services (DAS), Air Quality (AQ), Environmental Health (EH), Water Quality (WQ) and Spill Prevention and Response (SPAR). The Commissioner of the ADEC has the overall responsibility for managing these divisions according to stated ADEC policy. The Commissioner delegates the responsibility of QA development and implementation in accordance with ADEC policy to the Division Directors. The responsibility for assuring data quality rests with these Directors and the line management under them.

The organizational structure of the ADEC Division of Air Quality for the implementation of the Ambient Air Quality Monitoring Program is shown in **Figure A1**. **Table A2** lists the specific responsibilities of each significant position within the ADEC Ambient Air Quality Monitoring Program.

Figure A1. Organizational Structure of the ADEC Air Monitoring & Quality Assurance Program

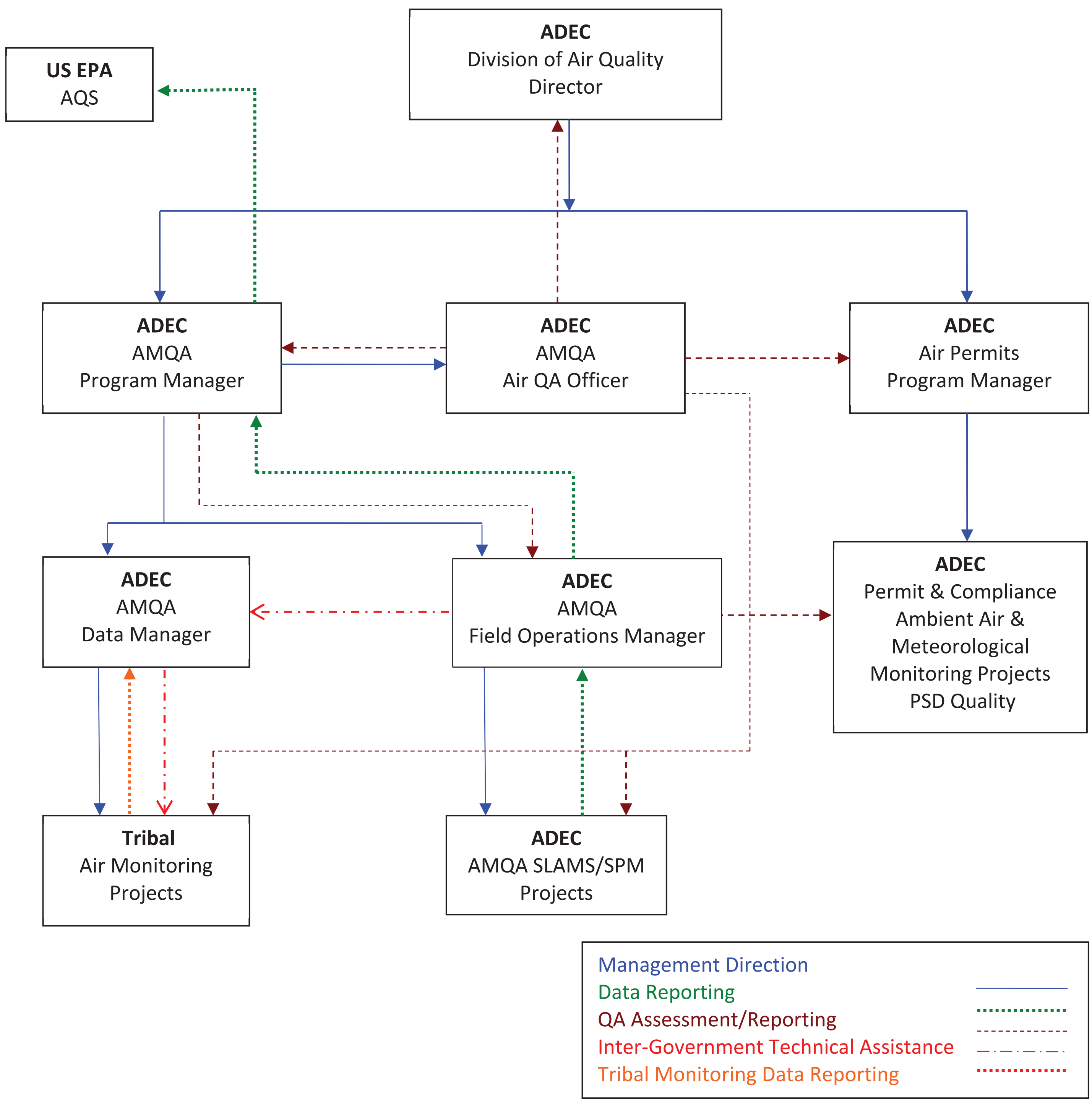


Table A2. ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	Air Quality (AQ)		Director	The Division of Air contains the Air Monitoring & Quality Assurance (AMQA) Program as one of four technical programs. The AMQA Program is responsible for coordinating all aspects (quality assurance, data collection, and data processing) with respect to ambient air quality and meteorological monitoring of the ADEC Division of Air Quality. The Division Director has direct access to the Commissioner on all matters relating to the Division's operation. Responsibilities include: - Oversight of QA activities of AMQA; - Oversight of monitoring network design and review; - Final certification and approval of data submitted to AQS; and - Review for budgets, contracts, grants, and proposals.

Table A2. ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AMQA	Program Manager (EPM 2)	The Air Monitoring Program Manager reports directly to the AQ Division Director and has the overall responsibility for the development and maintenance of the Quality Assurance activities for the AMQA program. Responsibilities include: - Directs the monitoring network design and review process; - Ensures that reviews, assessments and audits are scheduled and completed at the appropriate times; - Ensures that environmental data collection activities are covered by appropriate QA planning documentation; - Directs and assists in the implementation of QAPPs, work plans, contracts, reports and resource allocation, and ensures that monitoring personnel follow the QAPPs; - Ensures that a QAPP is in place for all environmental data collection activities and that it is up to date; - Communicates with EPA Project Officers and EPA QA personnel on issues related to routine sampling and QA activities; - SLAMS and SPM network operations - Purchasing equipment and issuance of contracts necessary for the implementation of monitoring programs; - Ensures that all personnel involved in environmental data collection have access to any training or QA information needed to be knowledgeable in QA requirements, protocols and technology; and - Recommends required management level corrective action.

Table A2. ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AMQA	Air Monitoring Field Operations Section Manager (EPM 1)	Under the general direction of the AMQA program manager, the Air Monitoring Field Operations Manager is responsible for the state-wide development, management and supervision of the field monitoring and laboratory section of the AMQA Program. The primary focus of this position is to determine compliance with the national ambient air quality standards. Responsibilities include: - Development of air quality monitoring plans for the regulatory required monitoring network to assess community-wide air pollution levels on a pollutant/multi-pollutant basis; - Oversight of local air monitoring projects; - Assistance in development of air quality control plans and State Implementation Plan control strategies; and - Management of budgetary, fiscal, accounting, procurement, and personnel responsibilities necessary for successful implementation of the section.

Table A2. ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AMQA	Air QA Officer (Chemist 4)	Regarding matters of quality assurance, the Air Quality Assurance Officer (Air QA Officer) reports directly to the Air Quality Division Director. All other directives and reporting responsibilities are managed by the Air Monitoring & Quality Assurance Program Manager. Responsibilities include: - Conducts QA performance and systems audits of NCore/SLAMS/SPM monitoring networks in Alaska; - Develops and/or recommends for approval procedures for establishing and assuring data quality, use and control of ambient air quality data; - Recommends modifications to the Alaska Ambient Air Monitoring Quality Assurance Project Plan (QAPP) and to Alaska's Ambient Air Monitoring Quality Management Plan; - Provides guidance and assists in the development of QAPPs; - Recommends rejection/approval of ambient air and meteorological monitoring QAPPs; - Provides training and certification to field and laboratory personnel; - Recommends actions to be taken in response to unsatisfactory operation or maintenance of ambient monitors; and - Assists air monitoring community in developing QA documentation and provides answers to technical questions. The QA Officer also functions as the AQS Database Manager. Responsibilities include: - Coordination of information management activities for NCore/SLAMS/SPM data; - Verification and review of data reliability prior to submission of AQS data to EPA; and - Reporting and interpretation of all required NCore/SLAMS/SPM data to the AQS system.

ADEC	AQ	AMQA	Environmental Program Specialist [Meteorologist] (EPS 4)	Under general direction of the AMQA program manager, the EPS 4 (Meteorologist) position functions as the sole staff meteorologist for ADEC enabling management to fulfill its duty to advise the public of air quality threats due to natural or man-made pollution events that may have a broad scale geographical impact for Alaska's health and environment. Responsibilities include: - Routine evaluation of weather and air pollution conditions around the state and, as needed, forecasts transport of air pollution to predict how, where and when pollution will be transported from one part of the state to another. Pollution events that may require forecasting and subsequent issue of health advisories include: broad scale forest fires, volcanic eruptions, prescribed burns of large tracks of land, high wind events that generate high concentrations of wind-blown dust, and international incidents that transport pollution to Alaska from abroad; - Works in partnerships with federal, state land management agencies, communities and tribal organizations to assess local, regional and multi-national scales of air pollution; - Conducts air quality studies to determine pollution levels; - Provides emergency monitoring of man-made and/or natural air quality impacts (e.g. wildfires, volcanic eruptions, etc.) - Provides technical expertise to Air Permits Compliance staff in regard to when meteorological conditions are appropriate for issuance of open burn approvals; and - Reviews/recommends/rejects approval (in coordination with the Air QA Officer) of PSD ambient air quality and meteorological monitoring project plans and data reports;
ADEC	AQ	AMQA	Data Management Section Manager (EPM 1)	Performs data management for the program. Responsibilities include: - Supervision of the data management team; - Development and deployment of the state's sensor network; - Review, validation, and analysis of monitoring data from regulatory monitors and low-cost sensors; and - Management of local sensor projects;

ADEC	AQ	AMQA	Chemist (Chemist 1-3)	Under supervision of the AMQA Program Manager, these positions perform ADEC's field monitoring and air laboratory operations. Responsibilities include, but are not limited to: - Collection, calculation, and review of environmental data; - Participation in training and certification activities; - Verification of required monitoring QA activities and measurement quality objectives (MQO's) as prescribed in the QAPP; - Documentation of deviations from established procedures and methods; - Reporting of all problems and corrective actions to the AMQA section manager and the Air QA officer; - Assessment of data quality and flagging of suspect data; - Preparation of data reports for submission to the Air Quality System (AQS) database manager; - Maintenance of QA records, flagging of suspect data, and assessment and reporting of data; and - Maintenance of field and laboratory equipment and associated documentation.
Tribal Air Monitoring Organizations				<u>Tribal Air Monitoring Support</u> – The ADEC Division of Air Quality provides monitoring assistance to Tribal Villages as funding The Department provides direct monitoring assistance to villages receiving air monitoring funding through EPA Region 10 Air Tribal Programs. Technical assistance may include any of the following: - Development and review of project specific air monitoring QAPPs, - Air monitoring equipment operations training, - Air monitoring station site selections, - Installation of monitoring sites, - Instrument maintenance and repairs, - Instrument calibrations and operations, - Instrument performance and systems audits, - Laboratory analysis of air monitoring samples, - Equipment loans, - Data analysis.

Independent Projects by Industry and Others				Ambient air quality and meteorological monitoring is performed throughout the state by a variety of private and academic concerns. Monitoring projects directed by a Title I and/or Title V permit must meet the respective PSD quality criteria as set forth in the ADEC AMQA QAPP and in the Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) EPA-450/4-87-007. Other monitoring projects beyond the direct review authority of the Department are not required to comply with the criteria set out in this document. Prior to initiation of an independent monitoring project, a Quality Assurance Project Plan (QAPP) must be submitted to the Department for review and approval. The QAPP must follow QAPP criteria as defined in, *"Elements for Ambient Air Monitoring Quality Assurance Project Plan, Revision 1.1."* This document prescribes the required QAPP format and content for a Department-approved QAPP and is available via the Department's Division of Air Quality, Air Monitoring & Quality Assurance Program web page: https://dec.alaska.gov/air/air-monitoring/ The Department also prescribes the format, acceptance criteria and reporting frequencies for all data collected/reported in support of PSD quality ambient air and/or meteorological monitoring projects. These web-linked documents are: http://www.dec.state.ak.us/air/am/Elements_Ambient_Air_Monitoring_QAPP_rev1-1.pdf https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans http://www.dec.state.ak.us/air/am/PSD_Met_annual.pdf
EPA	OAQPS			Responsibilities and Authority – The Office of Air Quality Planning and Standards (OAQPS) is charged under the authority of the Clean Air Act (CAA) to protect and enhance the quality of the nation's air resources. OAQPS sets standards for pollutants considered harmful to public health or welfare and, in cooperation with EPA's Regional Offices and the States, enforces compliance with the standards through state implementation plans (SIPs) and regulations controlling emissions from stationary sources. The OAQPS evaluates the need to regulate potential air pollutants and develops national standards; works with the State, local agencies, and Tribes to develop plans for meeting these standards; monitors national air quality trends and maintains a database of information on air pollution and controls; provides technical guidance and training on air pollution control strategies; and monitors compliance with air pollution standards.

EPA	Region 10			<u>Responsibilities and Authority</u> – EPA Regional Offices have been developed to address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs. The major QA responsibilities of EPA's Region 10 Office are the coordination of quality assurance matters at the regional level with state, local agencies and Tribes. This is accomplished by the designation of EPA Regional Project Officers who are responsible for the technical aspects of the program.

5. PROBLEM DEFINITION AND BACKGROUND

5.1 *Problem Statement and Background*

Between the years 1900 and 1970, the emission of six principal ambient air pollutants increased significantly. The principal pollutants, referred to as *criteria pollutants*, consist of particulate matter (PM), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3) and lead (Pb). In 1970, the Clean Air Act (CAA) was signed into law. The CAA and its amendments define the framework for air quality protection and provides direction for pertinent organizations to create air quality programs. The CAA provides an outline for the monitoring to be performed by State and local organizations for criteria pollutants.

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

- To judge compliance with and/or progress made towards meeting the National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS).
- To develop, modify or activate control strategies that prevent or alleviate air pollution episodes.
- To observe pollution trends throughout the region, including non-urban areas.
- To provide a database for research and evaluation of effects of air pollution.

With the end use of the air quality samples as a prime consideration, various networks can be designed to meet one of six basic monitoring objectives, listed below:

- Determine the highest concentration to occur in the area covered by the network.
- Determine representative concentrations in areas of high population density.
- Determine the impact of significant source or source categories on pollution levels.
- Determine general background concentration levels.
- Determine the extent of regional pollutant transport among populated areas, and in support of secondary standards.
- Determine the welfare-related impacts in more rural and remote areas.

5.2 *Alaska's Air Monitoring Network*

The State of Alaska's air monitoring network consists of three major categories of monitoring stations that measure criteria pollutants. These types of stations are described below:

1. National Core (**NCore**) Multi-Pollutant Monitoring Station. Alaska has one NCore monitoring station located in Fairbanks.

2. The State and Local Air Monitoring Stations (**SLAMS**) network consists of monitoring stations with size and distribution largely determined by the needs of State and local pollution control agencies to meet their respective State Implementation Plan (SIP) requirements.

3. The Special Purpose Monitoring Stations (**SPMS**) network provides for special studies needed by the State and local agencies to support their SIPs and other air program activities. The SPMS are not permanently established and can be adjusted easily to accommodate changing needs and priorities. The SPMS are used to supplement the fixed monitoring network as circumstances require and resources permit. If the data are used for SIP purposes, the data must meet all QA and methodology requirements for SLAMS monitoring.

This Quality Assurance Plan focuses on the QA activities of the NCore Level 2, SLAMS and SPM network and the objectives of this network, which include any air monitor(s) used for comparison to the NAAQS and AAAQS. Since there is more than one objective for this data, the quality of the data will be based on the highest priority objective, which is identified as the determination of violations of the NAAQS and AAAQS.

6. PROJECT/TASK DESCRIPTION

6.1 Description of Work to be Performed

The Department is responsible for maintaining the quality of ambient air to protect the health and welfare of Alaskans. To facilitate the protection of public health and welfare from the effects of air pollution, the Department adopted the Alaska Ambient Air Quality Standards (AAAQS 18 AAC 50.010) which are equal to or more restrictive than the NAAQS. The AAAQS parameters and regulated concentrations are listed in **Table A3**. **Table A4** lists meteorological parameters the Department may monitor in support of characterizing the air quality of selective monitoring networks.

Table A3. Alaska Ambient Air Quality Standards (18 AAC 50.010)

Parameter	1-hour		3-hour		8-hour		24-hour		Quarterly	Annual	
	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(mg/m^3)	(ppm)
Ammonia (NH_3)					2.1	3.0					
Carbon Monoxide (CO)	40	35			10	9					
Nitrogen Dioxide (NO_2)	0.188	0.100								0.100	0.053
Ozone (O_3)		0.12			Annual 4th highest daily max 8-hr conc averaged over 3 years						
						0.070					
Sulfur Dioxide (SO_2)	0.196	0.075	1.300	0.5			0.365	0.140		0.080	0.030
							(µg/m^3) 3-year 98%		(µg/m^3)	(µg/m^3)	
Lead (Pb)									0.15		
PM_{10}							150				
$PM_{2.5}$							35			12	

Table A4. Meteorological Parameters								
Wind Speed (WS)	Wind Direction (WD)	Ambient Temperature (T)	Temperature Difference (ΔT)	Solar Radiation (SR)	Ambient Pressure (P)	Dew Point Temperature	Relative Humidity (RH)	Precipitation

With the end use of the air quality samples as a prime consideration, various networks can be designed to meet one of the basic monitoring objectives listed below:

- Determine/document the highest concentrations to occur in the area covered by the network;
- Determine/document representative concentrations in areas of high population density;
- Determine/document the impact on ambient pollution levels of significant source or source categories;
- Determine/document general background concentration levels;
- Determine/document the extent of regional pollutant transport among populated areas, and in support of secondary standards;
- Determine/document the welfare-related impacts in more rural and remote areas;
- Document existing air quality and air quality trends at selected locations of interest;
- Evaluate compliance with the NAAQS, AAAQS and increment standards after the start-up of new air pollution sources;
- In response to citizen complaints, investigate air quality degradation to determine the level of action required.
- Judge compliance with and/or progress made towards meeting the NAAQS and AAAQS;
- Maintain or improve the existing ambient air quality of Alaska;
- Develop, modify or activate control strategies that prevent or alleviate air pollution episodes;
- Observe pollution trends throughout the region, including non-urban areas; and
- Provide a database for research and evaluation of effects.

When the Department or other entity determines that an air quality monitoring project is to occur, the responsible party will:

- Survey the impacted area to identify the pollutant source/s.
- Survey the impacted area to identify the aerial extent of the problem.
- Utilize appropriate dispersion modeling tools or other scientific or engineering principles to identify the zone/s of potential impact.
- Evaluate meteorological data to identify maximum impact zones.
- Survey potential maximum impact areas to identify appropriate monitoring site locations.
- Conduct air quality monitoring to reliably assess air quality conditions.

6.2 Field Activities and Measurements

Field activities and measurements include all field activities performed that support the collection of valid samples to assess air quality within Alaska's ambient air quality network. This includes but is not limited to problem identification, site selection, site installation/deinstallation, equipment calibration, sample and data collection and shipping.

6.3 Laboratory Activities

The AMQA program includes an air quality laboratory that supports field monitoring activities throughout Alaska. Laboratory activities include repair of equipment, calibration and certification of various air quality standards and gravimetric analysis of particulate matter (PM) sample filters.

Gravimetric analysis of PM_{10} and $PM_{2.5}$ samples includes preparing the filters for the routine field operator, which includes the following:

- Pre-Sampling Weighing
- Shipping/Receiving
- Post-Sampling Weighing
- Filter storage/archival

Standard Operating Procedures (SOPs) for particulate sample filter analyses are described in the respective ADEC Laboratory PM SOP and are available on the internet at https://dec.alaska.gov/air/air-monitoring/standard-operating-procedures/

6.4 Project Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, or inspection. **Table A5** presents a schedule of these assessments. Section 18 discusses the details of these assessments.

Table A5. Assessment Schedule

Assessment Type	Assessment Agency	Frequency
Technical Systems Audit	EPA Region 10/ADEC	1 every 3 years
Network Review	EPA Region 10/ADEC	Annual
Data Qualifiers/Flags Review	ADEC	Annual
SOP Review	ADEC	Every 3 years or as needed

Performance Evaluations	EPA Region 10	5 valid audits/yr for primary QA orgs with ≤ 5 sites 8 valid audits/yr for primary QA orgs with > 5 sites All samplers in 6 years
Performance Audits	ADEC	SLAMS/SPM/NCore each particulate monitor every 6 months, each gaseous monitor every year.
Data Quality Assessment	ADEC	Annual

6.5 *Project Records*

Table A6. Critical Documents and Records	
Categories	**Record/Document Types**
Site Information	Network description Site characterization file Site checklist Site maps & pictures
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory notebooks/ electronic notebooks Sample handling/custody records Inspection/maintenance records
Raw Data	Any original data (routine and QC data) including data entry forms
Data Reporting	Air Quality Index report Annual NCore/SLAMS/SPM air quality information Data/summary reports
Data Management	Data algorithms Data management plans/flowcharts Validated air monitoring data Data management systems
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site audits

7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The ADEC will meet the QA/QC requirements outlined in 40 CFR Parts 50 and 58 or, where different, as described within this QAPP.

7.1 Data Quality Objectives (DQOs)

DQOs are qualitative and quantitative statements derived from the DQO Process that:

- Clarify the monitoring objectives.
- Define the appropriate type of data.
- Specify the tolerable levels of decision errors for the monitoring program.

By applying the DQO Process to the development of a quality system, the Air Quality Program guards against committing resources to data collection efforts that do not support a defensible decision.

Data Quality Objectives (DQOs) determine whether a particular location meets the NAAQS. The EPA states that there should be a 5% (or less) chance of being wrong about whether a site meets or does not meet the standard. For example, if the true concentration is below the NAAQS but the measured value is above, this may be due to measurement bias, imprecision, or incomplete data. The other possibility is that the true concentration is above the NAAQS but the measurement is below the NAAQS. The general goal is to keep the rate of these decision errors (whether the standard has been met) to below 5%. In order to do this, EPA looked at data from the past few years in terms of bias and imprecision, and calculated that if each site keeps bias and precision under the pollutant specific values (listed in **Table 7**), these overall goals of limiting the decision error rate will be met. The DQOs were subsequently translated into the measurement quality objective (MQO) for each parameter **(Table 7)**. This document does not describe how they have been translated into MQOs.

7.2 Clarify Monitoring Objectives

The monitoring objectives for implementing the Air Quality Program are to:

- Determine ambient concentrations of criteria pollutants.
- Determine compliance with the NAAQS for the criteria pollutants.

7.3 Define Appropriate Type of Data

To accomplish the monitoring objectives, the appropriate type of data needed is defined by the NAAQS. For criteria pollutants, compliance with the NAAQS is determined by specific measurement requirements. The measurement system is designed to produce criteria pollutant concentration data that are of the appropriate quantity and quality necessary to determine compliance with these standards.

7.4 *Specify Tolerable Levels of Decision Errors for the Monitoring Program*

DQOs for criteria pollutant monitoring are based on data requirements of the decision-maker(s). Regarding the quality of the measurement system, the objective is to control precision and bias to reduce the probability of decision errors.

7.5 *Measurement Quality Objectives (MQOs)*

Once a DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs. MQOs can be defined in terms of *precision, bias, representativeness, detectability, completeness, and comparability*.

Bias – Bias is the systematic or persistent distortion of a measurement process that causes uncertainty in one direction (e.g., results are either higher than or lower than they should be). Bias is estimated by evaluating the instrument-measured result against a known standard used as the "true" value. It is expressed as a positive or negative percentage of the "true" value. In this program, the manual quality control (QC) checks with a known concentration done at least every two weeks for gaseous pollutants, or monthly for particulate pollutants, will be the major estimate of bias on an ongoing basis. Performance audits will provide another estimate of bias. Performance audits of the monitoring equipment will be performed with personnel and equipment/standards completely independent from the standards used to calibrate the monitoring equipment and the personnel responsible for site operations. In this program, bias is estimated using the calculations found in **Table C1**.

Precision - Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, or how well side-by-side measurements of the same thing agree with each other. It is important that the measurements be as similar as possible, using the same equipment or equipment as similar as possible. Precision represents the random component of uncertainty. This random component is what changes randomly high or low, and which cannot be controlled with the equipment and the procedures used. Precision is estimated by various statistical techniques using the standard deviation or, if you only have two measurements, the percent difference. In this program, precision is estimated using the calculations found in **Table C2.**

Accuracy – Accuracy has been a term frequently used to represent closeness to truth and includes a combination of precision and bias uncertainty components. This term has been used throughout the CFR. In general, ADEC AMQA will follow the conventions of the NIST and, more recently, of EPA (ref. NIST Report 1297 and EPA G-9) and will not use the term accuracy, but will describe measurement uncertainties as precision, bias, and total uncertainty (total uncertainty is the combination of both precision and bias). In this program, total error is estimated using the calculations found in **Tables C1 and C2**.

Representativeness - Representativeness is defined as a measure of the degree to which data represents some characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. The representativeness of measurements made in this program is ensured by following EPA siting guidelines. The goal is to measure the pollutant concentrations representative of what most people breathe throughout different population centers and microclimates across Alaska.

Detectability – Defined as the lowest value that a method's procedure can reliably discern a measured response above background noise. In other words, detectability is the level that the instrument can reliably discriminate from zero. Because there is variation in any measurement process (precision uncertainty), the level of detectability depends on how much precision error is in the process. Detection limits for ADEC AMQA air quality instruments are consistent with the requirements listed in 40 CFR 53. For Federal Reference Methods (FRM) and Federal Equivalent Methods (FEM), the detection limits are specified with the respective EPA FRM/FEM designation.

Completeness - Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50) and 40 CFR 58 Appendix A.

Comparability – Comparability is a measure of confidence with which one set of data can be compared to another. This is important so that data sets in different locations or timeframes can be compared.

Various parts of 40 CFR have identified acceptance criteria for some of these attributes, as well as U.S. EPA Quality Assurance Guidance Documents, and additional DEC ambient air regulatory monitoring methods. These Ambient Air Quality parameter MQOs are listed in **Table A7**. **Table A8** lists MQOs for meteorological parameters. More detailed descriptions of these MQOs and how they will be used to control and assess measurement uncertainty are described in method-specific data validation tables. Method-specific data validation tables may be found in **Appendix A**.

Table A7. Alaska Ambient Air Quality Monitoring MQOs

Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
$PM_{2.5}$ FRM **PM_{10} FRM Low Volume Method**	EPA $PM_{2.5}$ FRM sampler EPA FRM/FEM sampler	EPA QA Handbook Vol II; Method 2.12 ADEC PM2.5 Partisol FRM Model 2000i/2025i Particulate Monitor SOP https://dec.alaska.gov/media/18122/sop-partisol-2019.pdf		24-hr ± 1hr, midnight to midnight	≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤ ±5.1% Δ (16.67 lpm), Accuracy Flow: ≤ ±4.1% Δ	CV ≤ 10.1% for paired values ≥ 3.0 ug/m^3	1/3 day, 1/12 collocated 15% of sites PSD 1/6 collocated 15% of sites	EPA siting guidelines for PM_{10} and $PM_{2.5}$
$PM_{2.5}$ and PM_{10} **Continuous Methods**	Met One Beta Attenuation Mass (BAM) Monitor 1020, Teledyne T-640X	ADEC AMQA Met One Model 1020 Beta Attenuation Mass (BAM) Monitor SOP ADEC Teledyne T-640X SOP EPA QA guidance criteria for continuous PM Standard Operating Procedure Teledyne Model 640x Real-Time Continuous PM Monitor (epa.gov)	≥75 %	≥ 75% aggregate hours/day	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** $PM_{2.5}$ & PM_{10} Design Flow: ≤ ±5.1% Δ (16.7 lpm) PM_{10} & $PM_{2.5}$ Accuracy Flow: ≤ ±4.1% Δ		Continuous, hourly average, $PM_{2.5}$ collocated 1/12 (PSD 1/6) with $PM_{2.5}$ FRM	

Table A7. Alaska Ambient Air Quality Monitoring MQOs

Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
EPA PM$_{2.5}$ Speciation Method	Met One Super Spiral Ambient Speciation Sampler (SSASS) URG 3000N	EPA PM$_{2.5}$ Speciation QAPP https://www3.epa.gov/ttn/amtic/files/ambient/pm25/spec/CSN_QAPP_v120_05-2012.pdf		24-hr ± 1hr	SLAMS ≥ 75% all sample days	**Flow audit** Design Flow: ≤ ±10.1% Δ (6.7 lpm), Accuracy Flow: ≤ ±10.1% Δ		1/3 day	
PM$_{2.5}$ Aethalometer **Continuous Method**	Magee Scientific Aethalometer		≥75 %	≥ 75% aggregate hours/day	SPM ≥ 75% all sample days	**Flow audit** Design Flow: ≤ ±7.5% Δ (3.0 lpm), Accuracy Flow: ≤ ±10% Δ			
Lead on TSP	EPA FRM/FEM sampler and analytical method	EPA QA Handbook Vol II; Method 2.8 ADEC Lead TSP SOP		24-hr ± 1hr	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** 1.1 m^3/min≤ Design Flow≤1.7m^3/min Accuracy Flow: ≤ ±10% Δ	CV ≤ 20% for paired values ≥ 0.02 ug/m^3	1/3 day, 1/12 (PSD 1/6) collocated 15% of sites	EPA siting guidelines for Pb on TSP,
CO	EPA FRM/FEM	EPA QA Handbook Vol II; Method 2.6 ADEC CO by Non-Dispersive Infraradiation, Gas Filter Correlation (NDIR-GFC) SOP https://dec.alaska.gov/media/10554/ade	≥75 %		SLAMS ≥ 75% all hours PSD ≥ 80%	Audit levels 3-10 < ± 15.1%, Audit levels 1&2 < ± 0.031 ppm diff or < ± 15.1% Linear regression criteria: All points < ± 2.1% or ≤ 0.03 ppm diff of best-fit straight line,	1-point QC check < ± 10.1% (percent difference)	Continuous	EPA siting criteria for CO

Table A7. Alaska Ambient Air Quality Monitoring MQOs									
Parameter	**Comparability**		**Completeness**			**Bias**	**Precision**	**Representativeness**	
	Equipment	**Reference/ Method**	**Hourly**	**Daily**	**Quarter**			**Sampling Frequency**	**Siting**
		c-co-sop-rev-3-final-2015-with-signature-page.pdf				whichever is greater, and Slope 1 ± 0.05 .995 ≤ r^2 ≤ 1.000			
NH_3	NO_2 EPA FRM/FEM approved analyzer with NH_3 converter	ADEC method 4.10 NH_3 by Chemiluminescence (PDF)	≥ 75 %		≥75% all hours	Audit levels ≤ ±15.1% Linear regression: All points ≤ ± 2.1% or ≤ 1.5 ppb diff of best-fit straight line, whichever is greater, and Slope 1 ± 0.05 .995 ≤ r^2 ≤ 1.000 NO_2 converter efficiency ≥96 % NH_3 converter efficiency ≥90%	90% CL CV < ± 15.1%	Continuous	ADEC NH_3 method 4.10.1
NO-NO_x-NO_2 **NO-DIFF-NO_y**	EPA FRM/FEM	EPA QA Handbook Vol II; Method 2.3 ADEC NO_x by Chemiluminescence SOP https://dec.alaska.gov/media/5182/sop-nox-2016.pdf	≥ 75%		SLAMS ≥ 75% all hours PSD ≥ 80%	Audit levels 3-10 < ± 15%, Audit levels 1&2 < ± 1.5 ppb diff or < ± 15% Linear regression: All points ≤ ± 2.1% or ≤ 1.5 ppb diff of best-fit straight line, whichever is greater, and Slope 1 ± 0.05	1-point QC check < ± 15.1% (percent difference) or < ± 1.5 ppb difference whichever is greater	Continuous	EPA siting guidelines for NO_2

Table A7. Alaska Ambient Air Quality Monitoring MQOs									
Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
						.995 ≤ r^2 ≤ 1.000 NO2 converter efficiency ≥96 %			
O_3	EPA FRM/FEM	EPA QA Handbook Vol II EPA Technical Assistance Document for Ozone, EPA-454/B-13-004 https://www.epa.gov/sites/default/files/2020-09/documents/ozonetransferstandardguidance.pdf ADEC O_3 Monitoring by UV Absorption SOP https://dec.alaska.gov/media/10556/sop-ozone-uv-sop-2016.pdf	≥ 75 %		SLAMS ≥ 75% all hours PSD ≥ 80%	Audit levels 3-10 < ± 15.1%, Audit levels 1&2 < ± 1.5 ppb diff or < ± 15.1% Linear regression: All points ≤ ± 2.1% or ≤ 1.5 ppb diff of best-fit straight line, whichever is greater and Slope 1 ± 0.05 .995 ≤ r^2 ≤ 1.000	1-point QC check < ± 7.1% (percent difference) or < ± 1.5 ppb difference whichever is greater	Continuous	EPA siting criteria for O_3
SO_2	EPA FRM/FEM	EPA QA Handbook Vol II; Method 2.9 ADEC SO_2 Monitoring by Ultraviolet	≥ 75 %		SLAMS ≥ 75% all hours PSD ≥ 80%	Audit levels 3-10 < ± 15%, Audit levels 1&2 < ± 1.5 ppb diff or < ± 15%	1-point QC check < ± 10.1% (percent difference) or	Continuous	EPA siting guidelines for SO_2

Table A7. Alaska Ambient Air Quality Monitoring MQOs									
Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
		Fluorescence SOP https://dec.alaska.gov/media/18123/sop-sulfur-dioxide-2016.pdf				Linear regression: All points ≦ ± 2.1% or ≦ 1.5 ppb diff of best-fit straight line, whichever is greater, and Slope 1 ± 0.05 .995 ≦ r^2 ≤ 1.000	< ± 1.5 ppb difference whichever is greater		

Table A8. Alaska Meteorological Monitoring MQOs									
Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
WS	Cup or Sonic Anemometer 0.25 m/s	WS Range 0.5m/s – 50 m/s VWS Range -25.0 m/s – 25.0 m/s WS Threshold ≤ 0.5 m/s Accuracy ≤ (0.2m/s + 5% obs) Dist Const. ≤ 5m/s at 1.2kg/m^3	Meets minimum specs per EPA-454/R-99-005 Section 5.1, Table 5.1 and appropriate for range of site environmental conditions	≥75 %		**NCore and SLAMS:** ≥ 80% all sample days **PSD:** ≥ 90% all sample days for 4 consecutive quarters	± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	EPA-454/R-99-005 Section 3.1 EPA QA Handbook Vol IV
Vertical WS	Cup or Sonic Anemometer 0.1 m/s						± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	
WD	Vane or sonic anemometer 1.0 m/s	1 – 360° (540°) Threshold ≤ 0.5 m/s Accuracy.≤ 3° from sensor mount ≤ 5° absolute error Delay Disrt. ≤ 5m/s at 1.2kg/m^3					± 5° includes ± 3° from sensor mount	Continuous, 1 min sample interval, hourly avg	

Table A8. Alaska Meteorological Monitoring MQOs

Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
		Damping Ratio 0.4 at 1.2kg/m³ or Overshoot ≤ 25% at 1.2kg/m³							
Vector Data **WS** **WD** **Sigma Theta (σθ)** **Sigma W (σΦ)**	DAS Calculation 0.1 m/s 1.0 degree 1.0 degree 0.1 m/s	Range 0 – 50.0 m/s, Range 0° – 360° Range 0° – 105° Range 0 – 10 m/s					Vector Data WS ± 0.2 m/s WD ± 5° σθ ± 5° σΦ ± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	
Ambient Temperature	Thermistor 0.1°C	Range -40°C - +40°C Meas. Resolution ≤ 0.1°C Accuracy ≤ ±0.5°C					± 0.5° C	Continuous, 1 min sample interval, hourly avg	
Vertical Temperature Difference	Thermistor 0.02°C	Motor aspirated Range -3°C to +7°C Relative Accuracy ≤ 0.1°C					± 0.1° C Relative Accuracy	Continuous, 1 min sample interval, hourly avg	
Temperature Radiation Shield	Motor aspirated	Range -100 to 1300W/m² Flow Rate ≥ 3 m/s Radiation error < 0.2°C							
Relative Humidity	Psychrometer/ Hygrometer 0.5 %RH	Range 0 – 100% Accuracy ± 7%					± 7% RH	Continuous, 1 min sample interval, hourly avg	
Dew Point	Psychrometer/ Hygrometer 0.1°C	Range -30° to +30°C Accuracy ± 1.5°C					± 1.5°C	Continuous, 1 min sample interval, hourly avg	

Table A8. Alaska Meteorological Monitoring MQOs									
Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
Barometric Pressure	Aneroid Barometer 0.5 Mb	Range 600 to 1060 Mb Accuracy ± 3Mb					± 3 Mb (0.3 kPa)	Continuous, 1 min interval Hourly avg.	
Precipitation	Tipping bucket 0.2 mm/hr	Range 0 - 50 mm/hr Accuracy ± 5% of input volume					≤± 10%Δ	Continuous, 5 min sample interval, Hourly avg	
Solar Radiation	pyranometer 10 W/m^2	Range 0 to 1300 W/m^2 Accuracy ± 5% of mean observed interval					± 5% Δ of audit value when insolation ≥ 200 W/m^2; ± 10 W/m^2 when insolation ≤ 200 W/m^2	Continuous, 1 min sample interval, Hourly avg	

8. TRAINING

Air monitoring personnel will be recruited and screened to ensure they are experienced and qualified. Air monitoring personnel will meet the educational, work experience, responsibility, personal attributes, and training requirements for their respective positions. Training will be available to employees supporting the Ambient Air Quality Monitoring Program, commensurate with their assigned duties and sufficient to contribute to the reporting of complete and high-quality data.

Primary responsibility for training will rest with the individual's supervisor. Records on personnel qualifications and training will be maintained in personnel files. Training may consist of courses, workshops, classroom lectures, teleconferences, and on-the-job training. The following groups provide training: U.S. EPA's Air Knowledge (https://airknowledge.gov/), U.S. EPA Quality Assurance Division (QAD), U.S.EPA Office of Air Quality Planning and Standards (OAQPS), American Society for Quality Control (ASQC), Western States Air Resources Council (WESTAR) and Air & Waste Management Association (AWMA). **Table A9** suggests a list of training courses for all air monitoring personnel. **Table A10** suggests a sequence of specific training courses for the respective air monitoring responsibility (e.g., field personnel, lab personnel, monitoring supervisor, QA officer, etc.).

Table A9. Suggested Core Ambient Air Monitoring Training Courses

Sequence	Course Title	Course	APTI Type			Source
			Self Instruction	Classroom	Web	
1	**History of the Clean Air Act and Progress Since Its Enactment**	BASC102-SI	X		X	AK
2	**Types of Air Pollutants**	BASC103-SI	X		X	AK
3	**Health and Environmental Effects of Air Pollutants**	BASC106-SI	X		X	AK
4	**Introduction to the National Ambient Air Quality Standards (NAAQS)**	BASC110-SI	X		X	AK
5	**Introduction to National Ambient Air Quality Standards (NAAQS) Implementation**	BASC111-SI	X		X	AK
6	**Air Pollution Control Orientation Course**	BASC124-SI	X		X	AK
7	**Air Quality Management Under the Clean Air Act**	BASC198-SI	X		X	AK
8	**Introduction to Ambient Air Monitoring for Criteria Pollutants**	AMBM103-SI	X		X	AK
9	**Network Design and Site Selection for Monitoring Particulate Matter (PM2.5 and PM10) in Ambient Air**	AMBM206-SI	X		X	AK
10	**Site Selection for Monitoring of Sulfur Dioxide (SO2) and Particulate Matter (PM10) in Ambient Air**	AMBM207-SI	X		X	AK
11	**Quality Assurance for Air Pollution Measurement Systems**	AMBM208-SI	X		X	AK
12	**Basic Air Pollution Meteorology**	MODL102-SI	X		X	AK
13	**What are the Components of Attainment SIPs and TIPs?**	PLAN111-SI	X		X	AK
14	**Applying Technical Factors for Area Designations**	PLAN201-SI	X		X	AK
15	**Principles of Ambient Air Monitoring**	AMBM102-CI		X		AK
16	**Analytical Methods for Air Quality Standards**	AMBM301-CI		X		AK
17	**Atmospheric Sampling**	AMBM311-CI		X		AK
18	**Quality Assurance for Air Pollution Measurement Systems**	APTI 470		X		APTI
19	**Operation, Maintenance, and Calibration of Trace-Level CO Instruments**	OPS1	X		X	EPA

Table A9. Suggested Core Ambient Air Monitoring Training Courses

20	**Operation, Maintenance, and Calibration of Trace-Level NO_y Instruments**	OPS2	X		X	EPA
21	**Operation, Maintenance, and Calibration of Trace-Level SO_2 Instruments**	OPS3	X		X	EPA
22	**Operation and Maintenance of a Mass Flow Calibration System**	OPS4	X		X	EPA
23	**A Calibration System for Low Range GPT Calibrations of High Sensitivity NOx and NOy Monitors**	OPS5	X		X	EPA
24	**AQS**	AQS	X		X	EPA
25	**Introduction to Data Quality Assessment**	DQA	X		X	EPA
26	**Introduction to Data Quality Objectives**	DQO	X		X	EPA

Table A10. Suggested Training Courses for Air Monitoring Personnel

Course #	Air Monitoring Position						
	Field Personnel	Laboratory Personnel	QC Supervisor	Data Management	Monitoring Supervisor	QA Personnel	QA Management
BASC102-SI	x	x	x	x	x	x	x
BASC103-SI	x	x	x	x	x	x	x
BASC106-SI	x	x	x	x	x	x	x
BASC110-SI	x	x	x	x	x	x	x
BASC111-SI	x	x	x	x	x	x	x
BASC124-SI	x	x	x	x	x	x	x
BASC198-SI	x	x	x	x	x	x	x
AMBM103-SI	x	x	x	x	x	x	x
AMBM206-SI	x		x		x	x	x
AMBM207-SI	x		x		x	x	x
AMBM208-SI	x	x	x	x	x	x	x
MODL102-SI	x		x		x	x	x
PLAN111-SI			x		x	x	x

PLAN201-SI			x		x	x	x
AMBM102-CI	x	x	x	x	x	x	x
AMBM301-CI	x	x	x	x	x	x	x
AMBM311-CI	x		x		x	x	x
APTI 470	x	x	x	x	x	x	x
OPS1	x		x		x	x	x
OPS2	x		x		x	x	x
OPS3	x		x		x	x	x
OPS4	x		x		x	x	x
OPS5	x		x		x	x	x
AQS			x	x		x	x
DQA			x	x	x	x	x
DQO			x	x	x	x	x

9. DOCUMENTS AND RECORDS

ADEC is moving away from paper files. All non-confidential documents are either stored on our website, Division network drives, or stored in the Division's AirTools database and the AMQA Program's Agilaire AirVision data acquisition system. Certified records are accessible to the public.

As indicated in 40 CFR Part 58, the Air Quality Program shall submit to the EPA Administrator, through the Region 10 Office, an annual summary report of all the air quality monitoring data from monitoring stations designated as SLAMS. The report will be submitted by May 1st of each year for the data collected from January 1st to December 31st of the previous year. The AMQA Program Manager will certify that the annual summary is accurate to the best of his/her knowledge. This certification will be based on the various assessments and reports performed by the organization. Documents and records required to support concentration data reported to EPA, which includes all data required to be collected as well as data deemed important by the ADEC, are listed in **Table A11**.

Table A11. Reporting Package Information

Categories	Record/Document Types	File Locations
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and training Training Certification Quality management plan Document control plan EPA Directives Grant allocations Support contracts	https://dec.alaska.gov/air/anpms/sip/ ADEC SharePoint and network drives https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans/ ADEC SharePoint and network drives
Site Information	Network description Site characterization files Site maps Site Pictures	ADEC-AMQA website and network drives: https://dec.alaska.gov/air/air-monitoring/monitoring-plans/ https://dec.alaska.gov/air/air-monitoring/monitoring-site-information/
Environmental Data Operations	QA Project Plans Standard Operating Procedures (SOPs) Field notebooks Inspection/Maintenance records Laboratory notebooks Sample handling/custody records	https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans/https:/ AMQA https://dec.alaska.gov/air/air-monitoring/standard-operating-procedures/ Airtools, Agilaire AirVision Data Acquisition System AMQA Laboratory Juneau and Fairbanks
Raw Data	Any original data (routine and QC data) including data entry forms	AirTools, Agilaire AirVision Data Acquisition System ADEC AMQA Laboratory Juneau/ Anch/Fairbanks
Data Reporting	Air quality index report	https://dec.alaska.gov/air/air-monitoring/ https://dec.alaska.gov/air/air-monitoring/

	Annual SLAMS air quality information Data/summary reports Journal articles/papers/presentations	https://dec.alaska.gov/air/air-monitoring/ ADEC SharePoint and network drives
Data Management	Data algorithms Data management plans/flowcharts Data Management Systems	ADEC AMQA Laboratory Juneau/Fairbanks/Anc. ADEC AMQA Anchorage
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits	AirTools, Agilaire AirVision Data Acquisition System and ADEC network drives

B. MEASUREMENT AND DATA ACQUISITION

10. SAMPLE PROCESS AND DESIGN

The purpose of this section is to describe the relevant components of the State of Alaska's NCore, SLAMS, and SPM monitoring networks as well as monitoring conducted to support PSD quality monitoring objectives. The network design components comply with the regulations stipulated in 40 CFR Part 58 Section 58.13, Appendix A and Appendix D. In addition, **Table B1** lists criteria pollutant and other parameter specific siting guidance documents available from EPA's AMTIC web site. These documents are listed as a resource to those parties considering air quality and meteorological monitoring projects as an aid in identifying areas of air quality concern as well as selecting the best available monitoring site.

Table B1. Air Quality & Meteorological Sample Process & Design Documents

Parameter	Document Title	Source	Location
Criteria & Non-Criteria Pollutants	SLAMS/NAMS/PAMS Network Review Guidance	EPA AMTIC	https://www.epa.gov/amtic/amtic-ambient-air-monitoring-networks
Criteria & non-Criteria Pollutants, Monitoring Network Design and Monitor Placement	QA Handbook for Air Pollution Measurement Systems, Vol II Sections 6 & 7	EPA AMTIC	https://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/Final%20Handbook%20Document%201_17.pdf
Criteria & non-Criteria Pollutants	40 CFR Parts 50, 53 & 58	e-CFR	https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40tab_02.tpl
Network Design and Probe & Monitoring Path Siting Criteria for O_3, CO, NO_2, SO_2, Pb, PM	40 CFR Part 58 Appendices D, E	e-CFR	eCFR :: 40 CFR Part 58 -- Ambient Air Quality Surveillance
NH_3	Method for the Determination of Ammonia (NH_3) by Chemiluminescence	ADEC Method 4.10	ADEC Ambient Air Quality Method 4.10
$PM_{2.5}$, PM_{10}	Network Design, Implementation, Policy & Guidance, Quality Assurance for Particulate Matter	EPA AMTIC	https://www3.epa.gov/ttn/amtic/amticpm.html
Pb	Network Design and Monitoring Siting, Sampling and Analysis, Data Reporting	EPA AMTIC	https://www.epa.gov/amtic/lead-pb-monitoring-network https://www.epa.gov/amtic/lead-pb-monitoring-network
Meteorological Measurements	Meteorological Monitoring Guidance for Regulatory Modeling	EPA SCRAM	https://www.epa.gov/scram/air-modeling-meteorological-guidance

Table B1. Air Quality & Meteorological Sample Process & Design Documents			
	Applications, Section 3.0 Siting & Exposure		
Meteorological Measurements	QA Handbook for Air Pollution Measurement Systems, Vol IV, Meteorological Measurements Version 2.0 (Final)	EPA AMTIC	https://nepis.epa.gov/Exe/tiff2png.cgi/P100FOMB.PNG?-r+75+-g+7+D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTIFF%5C00001457%5CP100FOMB.TIF https://nepis.epa.gov/Exe/ZyNET.exe/P100FOMB.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000033%5CP100FOMB.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
PSD Criteria and Non-Criteria Pollutants	Ambient Monitoring Guidelines for Prevention of Significant Deterioration	EPA AMTIC	https://www.epa.gov/nsr/ambient-monitoring-guidelines-prevention-significant-deterioration https://www.epa.gov/nsr/ambient-monitoring-guidelines-prevention-significant-deterioration https://www.epa.gov/sites/production/files/2017-02/documents/psd_qa.pdf
PSD Criteria and Non-Criteria Pollutants	QA Requirements for Prevention of Significant Deterioration Air Monitoring 40 CFR Part 58 Appendix B	e-CFR	eCFR :: 40 CFR Part 58 -- Ambient Air Quality Surveillance

a. Network Objectives

<u>**NCore Monitoring Objectives**</u>

The ADEC NCore monitoring site is one of 78 nation-wide multi-pollutant sites focused on community-wide air quality assessment. The NCore site in Fairbanks became operational in 2011. The NCore parameters measured are listed in **Table B5**. The intent of the NCore monitoring site is to:

- Represent ambient concentrations over a neighborhood-scale representative of similar neighborhoods;

- Represent an area impacted by mobile source emissions;
- Represent an area not impacted by unique local emission sources;
- Remain a long-term site with reasonable assurance of 5+ year "permission" period;
- Be collocated with an STN or NATTS site, if possible; and
- Have room for multiple gas monitors and associated equipment, integrated samples, and meteorology.

(SLAMS) and SPM Monitoring Objectives

Alaska's SLAMS/SPM Monitoring Network is designed to:

- Determine compliance or non-compliance with the NAAQS/AAAQS;
- Best represent the exposure of populations that may be affected by elevated criteria and non-criteria pollutant concentrations; and
- Meet EPA objectives. The design of the SLAMS/SPM network must achieve one of six basic monitoring objectives as described in 40 CFR Part 58, Appendix D. These are:
    - Determine the highest concentrations expected to occur in the area covered by the network;
    - Determine representative concentrations in areas of high population density;
    - Determine the impact on ambient pollution levels of significant sources or source categories;
    - Determine general background concentrations levels;
    - Determine the extent of regional pollution transport among populated areas, and in support of secondary standards; and
    - Determine the welfare-related impacts in more rural and remote areas (such as visibility impairment and effects on vegetation.

b. Selection of Monitoring Areas

The ADEC ambient air quality monitoring network is designed to protect the health and welfare of its residents and visitors. To meet this objective, monitoring sites are installed at locations specifically selected to evaluate public impacts of air quality pollutants in areas with the highest potential for exceeding the NAAQS/AAAQS. Where problems exist, priority will be given to communities with high population density. Where impacts are seasonal, monitoring studies will be designed to examine seasonal impacts on local residents.

Alaska does not meet many of the traditional concepts of population centers envisioned in the guidance documents for the criteria pollutant standards. Instead, Alaska's "population centers" closely resemble the supply centers of the 1800's used to explore the West. Alaska has only four communities over 15,000 people: Anchorage, Fairbanks, Wasilla/Palmer, and Juneau. Each of these areas must be considered separately and independent from the others when considering air quality impacts and influences on neighboring communities. Alaska's long-term goals are split between using SPM monitors to help characterize the most representative SLAMS sites and evaluating potential microscale impacts on the public.

Table B2 describes the representative measurement scales appropriate for Alaska's state-wide monitoring network.

Table B2. Description of Representative Measurement Scale	
Measurement Scale	**Description**
Micro	Concentrations ranging in area from several meters to 100 meters.
Middle	Concentrations typical of areas of several city blocks in size with dimensions ranging from 0.1 to 0.5 kilometers.
Neighborhood	Concentrations within an extended area of the city that has relatively uniform land use with dimensions ranging from 0.5 to 4.0 kilometers.
Urban	Overall, city-wide conditions with dimensions ranging from 4 to 50 kilometers.
Regional	Rural area of reasonably homogenous geography ranging from tens to hundreds of kilometers

Table B3 summarizes relationships among monitoring objectives and appropriate scales of representativeness.

Table B3. Relationship Among Monitoring Objectives and Scales of Representativeness	
Monitoring Objective	**Appropriate Siting Scale**
Highest Concentration	Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants)
Population Oriented	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General/Background & Regional Transport	Urban, regional
Welfare-Related impacts	Urban, regional

Table B4 summarizes spatial scales appropriate for SLAMS and SPM monitoring sites.

Table B4. Spatial Scales Appropriate for NCore, SLAMS, and SPM Monitoring Sites							
Spatial Scale	**CO**	**NO_2**	**O_3**	**SO_2**	**Pb**	**PM_{10}**	**$PM_{2.5}$**
Micro	•	•		•	•	•	•
Middle	•	•		•	•	•	•
Neighborhood	•	•	•	•	•	•	•
Urban		•	•	•			•

Regional			•				•

c. *Sampling Schedule*

Sampling schedules for criteria pollutants, NH_3 and meteorological parameters are continuous, except for the 24-hour integrated gravimetric methods PM_{10}, $PM_{2.5}$, and Pb-TSP. All continuous analyzer data must include hourly values. Any group or agency operating a continuous SO_2 analyzer must report the twelve 5-minute SO_2 block averages in each hour, the maximum 5-minute block average in each hour, as well as the integrated 1-hour average value, for each hour of the day. Continuous PM methods are required to sample continuously and report hourly as well as 24-hr values.

All integrated PM_{10} and Pb monitors used to collect NCore and SLAMS quality criteria data must sample 24-hours from midnight (local standard time) to midnight. For Pb the minimum sampling frequency is every six days following the EPA national sampling schedule. For PM_{10} the minimum monitoring schedule is based on the relative level of the PM_{10} concentration at that site with respect to the 24-hour standard. In cases where PM concentrations approach the NAAQS/AAAQS, more frequent sampling is required as detailed in 40 CFR Part 58.12(e).

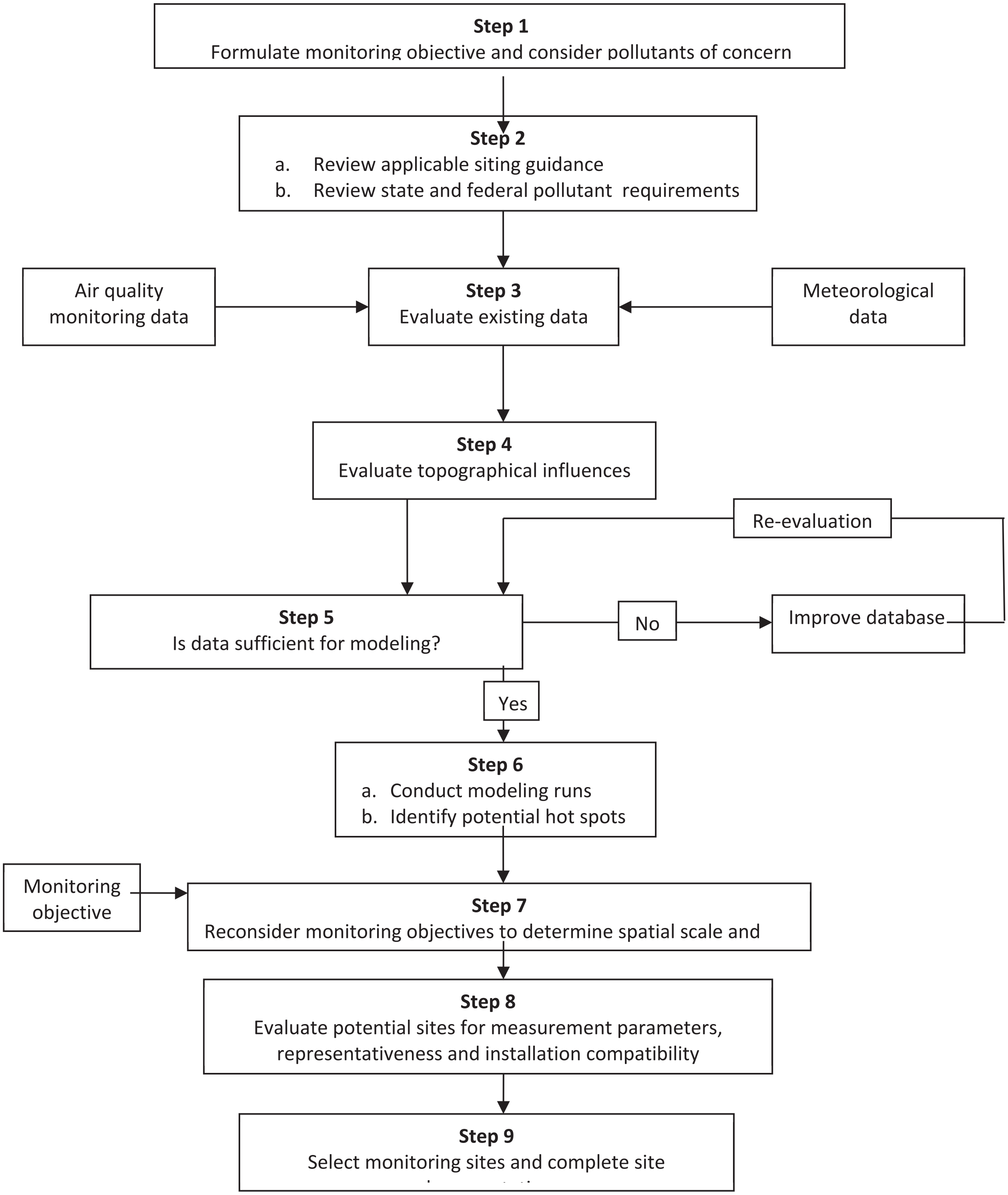
All integrated $PM_{2.5}$ monitors used to collect NCore and SLAMS quality criteria data must sample 24 hours from midnight (local standard time) to midnight. Minimum sampling frequency is every third day following the EPA national sampling schedule. In some cases, the sampling frequency may be reduced to every 6^{th} day with EPA regional office waiver. Site-specific $PM_{2.5}$ sampling frequency requirements will be followed as detailed in 40 CFR Part 58.12(d).

The EPA National Sampling Schedule is updated yearly and is available from the following web link: https://www.epa.gov/amtic/sampling-schedule-calendar.

d. *Selection of Monitoring Sites*

Monitoring site locations will be based on the State's present understanding of local sources and their potential contributions to the NAAQS/AAAQS. Alaska's monitoring network contains one NCore site as well as a mix of SLAMS and SPM monitoring locations to address neighborhood-scale, micro-scale and associated gradients where necessary to develop effective control strategies. SLAMS and SPM sites are selected to meet, as much as possible, guidance found in documents listed in **Table B1**. If siting criteria is not met, this will be documented with sufficient reasons to justify the selection and have an approved waiver from EPA.

Figure B1. Monitoring Site Selection Process



Monitoring Network Description

The configuration of ADEC's monitoring network, based on the site selection criteria described above, is summarized in **Table B5**. Detailed site information, including the rationale for each site selection, is available in Alaska's Ambient Air Monitoring Network Plan (https://dec.alaska.gov/air/air-monitoring/monitoring-plans/).

Table B5. Alaska NCore, SLAMS, and SPM Monitoring Network

Site	CO	NO_2	NO_y	O_3	SO_2	$PM_{2.5}$	PM_{10}	$PM_{2.5}$ Cont.	PM_{10} Cont.	$PM_{2.5}$ Cont.	$PM_{2.5}$ Spec.
						FRM	FRM	FEM	FEM	Non-FEM	
Anchorage											
16th & Garden [LP]	•					•[1]	•[2]	•[1]	•[2]		
Parkgate [L] (Eagle River)									•		
Laurel [P]									•		
Matanuska-Susitna Valley											
Butte (Harrison Ct.) [LP]								•	•		
Juneau											
Floyd Dryden [LP] **Middle School**						•	•		•	•	
Fairbanks											
FNSB Bldg [NP] 819 Pioneer Rd	•	•	•	•	•	•	•[3]		•[3]	•	•
A Street [LP]						•[4]		•[4]			
Hurst Road [LP] (North Pole)					•	x2 •[5]		•		•	•

[#] Collocated PM monitor pairs [L] SLAMS [P] SPM [N] NCore

Blue = Gaseous; Green = PM Non-Continuous; Red = PM Continuous; Yellow = PM Speciation

11. SAMPLING METHODS

This section describes the sample collection methods and continuous measurement methods for determining compliance with the primary and secondary NAAQS/AAAQS criteria pollutants and meteorological parameters.

a. Environmental Control

Monitoring stations should be designed for functionality and with the station operator in mind, considering safety, ease of access to instruments, optimal workspace, and security. **Table B6** lists recommended environmental control parameters for monitoring shelters. Continuous temperature measurement is required inside monitoring shelters to ensure temperature is maintained within required shelter temperature criteria for all gaseous monitors (20° - 30°C or per manufacturers specifications if designated to a wider temperature range, < 2.1°C SD over 24 hours). Ambient air monitoring data collected outside this shelter temperature criteria must be evaluated to determine if acceptable data quality criteria has been met to validate the affected data.

Table B6. Environmental Control Parameters for Monitoring Shelters

Parameter	AQ Method	Source of Specification	Method of Control
Instrument Vibration	All Equipment	Manufacturer's Specs	Design of Instrument housing's benches, per manufacturer's specs.
Light	Overhead light	Method Description or manufacturer's specs	Shield chemicals or instruments that can be affected by natural or artificial light.
All parameters	Sample lines for automated methods	Borosilicate glass, Teflon, laminar flow, moisture trap	See guidance on sample lines for automated methods https://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/vol2sec07.pdf https://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/vol2sec07.pdf Section 7.3
Electrical Voltage	All Equipment	Method Description or manufacturer's specs	Constant voltage transformers or regulators; separate power lines, isolated high current drain equipment such as High-Vols, heating baths, pumps from regulated circuits
Temperature, Humidity	All gaseous and PM continuous monitoring equipment	Method description or manufacturer's specs. EPA monitoring shelter criteria	Operated within temperature-controlled monitoring shelter with sample inlet sampling air at ambient temperature conditions. Regulated temperature conditioning system (EPA criteria 20° – 30°C < 2°C SD/24-hr, Alaska variance 15° – 30°C < 2°C SD/24-hr), continuous temperature recorder, electric cooling and heating only

Table B6. Environmental Control Parameters for Monitoring Shelters			
		unless otherwise specified. Alaska continuous PM method requirement	
Temperature	$PM_{2.5}$-FRM, if inside monitoring shelter	EPA-Alaska Modification	http://www.epa.gov/ttn/amtic/files/cfr/akmod799.pdf Alaska Modification for operating $PM_{2.5}$ FRM within monitoring shelter with sample probe to outside shelter
Security	Shelter Security		Shelter secured with lock. Where monitoring equipment located outside shelter (e.g., met tower, PM monitors, etc.) monitoring equipment should be surrounded by locked chain link fence.
Safety	Cylinder gas		Cylinder gases secured upright in cylinder racks or otherwise secured upright against wall, instrument rack etc. Cylinders not in use capped with threaded cylinder gas cap.
	Venting exhaust/excess calibration gases		Excess calibration gas delivered to gaseous monitors as well as exhaust gases vented outside shelter.
	Electrical	Local/state	Comply with local, State or national building codes.
	Shelter Construction	Local/state	Comply with local, State or national building codes. If monitors located on roof of shelter, safety railing required.
	Fire Safety	Local/state	Fire extinguisher mounted by door
	Basic First Aid Kit		
	Emergency light with battery back-up by door.		

b. Sampling Probes and Manifolds

Variables affecting sample manifold design are diameter, length, flow rate, pressure drop, and construction materials. These variables must be taken into consideration when designing a sample delivery system. Sample probe manifold material for gaseous reactive gases may only be constructed with smooth, non-reactive and non-porous materials (i.e., FEP Teflon, PFA Teflon, or borosilicate glass). Sample probe material for non-reactive gases (e.g., CO) should also utilize the same sample probe and manifold materials as used for reactive gases (e.g., SO_2, NO_2, O_3). Connective tube fittings must also be constructed of smooth non-reactive and non-porous materials (e.g. FEP Teflon, borosilicate glass, or equivalent). Water traps should be configured into the sampling system to remove condensate that may accumulate in the sample line upstream of any monitoring equipment. See https://www.epa.gov/amtic/ambient-air-monitoring-quality-assurance-guidance-documents, Section 7.3 for recommended design configurations of sampling probes and manifolds.

c. Sample Residence Time

The residence time of pollutants within the sample train is critical. Residence time is defined as the amount of time it takes for a sample of air to travel from the sample probe inlet (or cane) to the inlet at the back of the analyzer. For the reactive gases (NO_2, SO_2, NH_3 and O_3), sample residence must be < 20 seconds. Sample residence time can be determined using the formula:

$$V = \pi * (d/2)^2 * L$$

Determine V separately for sample probe, manifold, and line. Where:

V = volume
π = 3.14159
L = length
d = inside diameter

Add volume of various volume components together (V_{Total})

Determine sample residence time (*R*) using the formula:

$$R = V_{Total}/(\text{flow rate of all instruments})$$

If the sample residence time is found to be > 15 seconds, it is strongly encouraged to install a blower motor (or other device) to decrease the sample residence time to within 10 seconds.

Sample residence times for CO should be minimized as much as possible. It is recommended that CO sample residence times also be kept to < 20 seconds.

d. Placement of Sample Probes and Manifolds

Careful consideration must be taken in the placement of sample probes and manifolds to avoid introducing bias to the sample collection process. Considerations such as probe height (above ground), length (distance from structures) and physical influences nearby are factors that can influence collection of a representative sample. **Table B7** lists some general guidelines for placement of sample probes and manifolds.

Table B7. Guidelines for Sample Probe & Manifold Placement
• Do not place probes next to air outlets (e.g., exhaust fan openings)
• Horizontal probes must extend beyond building overhangs
• Avoid placing probes near physical obstructions (e.g., chimneys) which can affect air flow in vicinity of the sample probe/inlet
• Sample probe/inlet height above ground dependent upon pollutant being measured

Table B8 summarizes probe and monitoring path siting criteria.

Table B8. Summary of Representative Probe and Monitoring Path Siting Criteria				
Pollutant	**Representative Scale**	**Height above ground to probe or 80% of monitoring path[A] (meters)**	**Horizontal and vertical distance from supporting structures[B] to probe or 90% monitoring path**	**Distance from trees to probe of monitoring path[A] (meters)**
SO_2 [C, D, E, F]	Micro (100m), Middle (100-500 m), Neighborhood (0.5-4 km), Urban (4-50 km)	2 – 15	>1	>10
CO [D,E,G]	Micro Middle Neighborhood	2.5 - 3.5 2 – 7 2 – 15	>1	>10
O_3 [C,D,E]	Neighborhood, Urban, and Regional	2 – 15	>1	>10
NO_2 [C,D,E]	Micro Middle, Neighborhood and Urban	2 – 7 2 – 15 (all other scales)	>1	>10
NH_3 [C,D,E]	Middle, Neighborhood and Urban	2 – 15	>1	>10
Pb [C,D,E,F,H]	Micro Middle, Neighborhood	2 – 7 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)
PM_{10} [C,D,E,F,H]	Micro Middle Neighborhood	2 – 7 2-7 (middle $PM_{10-2.5}$) 2 – 15	>2 (all scales, horizontal distance only)	>10 (all scales)
$PM_{2.5}$ [C,D,E,F,H,I]	Micro Middle, Neighborhood, Urban and Regional	2 – 7 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)

[A] ≡ Monitoring path for open path analyzers is applicable only to middle or neighborhood scale CO monitoring and all applicable scales for SO_2, O_3, NO_2 and NH_3

[B] ≡ When probe is located on rooftop, this separation distance is in reference to wall, parapets, or penthouses located on roof.

[C] ≡ Should be >20 meters from dripline of tree(s) and must be ≥10 meters from the dripline when trees(s) act as an obstruction.

Table B8. Summary of Representative Probe and Monitoring Path Siting Criteria
D ≡ Distance from sampler, probe, or 90% of monitoring path to obstacle, such as a building, must be at least twice the height of the obstacle that protrudes above the sampler, probe or monitoring path. Sites not meeting this criterion may be classified as middle scale.
E ≡ Must have ≥ 270° unrestricted airflow around probe or sampler; 180° if the probe is located on the side of a building.
F ≡ The probe, sampler, or monitoring path should be away from minor sources, such as furnace or incineration flues. The separation distance is dependent on the height of the minor source's emission point (such as a flue), the type of fuel or waste burned, and the quality of fuel (sulfur, ash, or lead content). This criterion is designed to avoid undue influences from minor sources.
G ≡ For microscale CO monitoring sites, the probe must be >10 meters from a street intersection and preferably at a midblock location.
H ≡ For collocated Pb and PM_{10} samplers, a 2 – 4 meter separation distance between collocated Hi-Vol samplers and/or paired Hi-Vol and Low-Vol samplers must be met. For collocated Low-Vol samplers a 1 – 4 meter separation distance must be met.
I ≡ For collocated $PM_{2.5}$ samplers, a 1 – 4 meter separation distance must be met between samplers.

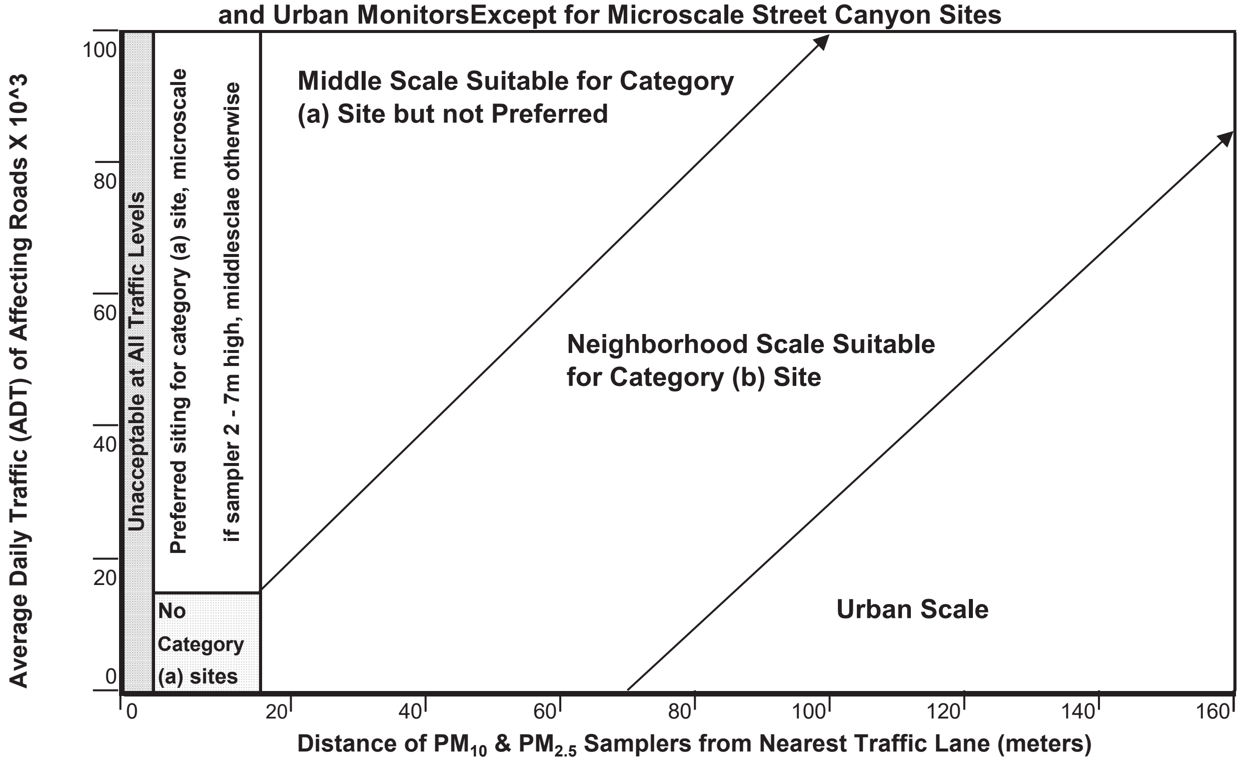
Table B9 summarizes spacing of probes from roadways. This information can be found in 40 CFR part 58 Appendix E.

Table B9. Minimum Separation Distance Between Sampling Probes and Roadways

Roadway avg. daily traffic vehicles/day	Minimum separation distance between roadways and probes or monitoring paths at various scales (meters)					
	O_3 Neighborhood & Urban	NO_2/NO_y Neighborhood & Urban	CO Neighborhood	Pb Micro	Pb Middle	Pb Neighborhood & Regional
≤10,000	10	10	10	5 – 15	>15 – 50	>50
15,000	20	20	25			
20,000	30	30	45	5 – 15	>15 – 75	>75
30,000			80			
≥40,000				5 – 15	>15 - 100	>100
40,000	50	50	115			
50,000			135			
≥60,000			150			
70,000	100	100				
≥110,000	250	250				

Figure B2 shows acceptable areas for locating PM_{10} and $PM_{2.5}$ monitors for the representative siting scales.

Figure B2 - Acceptable Areas for PM_{10} and $PM_{2.5}$ Micro, Middle, Neighborhood and Urban MonitorsExcept for Microscale Street Canyon Sites



e. Monitoring Methods

Federal Reference and Equivalent Methods

Monitoring methods used to support NCore, SLAMS, SPM and PSD monitoring must use EPA FRM, FEM or ARM (for continuous PM only) approved method analyzers and operated as specified within the EPA FRM/FEM and/or state method designations. For a list of EPA approved reference and equivalent criteria pollutant methods, please go to: https://www.epa.gov/amtic/air-monitoring-methods-criteria-pollutants. The EPA *QA Handbook for Air Pollution Measurement Systems, Volume II* provides specific FRM procedures for the measurement of the ambient air quality criteria pollutants. A list of these methods can be found on the EPA AMTIC website:
https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/Final%20Handbook%20Document%201_17.pdf.

DEC Approved Monitoring Methods

DEC maintains an inventory of “DEC approved” Ambient Air Quality Monitoring Methods and Standard Operating Procedures (SOPs). These methods, SOPs and other QA guidance documents can be found on the DEC AMQA web site: https://dec.alaska.gov/air/air-monitoring, and in **Appendix A** of this document. For those methods not yet developed, or under development by ADEC, the respective EPA method is the default criteria.

Meteorological Monitoring

Meteorological monitoring data collected to support NCore, SLAMS and PSD quality monitoring projects will follow EPA guidance criteria found in:

- EPA QA Handbook Volume IV, Meteorological Monitoring: https://www.epa.gov/amtic/ambient-air-monitoring-quality-assurance-guidance-documents
- EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005: https://www.epa.gov/scram/meteorological-guidance; and
- Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-87-007. https://www.epa.gov/nsr/ambient-monitoring-guidelines-prevention-significant-deterioration

Additional meteorological monitoring criteria specific to Alaska can be found on the Meteorological Monitoring Data Validation Tables (**Appendix A**) and **Table A8,** *Alaska Meteorological Measurement Quality Objectives***.**

Modifications to EPA/ADEC Method Analyzers and Procedures

If monitoring data is to be used to support NCore, SLAMS, SPM or PSD quality criteria pollutant monitoring, and design changes to the method equipment and/or method procedures are intended, prior approval must be received from the DEC's Air QA Officer (or designee) through the Quality Assurance Plan (QAPP) approval process before monitoring begins. Monitoring data collected without this approval may be rejected. Full responsibility for potential DEC non-acceptance of monitoring data rests solely on the primary organization/permittee/contractor collecting the data.

PM_{10} Continuous Method Analyzers and Procedures

Even though EPA has given federal equivalent method (FEM) approval to some continuous PM_{10} monitoring methods, ADEC requires that such monitoring methods must demonstrate in-situ comparability testing for one year with an approved EPA FRM PM_{10} monitor operating on a minimum every-6th-sampling day frequency. Comparability (least squares fit) between the PM_{10} FRM method and the continuous PM_{10} method must meet:

- $0.90 \leq$ slope ≤ 1.10
- Intercept ≤ 5 ug/m^3
- Correlation coefficient (R^2) ≥ 0.95

The data must be collected in different seasons at dramatically different temperatures and adequately represent a sufficient density of data points that span the PM_{10} method measurement range of interest. Once approval is received, the continuous PM_{10} monitoring method may be used in a similar local/regional airshed pending ADEC AMQA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ PM_{10} method comparability may be required for new locations. The EPA document, *"Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and Continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI),"* provides guidance on developing acceptable inter-method comparability (https://www.epa.gov/system/files/documents/2021-07/cont_pm2.5-for-aqi_-epa-454-b-02-002-002.pdf).

<u>$PM_{2.5}$ Continuous Method Analyzers and Procedures</u>

Even though EPA has given federal equivalent method (FEM) and Class III approval to some continuous $PM_{2.5}$ monitoring methods, ADEC requires that such monitoring methods must demonstrate in-situ comparability testing for one year with an approved EPA FRM $PM_{2.5}$ monitor operating on a minimum every-6th-sampling day frequency. Comparability (least squares fit) between the $PM_{2.5}$ FRM method and the continuous $PM_{2.5}$ method must meet:

- $0.90 \leq$ slope ≤ 1.10
- Intercept ≤ 2 ug/m^3
- Correlation coefficient (R^2) ≥ 0.95

The data must be collected in different seasons at dramatically different temperatures and adequately represent a sufficient density of points that span the $PM_{2.5}$ method measurement range of interest. Once approval is received, the continuous $PM_{2.5}$ monitoring method may be used in a similar local/regional air shed pending ADEC AMQA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ $PM_{2.5}$ method comparability may be required for new locations. The EPA document, *"Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI),"* provides guidance on developing acceptable inter-method $PM_{2.5}$ comparability (https://www.epa.gov/system/files/documents/2021-07/cont_pm2.5-for-aqi_-epa-454-b-02-002-002.pdf).

f. Good Field Measurement Practices

Good Field Measurement Practices (GFMPs) refer to general practices that relate to many, if not all the measurements made in the field (similar in scope and common sense as those referred to as Good Laboratory Practices (GLPs)). They are usually independent of SOPs and encompass subjects such as:

- Facility maintenance
- Records
- Field sample management and handling
- Maintenance of monitoring equipment
- Cleanliness of sample collection equipment, manifolds, etc.
- Representative traceability of calibration/audit standards (certification/recertification of calibration/audit standards over their intended range of use)

- General principles for calibration of monitoring equipment
- Safe handling of hazardous and/or potentially hazardous materials
- Field safety
- Etc.

In many cases, the activities may not be formally documented because they are considered common knowledge and common sense. However, not applying GFMPs can significantly affect the reliability of the collected data and may even be cause for data invalidation.

12. SAMPLE HANDLING & CUSTODY

Maintaining sample integrity through field collection, transit, storage, and subsequent analytical phases is critical to establishing final sample data reliability. Careful documentation of the process ensures that proper handling, etc. occurred and is part of the custody record.

The State of Alaska does not follow strict Sample "Chain of Custody" for Alaska's NCore, SLAMS and SPM monitoring program. The State, however, does maintain sample/sample data integrity by tracking samples/sample data from sample collection through analysis, data reduction, data validation, data reporting and archiving of sample/sample data. These procedures can be found in the respective monitoring methods.

For the Ambient Air Quality Monitoring Program, sample handling pertains only to the manual methods of particulates (PM_{10}, $PM_{2.5}$, $PM_{2.5}$ speciation) and Lead (Pb). Careful attention and consistency in the process of filter handling, as specified in SOPs, is critical to minimizing potential measurement errors. The phases of sample handling include:

- Sample labeling,
- Sample retrieval, and
- Sample transport.

a. Sample Labeling and Identification

Sample labeling and identification will follow the specific procedures in the respective methods/SOPs to ensure positive identification throughout the testing and analytical procedures. In general, each sample will:

- Have a unique identification label that is indelible and unaffected by gases and temperatures to which it will be subjected and does not impair the sample filter's capacity to function as designed.
- Use a transport container with a unique identification to prevent the possibility of sample interchange.
- Be properly handled to ensure there is no contamination and that the sample analyzed is actually the sample taken under the conditions reported.
- Be accompanied by pertinent sample collection data as specified in the respective method/SOP (e.g., sample date, sample run time, sample begin/end flow rate, sample retrieval date, operator's initials, etc.).

Data is recorded digitally in a computerized data acquisition system (DAS) and stored on secure servers.

b. Sample Retrieval

To protect the integrity of each sample, samples need to be carefully removed from monitoring equipment/devices and placed in sealed and non-reactive containers. Specific sample retrieval procedures may be found in the respective monitoring methods/SOPs.

c. Sample Transport

Precautions must be taken to eliminate the possibility of tampering, accidental destruction, and/or physical and chemical action on the sample. Attributes that can affect a sample's integrity include: temperature, air pressure, moisture, and physical handling of samples (packing, jostling, etc.). The practical aspects of sample transport can vary dependent upon the method. Specific handling procedures are addressed in the respective EPA and DEC monitoring methods and project-specific QAPPs and SOPs.

13. ANALYTICAL METHODS

Analytical methods for the Ambient Air Quality Monitoring Program are those methods requiring laboratory analysis of samples collected under field monitoring conditions, specifically the filter-based PM_{10}, $PM_{2.5}$ and Pb methods. These methods all have Federal Reference or Equivalent Methods designations. A list of these methods can be found at:
https://www.epa.gov/amtic/air-monitoring-methods-criteria-pollutants

The EPA *QA Handbook for Air Pollution Measurement Systems, Volume II* provides specific Federal Reference Method procedures for the measurement of the ambient air quality criteria pollutants. These methods can be found on the EPA AMTIC website:
http://www.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf.

ADEC AMQA also maintains a set of ADEC-approved analytical procedures for the analysis of PM_{10}, $PM_{2.5}$ and Pb-TSP filters. These methods, SOPs and other QA guidance documents can be found on the ADEC AMQA website:
https://dec.alaska.gov/air/air-monitoring

A list of these methods/SOPs can be found in **Appendix B** of this document.

Since both specific field and analytical procedures for ambient air quality criteria pollutants are available in the above referenced documents, this section limits discussion to general concepts of Standard Operating Procedures (SOPs) and Good Laboratory Practices (GLPs) as they relate to EPA and DEC criteria pollutant monitoring methods.

a. Standard Operating Procedures (SOPs)

To perform sampling and analysis operations consistently, SOPs must be written as part of a QAPP. SOPs are written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and are officially approved as the method for performing routine and repetitive tasks.

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

1. Scope & Applicability
2. Summary of Method
3. Definitions
4. Health & Safety Warnings
5. Cautions
6. Interferences
7. Personnel Qualifications
8. Apparatus & Materials
9. Instrument or Method Calibration
10. Sample Collection
11. Handling and Preservation Sample Preparation & Analysis
12. Troubleshooting
13. Data Acquisition, Calculations & Data Reduction
14. Computer Hardware & Software (used to manipulate analytical results and report data)
15. Data Management & Records Management
16. Data Validation Table (predetermined criteria that defines limits to determine collected data quality)

SOPs should follow the guidance document, *Guidance for Preparing Standard Operating Procedures EPA QA/G-6*. This document is available through the EPA Quality System Homepage and website: https://www.epa.gov/quality/guidance-preparing-standard-operating-procedures-epa-qag-6-march-2001

It is ADEC policy that SOPs be written by the individual(s) who are performing the procedures being standardized and subsequently reviewed by personnel that oversee the respective measurement operations. SOPs for the ambient air quality monitoring program must be included in QAPPs, either by reference or by inclusion of the actual method. If a method is referenced, it must be stated that the method is followed exactly or an addendum that explains changes to the method must be included in the QAPP. If a modified method will be used for an extended period of time, the method should be revised to include the changes to the appropriate sections. QA personnel (or their designees) with appropriate training and experience review and approve the SOPs.

b. Good Laboratory Practices (GLPs)

GLPs refer to general practices that relate to measurements made in a laboratory. They are usually independent of the SOP and cover subjects such as maintenance of facilities, records, sample management and handling, reagent control, and cleaning of laboratory glassware. In many cases, the activities mentioned above may not be formally documented because they are considered common knowledge. Although not every activity in a laboratory needs to be documented, the activities that could potentially cause unnecessary measurement uncertainty, or have caused significant variance or bias, would be reason to generate a method.

In 1982, the Organization for Economic Cooperation and Development (OECD) developed principles of good laboratory practice. The intent of the GLP is to promote the quality and validity of test data by covering the process and conditions under which Environmental Data Operations (EDOs) are planned, performed, monitored, recorded, and reported. The principles include:

- Test facility organization and personnel
- Quality assurance program
- Facilities
- Apparatus, material, and reagents
- Test systems
- Test and reference substances
- Standard operating procedures
- Performance of the study
- Reporting of study results
- Storage and retention of records and material

c. Laboratory Activities

For ambient air samples to provide useful information or evidence, laboratory analyses must meet the four basic requirements:

1. Equipment must be frequently and properly calibrated and maintained.
2. Personnel must be qualified to make the analysis.
3. Analytical procedures must be in accordance with accepted practice.
4. Complete and accurate records must be kept.

These laboratory activities relate not only to the analysis of particulate matter and lead but also other activities necessary to collect and report measurement data such as:

- Certification of field and laboratory calibration standards,
- Certification of field and laboratory audit standards, and
- Preparation of standard reference materials.

Table B10 and **Table B11** list Laboratory Quality Control activities, their frequency of occurrence, and criteria that are important to the analyses and data validation for PM_{10} and $PM_{2.5}$ sample filters.

Note: PM_{10} Low Vol filter analysis criteria same as $PM_{2.5}$ filter analysis, except no filter holding time criteria.

Table B10 Laboratory QC Criteria for Analysis of $PM_{2.5}$ & PM_{10} Low-Vol Filters

Requirement	Frequency	Acceptance Criteria	CFR & QA Guidance Document 2.12 Reference	Information Provided
Filter Checks				
Unexposed filter integrity check	Each filter	No visual defects	40 CFR Part 50 App L Sec 10.2 2.12 Sec 10.3	Contamination of filter blanks from moisture gain/loss or other contaminants
Exposed filter integrity check				
Lot Blanks	9 filters/lot	< ± 15.1 µg change between weighings	2.12 Sec 10.5	
Exposure Lot Blanks	3 filters/lot	< ± 15.1 µg change between weighings	2.12 Sec 10.5	
$PM_{2.5}$ Filter Holding Times				
Pre-sampling Weighing	All filters	≤ 30 days before sampling	40 CFR Part 50 App L Sec 8.3.5 2.12 Sec 7.9	Controls established to minimize potential loss of volatile/sub-volatile components of particulate mass
Sample Recovery		≤ 177 hours (7 days & 9 hrs) from sample end date	40 CFR Part 50 App L Sec 10.10 https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/appendix-Appendix%20L%20to%20Part%2050	
Post-sampling Weighing		Kept at ≤ 25°C from sample retrieval to conditioning ≤ 10 days from sample end date if shipped at ambient temp, or ≤ 30 days if shipped below avg ambient (or 4° C or below for avg sampling temps < 4° C) from sample end date	40 CFR Part 50 App L Secs 8.3.6 and 10.13	
Filter Conditioning Environment				
Equilibration	All filters	24 hrs minimum	40 CFR Part 50 App L Sec 8.2 2.12 Sec 10.4	Controls established to minimize potential mass
Temperature Range		24-hr mean, 20.0° – 23.0° C		
Temperature Control		< 2.1° C SD over 24 hrs		

Table B10 Laboratory QC Criteria for Analysis of $PM_{2.5}$ & PM_{10} Low-Vol Filters				
Requirement	**Frequency**	**Acceptance Criteria**	**CFR & QA Guidance Document 2.12 Reference**	**Information Provided**
Humidity Range		24-hr mean 30.0% - 40.0% RH or within ± 5.0% sampling RH but ≥ 20% RH	Summary of Guidance; Filter conditioning and Weighing Facilities and Procedures for $PM_{2.5}$ Reference and Class I Equivalent Methods (https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/appendix-Appendix%20L%20to%20Part%2050	gain/loss contamination due to moisture Weighing Lab 5-minute Temp and RH data must be retained for at least 5 years
Humidity Control		< 5.1% SD over 24 hrs		
Pre/Post Filter Conditioning RH		Difference in 24-hr means < ± 5.1% RH	40 CFR Part 50 App L Sec 8.3.3	
Balance		Located in filter conditioning environment	40 CFR Part 50 App L Sec 8.3.2	
Calibration/Verification				
Microbalance Readability	At purchase	1 µg	40 CFR Part 50 App L Sec 8.1 2.12 Sec 4.3.6	Required balance sensitivity
Microbalance Repeatability	At purchase & 1/year	1 µg	2.12 Sec 4.3.6	Required balance precision
Microbalance Auto-Calibration	Prior to each weighing session	Manufacturer's specification	40 CFR Part 50 App L Sec 8.1 2.12 Sec 10.6	Verification of equipment operation
Balance Calibration	At purchase, every 365 days, and 1/year	Manufacturers specification	40 CFR Part 50 App L Sec 8.1 2.12 Sec 10.11	Verification of equipment operation
Lab Temperature Check	Quarterly	< ±2.1° C	2.12 Sec 10.10	Verification of equipment operation
Lab Humidity Check	Quarterly	< ±2.1% RH	2.12 Sec 10.10	Verification of equipment operation
Calibration Standards				

Table B10 Laboratory QC Criteria for Analysis of $PM_{2.5}$ & PM_{10} Low-Vol Filters

Requirement	Frequency	Acceptance Criteria	CFR & QA Guidance Document 2.12 Reference	Information Provided
Working Mass Stds Verification Compared to primary standards	3-6 month	< ±2.1 µg	2.12 Sec 4.3.7 and 9.7	Working standards verification
Primary Mass Stds Certification	Every 730 days and once per two years	0.005 mg (Class 0)	2.12 Sec 4.3.7 and 9.7	Transfer standards certification
Working Mass Sds Certification	Every 365 days and once per year	0.010 mg (class 1)	2.12 Sec 4.3.7 and 9.7	Working standards certification
Lab Temperature Std	Every 365 days and once per year	± 0.1 °C resolution, ± 0.5 °C accuracy	2.12 Sec 4.3.8 and 9.4	Transfer standard certification
Lab Humidity Std Certification	Every 365 days and once per year	< ±2.1% RH	2.12 Sec. 4.3.8 and 9.4	Transfer standard certification
QC Checks				
Zero Balance Check	Prior to every weighing	≤ 1 µg		Balance bias/stability
Balance Check (working standards)	beginning, every 10th sample, end	< ±3.1 µg from certified value	2.12 Sec 10.6	
Field Filter Blank	10% or 1/weighing session	< ±30.1 µg change between weighings	40CFR Part 50 App L Sec 8.3 2.12 Sec 10.5	Overall filter handling/contamination
Lab Filter Blank	10% or 1/weighing session	< ±15.1 µg between weighings	40CFR Part 50 App L Sec 8.3 2.12 Sec 10.5	Contamination of lab blank due to moisture control, etc.
Duplicate Filter Weighing	1/weighing session	< ±15.1 µg between weighings	2.12 Sec 10.8	Weighing repeatability/filter stability

14. QUALITY CONTROL (QC)

a. Definitions

Care must be taken not to equate Quality Control (QC) with Quality Assurance (QA). Though the two are similar, there are some basic differences: QC is concerned with the product, while QA is process–oriented. QC is a subset of QA.

Even with the differences defined, identifying the differences between the two can be hard. QC involves evaluating a product, activity and/or service. By contrast, QA is designed to ensure processes are sufficient to meet the end objectives. QA ensures a product or service is manufactured, implemented, created, or produced in the correct way. QC evaluates whether the end result is satisfactory.

Quality Assurance (QA) – QA for ambient air and meteorological monitoring operations is the overall systematic process of planning, implementation, monitoring, verifying, and determining whether the collected data meets or exceeds the data quality objectives (DQOs) of NCore, SLAMS, SPM and/or PSD quality monitoring data.

Quality Control (QC) – QC for ambient air and meteorological monitoring operations is the overall system of technical functions, technical processes and physical characteristics that measures the attributes and performance of the monitoring procedure to ensure quality data meets the NCore, SLAMS, SPM and/or PSD data criteria requirements and objectives.

Quality Assessments – Quality Assessments are independent measurements/reviews (verifications) made of the QC System (i.e., the technical functions, technical processes, and physical characteristics that measure the attributes and performance of the monitoring procedure). Quality Assessments include Technical Systems Audits, Performance Audits, Network Reviews, etc. (please see **Section 20**, *Quality Assessments*). As with Quality Control, Quality Assessments are also under the umbrella of Quality Assurance.

Figure B3 depicts the functional aspects of Quality Control, Quality Assessment, and their relationship within the umbrella Quality Assurance Program for the Ambient Air Monitoring & Quality Assurance Program.

Figure B3. Quality Control & Quality Assessment's Relationship within the Ambient Air Monitoring & Quality Assurance Program

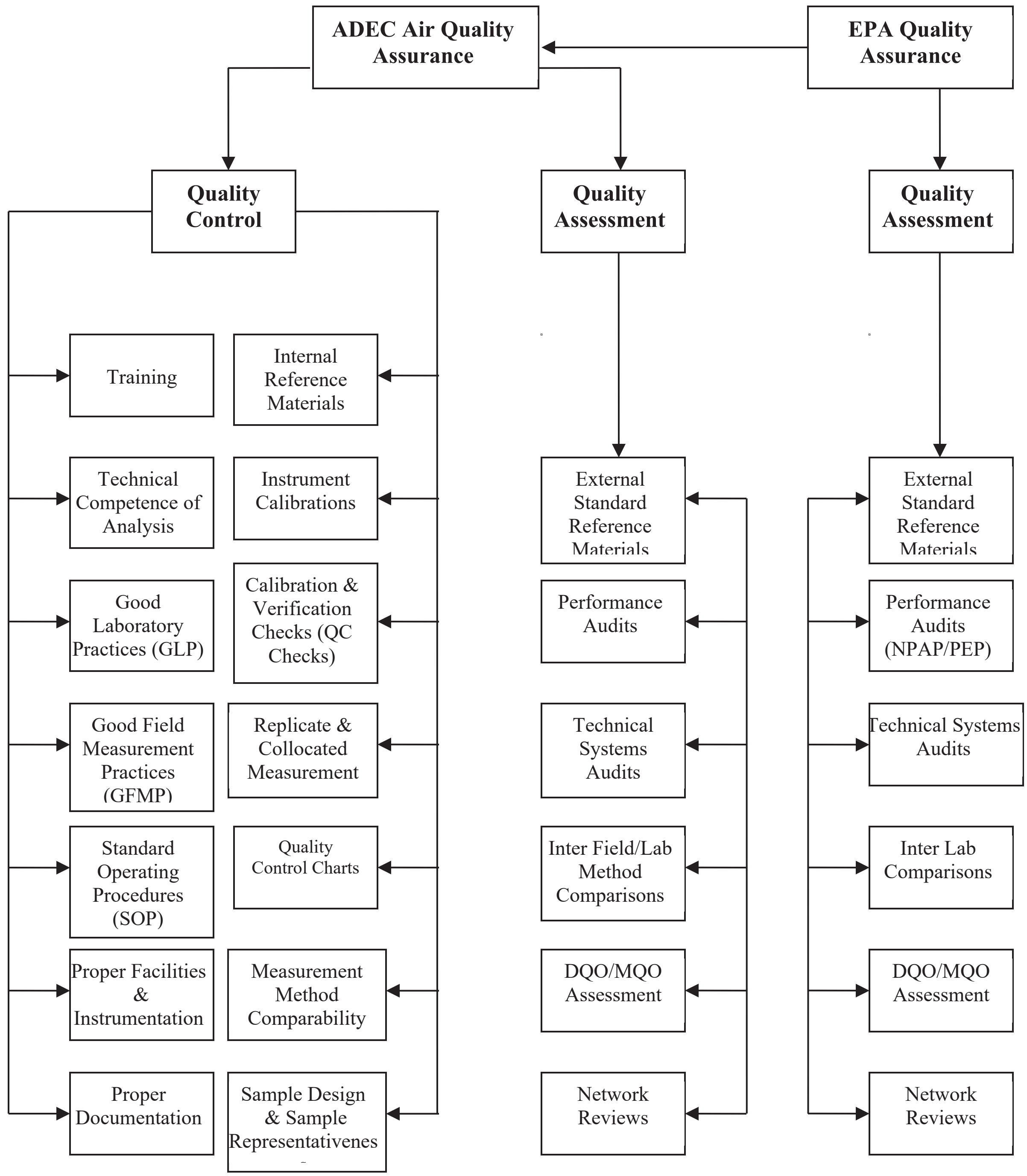
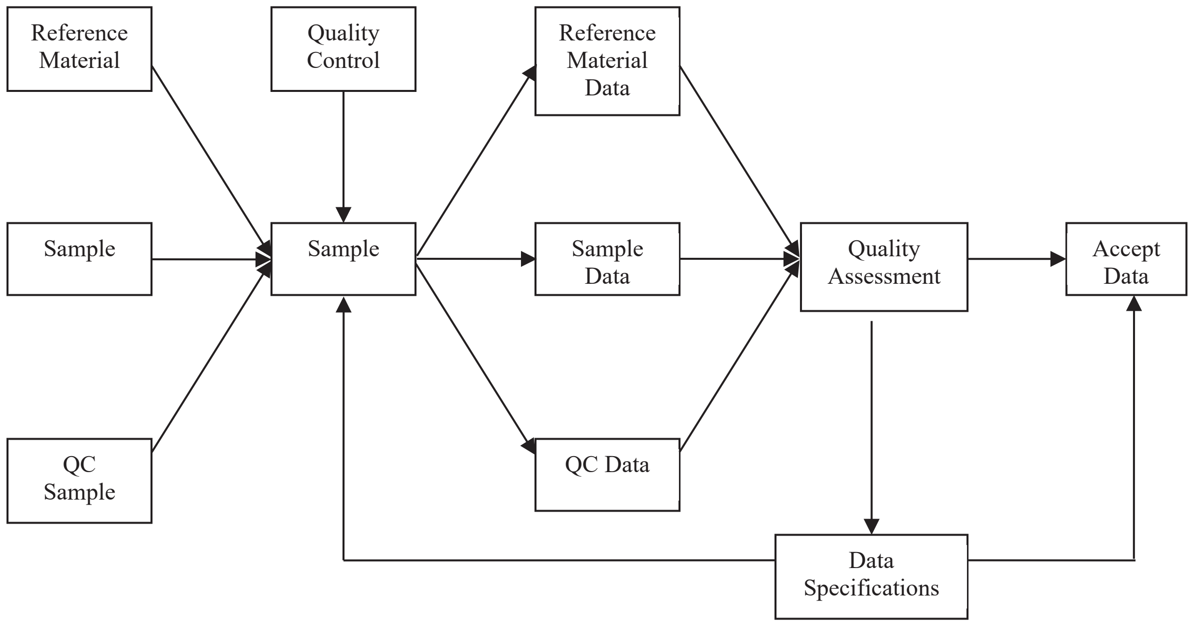


Figure B4 describes the overall process of accepting routine data.

Figure B4. Quality Control's Relationship to Routine Acceptance of Data



b. Measurement Quality Objectives and Quality Control

The Alaska Ambient Air Monitoring MQO Table (**Table A7**) and Alaska Meteorological Monitoring MQO Table (**Table A8**) list the most critical QC sample/criteria that must be met to validate/report reliable monitoring data.

c. Data Validation Tables and Quality Control

Method-specific Data Validation Criteria have been developed for the various ambient air quality and meteorological measurement methods. These criteria are ranked under three classes of "data acceptance criteria" for a measurement method and define how the criteria should/must be used to evaluate overall data quality. These method-specific Data Validation Tables are located in **Appendix A**. These data quality criteria categories are:

1. ***CRITICAL CRITERIA TABLE*** - Criteria deemed critical to maintaining the integrity of a sample or group of samples reside in the Critical Criteria Table. Observations that do not meet each criterion on the Critical Table should be invalidated unless there are compelling reasons and justifications for not doing so. The samples for which one or more of these criteria are not met are invalid unless proven otherwise. The cause for not operating in the acceptable range for each violated criterion must be investigated and minimized to reduce the likelihood that additional samples will be invalidated.

2. ***OPERATIONAL EVALUATIONS TABLE*** - Criteria that are important for maintaining and evaluating the quality of the data collection system reside in the Operational Evaluations Table. Violation of a criterion, or a number of criteria, may be cause for invalidation. The decision should consider other quality control information that may or may not indicate the data are acceptable for the parameter being controlled. Therefore, the sample or group of samples for which one or more of these criteria are not met is suspect unless other quality control information demonstrates otherwise. The reason for not meeting the criteria must be investigated, mitigated and/or justified.

3. ***SYSTEMATIC ISSUES TABLE*** - Criteria important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples reside in the Systematic Issues Table. For example, data quality objectives are included in this table. If data quality objectives are not met, this does not invalidate any of the samples, but it may impact the error rate associated with the attainment/non-attainment decision.

Other elements of this QAPP that contain related sampling and analytical QC requirements include:

- **Sample Process and Design (Section 10)** – discusses requirements/issues for determining if the collected sample(s) accurately represents population/area of interest;
- **Sample Method Requirements (Section 11)** – identifies planned field QC samples and procedures for sample(s) preparation and handling, etc;
- **Sample Handling & Custody (Section 12)** – discusses requirements/issues related to maintaining integrity of sample(s) during transport;
- **Analytical Methods (Section 13)** - discusses requirements/issues related to subsampling methods, preparation of QC samples (e.g., blanks and replicates); and
- **Instrument Calibration and Frequency (Section 15)** – defines prescribed criteria for triggering recalibration.

d. Use of Computers for Quality Control

Computers are used throughout the Ambient Air Monitoring and Quality Assurance Program for various aspects of Quality Control. Some analytical methods incorporate the use of a computer to control and semi-automate routine analytical measurement operations (e.g., DEC laboratory gravimetric analysis of PM_{10} and $PM_{2.5}$ sample filters). Other computers are also routinely used to monitor/measure QC within the Ambient AMQA Program to:

- Compute calibration equations
- Compute measures of linearity for calibrations (e.g., correlation coefficients, slope and intercept)
- Plot calibration curves
- Compute zero/span drift data
- Compute precision and accuracy results
- Plot and compute control limits
- Automatically flag out-of-control results
- Maintain and retrieve calibration and performance records

15. PROCUREMENT, ACCEPTANCE TESTING AND MAINTENANCE REQUIREMENTS FOR INSTRUMENTS, SUPPLIES AND CONSUMABLES

This section details the procedures used for procuring, inspecting, testing, and accepting instruments, supplies and consumables that directly or indirectly affect data quality. By having documented inspection and acceptance criteria, consistency can be assured.

a. Procurement and Acceptance Testing of Equipment

The AMQA Program Manager is responsible for identifying air monitoring equipment needs and approving equipment purchases. The following protocol will be used in procurement of air monitoring equipment:

- Equipment evaluation and selection. Prior to purchase, the equipment's performance will be evaluated, and other users queried, in regard to the performance, dependability and ease of operation.
- Purchase specifications. The purchase contract will state the performance specifications that ensure only equipment of the desired quality is obtained, require a one-year warranty, and indicate payment will not be made until the equipment has passed an acceptance test.
- Acceptance Testing. Prior to payment, the equipment should be tested to ensure that it meets the requirements listed in the purchase specifications. For analyzers, the minimum test consists of checking zero drift, span drift, voltage stability, temperature stability, and linearity.

b. Maintenance of Equipment

Utilizing the specifications in EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II* and *IV*, preventive and remedial maintenance tasks, schedules, parts, and supplies will be maintained by the AMQA Program.

The Station Operators are responsible for performing routine preventive and corrective maintenance. Each monitoring site and/or laboratory will maintain a logbook in which the Operator will record a brief description of the need for maintenance, the actions performed and the condition of the instrument after maintenance procedures were performed. Additionally, the date, time, shelter temperature, operator’s initials, and any pertinent site observations will be recorded.

Equipment will be maintained according to frequencies outlined in EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II* or by the maintenance frequency recommended in the respective instrument manufacturer’s manual.

c. Maintenance of Calibration/Audit Standards and Equipment

Calibration, Quality Control (QC) check, and audit standards will be maintained within the recommended certification time-period. Calibration, QC, and audit standards must be maintained within specified accuracy criteria for the method and should be calibrated/certified over the intended range of use. Upon receipt of a recertified or new standard, it should be compared against another standard of known quality and accuracy to ensure its reliability before routine use. Copies of all calibration/audit/QC check standards will be maintained by ADEC.

16. INSTRUMENT CALIBRATION AND FREQUENCY

Calibration of an analyzer (or any other piece of measurement equipment) establishes the quantitative relationship between a calibration standard of known pollutant concentration input (in ppm, ppb, µg/m^3, etc.) and the analyzer's response (chart recorder reading, output volts, digital output, etc.). This relationship is subsequently used to convert an analyzer's response to corresponding pollutant concentrations. For these measured values to be considered reliable, the analyzer must be calibrated over its expected range of use with calibration standards of known accuracy (i.e., certified accurate over the calibration standard's intended range of use). Each analyzer shall be calibrated as directed by the analyzer's operation/instruction manual and in accordance with method specific SOPs and data validation templates. Calibration documentation shall be maintained with each analyzer in the field and in a central backup file. Documentation should be readily available for review and must include:

- Calibration data,
- Calibration equation(s),
- Analyzer identification,
- Calibration date,
- Analyzer location,
- Calibration standards used and their traceability (showing the standard's certified traceability over range of intended use),
- Identification of calibration equipment used, and
- Person conducting the calibration.

a. Calibration Standards

This section primarily addresses requirements for calibrating the equipment used to calibrate the field equipment, e.g., transfer standards and working standards. The requirements for calibrating the field and laboratory analyzers/equipment are listed in method specific *Data Validation Tables* **(Section 14)** and **Tables B9 and B10** *Laboratory QC Criteria for the Analysis of $PM_{2.5}$ & PM_{10} Filters* **(Section 13).** Calibrations include *adjusting* the instrument or sensor to produce a response that is consistent with a standard. Calibration of a flow rate, for example, must consist of at least three separate flow rate measurements (a multipoint calibration) approximately evenly spaced within the range of the operational flow rate. Verifications, on the other hand, are made to verify that the operations of the instrument are within specified limits. Verifications do not include any adjustment to the sampler/analyzer and are described in **Section 14**.

Calibration activities follow a two-step process:

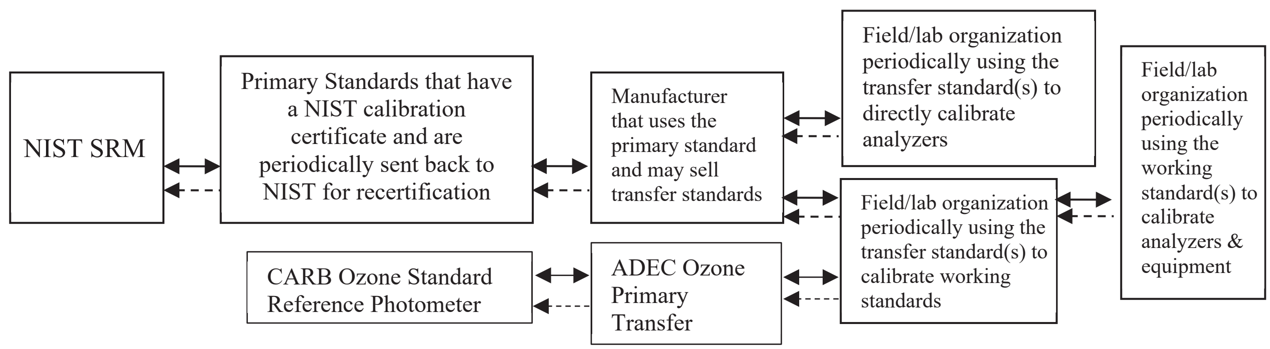
- Certifying the calibration standard (typical standards used by ADEC include flow rate instruments, thermometers, barometers, and laboratory scale weights) against a NIST standard (usually done by sending the calibration standard to a weights and measures laboratory), and

- Comparing the calibration standard and/or transfer standard against the routine samplers or sensors.

b. Calibration Hierarchy

Figure B5, *Hierarchy of Calibration Standard(s)*, depicts the hierarchy of calibration standards and their relationship to the field/lab equipment that they are used to calibrate.

Figure B5. Hierarchy of Calibration Standard(s)



Definitions

Primary Reference Standard - A primary reference standard can be defined as a homogenous material with specific properties, such as identity, unity, and potency that has been measured and certified by a qualified and recognized organization, such as the NIST standard reference materials (SRMs). NIST also describes a Primary Reference Standard as a standard that is designated or widely acknowledged as having the highest metrological qualities and whose value is accepted without reference to other standards of the same quantity. For example, NIST-F1 Atomic Clock is recognized as a primary standard for time and frequency. A true primary standard like NIST-F1 establishes maximum levels for the frequency shifts caused by environmental factors. By summing or combining the effects of these frequency shifts, it is possible to estimate the uncertainty of a primary standard without comparing it to other standards. NIST maintains a catalog of SRMs that can be accessed through the Internet *(*http://www.nist.gov). Primary reference standards are usually quite expensive and are often used to calibrate, develop, or assay working or secondary standards. In order to establish and maintain NIST traceability the policies posted at http://ts.nist.gov/traceability/ should be observed.

NIST Traceable Transfer Standard – is a standard that has been compared and certified either directly or via no more than one intermediate standard to a primary standard such as a NIST Standard Reference Material (NIST SRM) or a USEPA/ NIST approved Certified Reference Material (CRM). A NIST Traceable Reference Material^{TM} (NTRM^{TM}) is a commercially produced reference material with a well-defined traceability linkage to existing NIST standards for chemical measurements. This traceability linkage is established via criteria and protocols defined by NIST to meet the needs of the metrological community to be served (NIST SP 260-136). Reference materials producers adhering to these requirements are allowed use of the NTRM trademark. A NIST NTRM may be recognized by a regulatory authority as being equivalent to a CRM.

Working Standard – A working standard is used to directly calibrate analyzers/equipment. Working standards may either be a NIST Traceable standard or a standard that has been directly certified against a NIST traceable standard. Certification of working standards may be established by either the supplier or the user of the standard. At a minimum, the certification procedure for a working standard:

- Establishes the concentration and accuracy tolerance of a working standard or calibrates/establishes the readout of an analog/digital meter (e.g., flow meter, thermometer, barometer, RH meter and meters used to calibrate meteorological sensors). For analog/digital meter outputs the certification range and accuracy tolerances must be specified;
- Certifies that the working standard is traceable to a NIST traceable standard that is "in-certification over the range of measurements over which the working standard is certified;"
- Includes a test of the stability of the working standard over several days; and
- Specifies a recertification interval for the working standard.

Note 1: For standards that are calibrated/certified meters (e.g., flow rate, volume, thermometers, hygrometers, pressure devices, etc.), the certified standard needs to have a measurement resolution greater than the minimum required accuracy required by the monitoring method as well as to be at a minimum 2 to 4 times more accurate than the measurement method's required accuracy criteria. Typically, Commercial Reference Method (CRM) certifications for these meters are valid for one year, or as specified by the CRM certification time frame. Flow rate certifications, verifications, calibrations, acceptance criteria, methods and frequencies are discussed in respective methods and method specific data validation tables found in Appendices A and B, and in the EPA *QA Handbook for Air Pollution Measurement Systems, Volumes II and IV*.

Note 2: Test concentrations of ozone (O_3) must be traceable to a primary standard UV photometer as described in 40 CFR Part 50 Appendix D.

Note 3: Test concentrations at zero concentration are considered valid standards. Although zero standards are not required to be traceable to a primary standard, care should be exercised to ensure that zero standards are free of all substances likely to cause a detectable response from the analyzer. Periodically, several different sources of zero standards should be inter-compared. The one that yields the lowest response can usually (but not always) be assumed to be the "best zero standard." If several independent zero standards produce the same response, it is likely that all the zero standards are adequate.

Note 4: All test gas concentrations (except zero) used for multi-point calibrations, zero/span, precision and one-point QC checks must be certified NIST-traceable, or EPA protocol as described earlier in this section.

c. Multi-point Calibrations

Gaseous Analyzer Multi-Point Calibrations (e.g., CO, O_3, NH_3, NOy, NO_2, SO_2)- Multi-point calibrations consist of five test concentrations, including zero concentration, a span concentration between 80% and 90% of the full scale (FS) of the analyzer under calibration, and the remaining test concentrations equally distributed between zero and span. The zero/span test concentrations are to be introduced directly to the back of the analyzer's sample inlet port and analyzer response adjusted to match zero/span test concentrations. After the analyzer's zero/span has been adjusted, zero/span test concentrations shall again be repeated to verify analyzer response matches the zero/span test gas concentrations.

Before generating the remaining test gas concentrations, the same zero/span test concentrations shall be introduced through as much of the sample train (sample probe/lines and manifold) as practicable prior to being introduced to the analyzer's sample inlet. The zero/span analyzer responses for both test gas configurations should be the same. If not, either there is a leak or obstruction in the sample introduction system or sample lines are contaminated. After verifying sample inlet configuration is not biasing calibration gas concentrations, complete the analyzer's multi-point calibration by supplying test gas concentrations directly to the back of the analyzer. Multi-point calibrations are used to establish or verify the linearity of analyzers upon initial installation, following physical relocation, after major repairs, after failure of a zero/span or one-point QC check or performance audit, and at specified frequencies.

Most analyzers have manual zero and span adjustment controls, or are capable of automatic self-adjustments, but due to the advancement in monitoring technologies, ambient air monitors are much more stable and frequent adjustments are typically not necessary. Span adjustments between multi-point calibrations are not recommended but zero adjustments are appropriate as needed. For analyzers in routine operation, unadjusted ("as is") analyzer zero and span response readings must be obtained and recorded prior to making any zero or span adjustments. After analyzer adjustment, final post-adjusted zero and span analyzer response (using the same zero/span test gas concentrations) readings must be taken and recorded from the same calibrated output device (data acquisition system, chart recorder, etc.) that will be used for subsequent ambient air measurements. Recommendations on frequency of calibration and analyzer adjustment are discussed in the EPA *QA Handbook for Air Pollution Measurement Systems Volume II*, Section 12.

The analyzer measured responses are plotted against the respective test gas concentrations, and the best fit linear (or non-linear, if appropriate) curve is determined. Ideally, least squares regression analysis (with an appropriate transformation of the data for non-linear analyzers) should be used to determine the slope and intercept for the best fit calibration line of the form:

$$\mathbf{y = m \bullet x + b}$$

Where: y = the analyzers response,

x = the value of the corresponding test gas concentration,
m = the slope, and
b = the y-axis intercept of the best fit calibration line.

Specific calibration procedures and calibration criteria are found in the respective measurement methods/SOPs and data validation tables (see Appendices A and B).

As a quality control check on calibrations, the standard error or correlation coefficient must be calculated along with the regression calculations. A control chart of the standard error or correlation coefficient should be maintained to monitor the degree of scatter in the calibration points and limits of acceptability.

Calibrations of gaseous analyzers are generally required twice per year (see respective method SOPs and data validation templates for method specific calibration frequency criteria).

Particulate Monitor/Sampler Multi-point Calibrations - Multi-point flow rate calibrations consist of generating three to five evenly spaced calibration flows, including zero, that bracket the sampler's expected operating range.

Multi-point calibrations will be used by ADEC to establish or verify the linearity of particulate monitor flow rate responses to known flow rates upon initial installation, following physical relocation, after major repairs, after failure of a one-point QC flow check or performance audit, and at specified frequencies.

Most particulate monitors have flow adjustment controls, which are adjusted based upon known flow rates generated to bracket the sampler's expected flow operating range. For particulate monitors in routine operation, unadjusted ("as is") flow readings must be obtained and recorded prior to making any adjustments. After adjustment, a final post-adjusted sampler flow shall be measured/recorded to verify that the particulate monitor's flow rate was set correctly.

The particulate monitor measured responses are plotted against the respective "known" flow rates and the best fit linear (or non-linear if appropriate) curve fit is determined. Least squares regression analysis (with an appropriate transformation of the data for non-linear analyzers) shall be used to determine the slope and intercept for the best fit calibration line of the form:

$$\mathbf{y = m \bullet x + b}$$

Where: y = the particulate sampler's flow rate response,
x = the value of the corresponding flow rate standard
m = the slope, and
b = the y-axis intercept of the best fit calibration line

Specific calibration procedures and calibration criteria are found in the respective measurement methods/SOPs and data validation tables (see **Appendix A** and **B**).

As a quality control check on calibrations, the standard error or correlation coefficient must be calculated along with the regression calculations. A control chart of the standard error or correlation coefficient should be maintained to monitor the degree of scatter in the calibration points and limits of acceptability.

Calibrations of particulate monitor flow rate measurement systems are generally required on an annual basis (see respective method SOPs and data validation templates for method specific calibration frequency criteria).

d. Zero/Span Quality Control (QC) Checks for Gaseous Analyzers

A zero/span QC check is a simplified two-point analyzer calibration verification used when analyzer linearity does not need to be checked. For continuous gaseous analyzers, zero/span QC checks will be performed at least every 2 weeks (see specific method requirements), although more frequent zero/span checks are strongly encouraged. Frequent zero/span checks minimize the extent of analyzer drift by enabling earlier detection of drift and enables subsequent analyzer adjustment to be made before the analyzer breaches control criteria, with subsequent loss of collected sample data.

The span concentration shall be within 70% to 90% of the analyzer’s full scale (FS) range and must be certified traceable (as described in section 16.1). The zero/span gas should be introduced into as much of the sample train as practicable. Periodically the zero/span gas should be introduced into the sampling system as close to the outdoor sample inlet as possible as an integrity check of the entire sample inlet system (sample train). The analyzer’s response to the zero/span gas at the sampler’s outside inlet should mimic the analyzer’s response to the zero/span gas as normally configured (either at the span port on the back of the analyzer or at the sample manifold).

Adjustment to the span setting due to a failed span QC check is not recommended. A multi-point calibration should be performed if the span check does not pass QC criteria.

Zero/span QC checks are to be documented in chronological format. Documentation includes: analyzer ID, date, standard used and its traceability, equipment used, operator performing the zero/span QC check, and unadjusted zero and span responses. Documentation shall be maintained both with the analyzer onsite as well as in a central file. The use of quality control (QC) charts should be used to graphically record and track level 1 zero/span results and analyzer drift.

For method specific zero/span procedures and acceptance criteria, please see the respective monitoring methods and data validation tables found in Appendices A and B and in the EPA *QA Handbook for Air Pollution Measurement Systems, Volume II*.

e. One-point QC Checks for Gaseous Analyzers

ADEC will employ a one-point QC check to monitor both precision and bias of gaseous measurement systems. A one-point QC check for gaseous measurement systems is the same as the precision gas introduced every two weeks to the back of the gaseous analyzer. One-point QC check results will be used to assess precision and bias over time of each gaseous analyzer. Gaseous one-point QC checks are required once every two weeks, though more frequent checks are strongly encouraged. One-point QC check concentrations for SO_2, NO_2 and O_3 monitors must be within 0.005-0.08 ppm and must be related to the mean or median of the ambient concentrations routinely measured by that monitor. For CO monitors, a range of 0.5-5 ppm must be used, and the concentration must be related to the mean or median of the ambient concentrations normally measured.

For method specific one-point QC check acceptance criteria, please see the respective monitoring methods and data validation tables found in Appendices A and B.

One-point QC checks are not to be used as a basis for analyzer zero/span adjustments, calibration updates or adjustment of ambient data. They are to be used as a verification tool showing an analyzer's continued calibration status. Whenever a one-point QC check shows an analyzer is not within recommended calibration control, a subsequent zero/span (or a multi-point) calibration must be conducted before any corrective action is taken.

If a level 2 zero/span check (i.e., a diagnostic test that may use non-NIST traceable standards) is to be used in the quality control (QC) program, a reference response for the check must be obtained immediately following a level 1 (NIST-traceable standards) zero/span (or multi-point) calibration while the analyzer's calibration relationship is accurately known. Subsequent level 2 zero/span check responses are compared to the most recent reference response to determine if a change in response has occurred. All level 2 zero/span checks are documented in a similar manner to level 1 zero/span checks.

f. Particulate Monitor One-point QC Checks

A one-point QC check of a PM monitor's flow measurement system is a simplified one-point calibration verification of the PM measurement system when the monitor's measurement linearity does not need to be evaluated. One-point QC checks of particulate monitors are used by ADEC when the linearity of the flow measurement range (temperature and pressure also included for $PM_{2.5}$ monitors and some PM_{10} monitors) does not need to be checked.

One-point QC checks of particulate monitors are conducted monthly, although more frequent checks may be conducted when meteorological conditions are favorable and access to monitoring sites is feasible. More frequent one-point QC checks minimizes the extent of measurement drift by enabling earlier detection of the PM monitor's drift and allows subsequent adjustment to be made before the monitor breaches control criteria with subsequent loss of collected sample data.

One-point QC checks generally evaluate both:

- The bias of the PM monitor's calibrated flow measurement system,
- Whether specific sample design flow rate conditions are being met to ensure fractionation of particle sizes within specific ranges (e.g., ≤ 2.5µm for $PM_{2.5}$ ≤ 10µm for PM_{10}, and ≤ 35µm for TSP), and
- Whether other required method specific criteria are being met (e.g., bias of temperature, pressure, and time measurement sensors).

For method specific one-point QC check acceptance criteria, please see the respective monitoring methods and data validation tables found in **Appendices A** and **B** and in the EPA *QA Handbook for Air Pollution Measurement Systems, Volume II*.

g. Data Reduction Using Calibration Information

An analyzer/particulate monitor/meteorological sensor's response calibration curve relates the measurement system's response to actual concentration units of measure; and the response of most measurement systems tends to change (drift) unpredictably with passing time. Hence, for sample monitoring data to be meaningful the measurement system must:

- Be calibrated over the range of expected measurement concentrations, and
- All sample measurements must be bracketed by calibration zero/span checks and one-point QC checks (particulate and gaseous measurement systems) and/or multipoint calibrations.

These two conditions must be addressed in the mechanism that is used to process the raw sample measurement readings into final concentration measurements. Specific data reduction processes are addressed in the respective monitoring methods/SOPs and Data Validation Templates (see **Appendices A** and **B**).

h. Validation of Ambient Data Based Upon Calibration Information

When zero, span and/or precision drift validation limits are exceeded, ambient measurements are to be invalidated back to the most recent point in time where such measurements are known to be valid unless there are compelling reasons and justification for not doing so. Usually, this point is the previous calibration or QC verification (multipoint, level 1 zero/span, one-point QC check, or accuracy audit), unless some other point in time can clearly be identified and related to the probable cause of the excessive drift (power failure, etc.). Also, data following a measurement system's malfunction or period of non-operation are to be invalidated up to the point of the next passing calibration (multipoint or level 1 zero/span or one-point QC check). Specific validation criteria can be found in the *Alaska Ambient Air Quality Monitoring MQO* (**Table**

A7) and the *Alaska Meteorological Monitoring MQO* (**Table A8)**. More detailed descriptions of these MQO's and how they are to be used to control and assess measurement uncertainty are described in method specific data validation tables found in **Appendix A**.

17. INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

Ambient air quality and meteorological parameters are measured using either chemical techniques or physical methods. Chemical analysis as well as some physical analysis involves the use of consumable supplies that must be replaced on a schedule consistent with their stability and the rate at which samples are taken. Some continuous analyzer methods require chemical scrubbers to remove contaminants from zero air sources, etc. Such scrubbers need to be replaced at a frequency determined by the manufacturer, as well as by the rate it is consumed, which often is monitoring site specific. FRM filters are inspected visually by laboratory personnel with a lamp and magnifying glass. Please refer to the respective method/SOPs and/or manufacturer's operations manual for inspection/acceptance testing and consumables criteria.

18. DATA ACQUISITION REQUIREMENTS

This section addresses data not obtained by direct measurement from the Air Quality Program. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the Program in a variety of ways. At this time, ADEC has not formalized the types of additional data that may be needed in support of the monitoring program. Possible databases which might be used include:

- Chemical and Physical Properties Data
- Sampler Operation and Manufacturers' Literature
- Geographic Location
- Historical Monitoring Information
- External Monitoring Data Bases
- Lead and Speciated Particulate Data
- Air Toxics Monitoring Data
- Regional Haze Monitoring Data
- U.S. Weather Service Data

Any use of outside data will be quality controlled to the extent possible following QA procedures outlined in this document and in applicable EPA guidance documents.

19. DATA MANAGEMENT

The success of Alaska's Ambient Air Quality Monitoring Program's objectives relies on data and their interpretation. It is critical that data be available to users and that these data are:

- Of known quality
- Reliable
- Aggregated in a manner consistent with their prime use
- Safely archived, and
- Accessible to a variety of users.

Quality Assurance/Quality Control (QA/QC) of data management begins with the raw data and ends with a defensible report, preferably through the computerized messaging of raw data.

Data management encompasses the overall flow of data, from field instruments through transfer computers (laptops, data acquisition systems, etc.) to final systems, which may be local office computers, a local network, or external systems (AQS).

DEC transitioned to the Data Management System (DMS) developed by Agilaire LLC known as AirVision in summer 2021. AirVision polls instrument data from a data acquisition system (DAS) developed by Agilaire LLC using the Model 8872 data logger known as AV-Trend, in 1-minute, 5-minute and 1-hour averages. Each data logger collects data from each analyzer digitally using a MODBUS communication protocol via TCP/IP or via a RS-232 connection. All meteorological data is collected from analog instruments and converted to digital, stored on the Model 8872 data logger, and averaged. All real-time data collected can be reviewed on the data logger using the AV-Trend program.

If the data logger fails to collect data from the analyzers, the analyzers' internal data logging feature can be used to recall stored data values. Under normal operations, the data logger continuously polls each analyzer and records the values collected from all established channels as raw concentrations. For instruments that provide hourly data, (i.e., MET One BAM 1020) the data logger processes a poll request. For non-continuous instruments, AirVision processes a poll request directly with the instrument. The instrument response is monitored by the datalogger with a preconfigured file format that translates the data using the AV-Trend program. The data loggers do not collect data from direct-polled instruments. Program staff can view and edit the station's 1-min and 1-hr average data using their PC workstation through an AirVision client interface window.

AirVision utilizes an Automatic Data Validation Processor (ADVP) which runs in conjunction with the 1-hour polling task. The ADVP feature monitors data collected from each site and runs predetermined validation rules to screen data before it is made available to the public. If a parameter is found out of tolerance based on the rules set in ADVP, the data will be flagged. Manual edits to data in AirVision are tracked with an "E" flag.

Data review and validation is conducted in AirVision and is described in more detail in the Data Validation SOP (http://dec.alaska.gov/air/air-monitoring/standard-operating-procedures/).

DEC has a complete dataset for all regulatory monitors 2020 through present in the AirVision system. Prior to AirVision, DEC used the DR DAS LTD Envidas system as the DAS. DEC still has access to data in Envidas for any historical research or data requests and is actively migrating historical data from Envidas to the AirVision system to ultimately have one active DAS and retire Envidas.

DEC uses a commercial Laboratory Information Management System (LIMS) from Measurement Technologies Laboratory (MTL). The MTL Filter Weighing System (FWS) is a comprehensive set of hardware and software components which automates the weighing of filter media and handling of associated data. The software and hardware will be updated as recommended by MTL.

The hardware includes MTL's robotic auto-handler, microbalance, environmental monitor, barcode reader, and optional static meter. The software allows for data collection, statistical process controls, and quality assurance measures. Balance readings and environmental conditions are automatically collected and stored by the software, eliminating human effort and error. The analytical microbalance is linked to a computer and acquires filter weights, continuous weighing chamber temperature and percent relative humidity (RH) electronically through the MTL LIMS. Conditions that are out-of-tolerance are flagged and reported by the software.

Filter sampling metadata is downloaded from particulate monitors on-site and sent to the lab with associated sample filter paperwork. Site operators work closely with the lab staff to coordinate shipments of pre- and post-weighed filters according to the validation table requirements. Analysts use a laboratory QC notebook in addition to the LIMS electronic database to record all QC data, including the microbalance calibration and maintenance information, routine internal QC checks of mass reference standards, laboratory, field and lot filter blanks, and external QA audits. The gravimetric laboratory SOP describes these processes (http://dec.alaska.gov/air/air-monitoring/standard-operating-procedures/).

Air quality staff are assigned responsibilities for separate or discrete parts of the data management process:

- The site operators are responsible for first level preparation of data. They assemble and evaluate auxiliary data files to evaluate validity of raw data. These files can include calibration information and certificates, QC checks (routine checks and audits), data flags, operator comments, and meta-data where available.

- The secondary reviewers are responsible for QC review, reviewing any data flagging or invalidation decisions with the QA Officer, and reporting significant data quality issues to the field operations manager and the data analysts who report to the program manager.
- The data analysts conduct a final (tertiary) review and submit the validated data to AQS.
- The program manager is responsible for final data certification.

Figures B6 and **B7,** *AMQA Overall Data Management Flow Charts*, provide a visual summary description of the data flow/management process.

Figure B6. AMQA Data Management Flow Chart – NCore/SLAMS/SPM

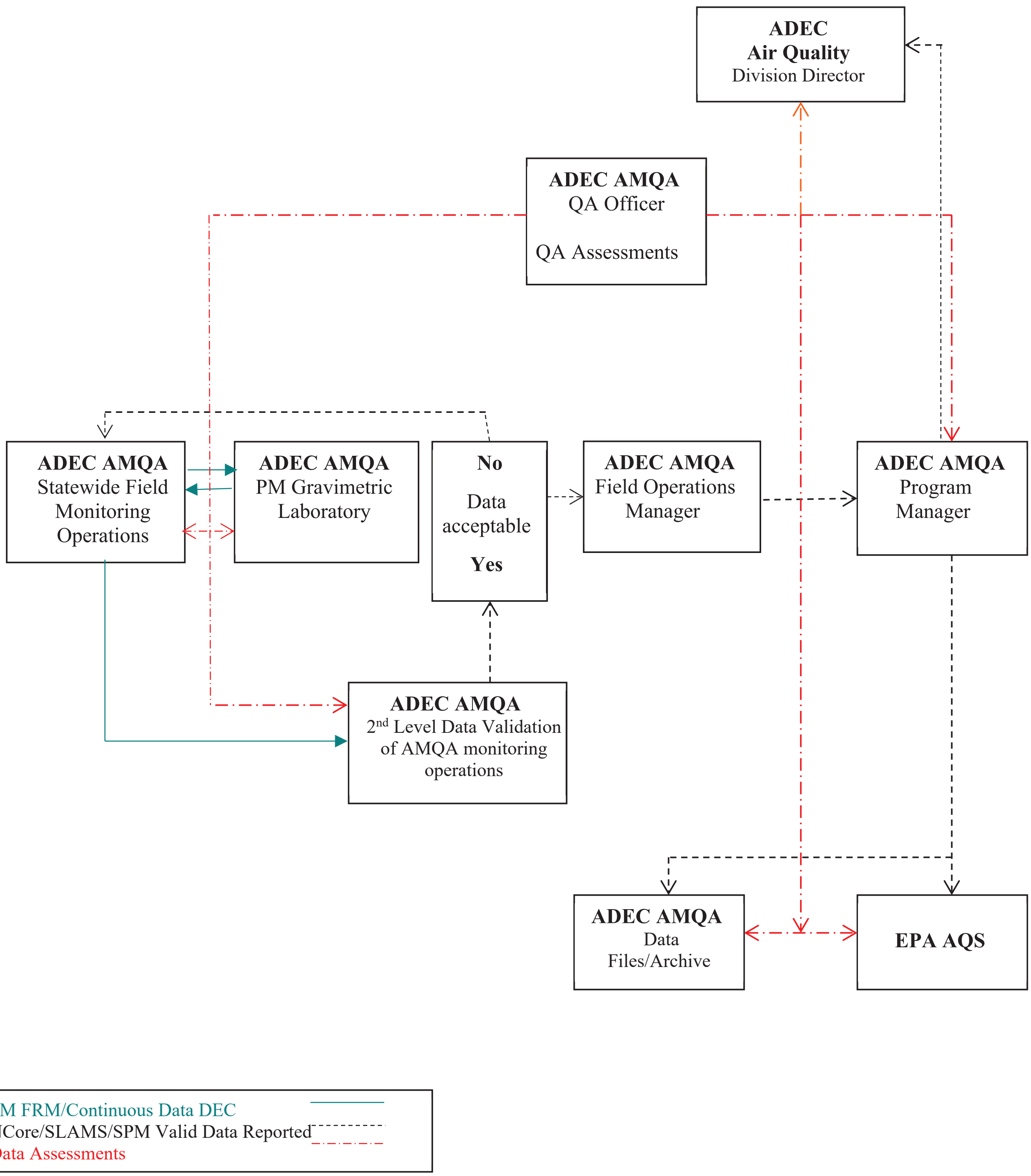
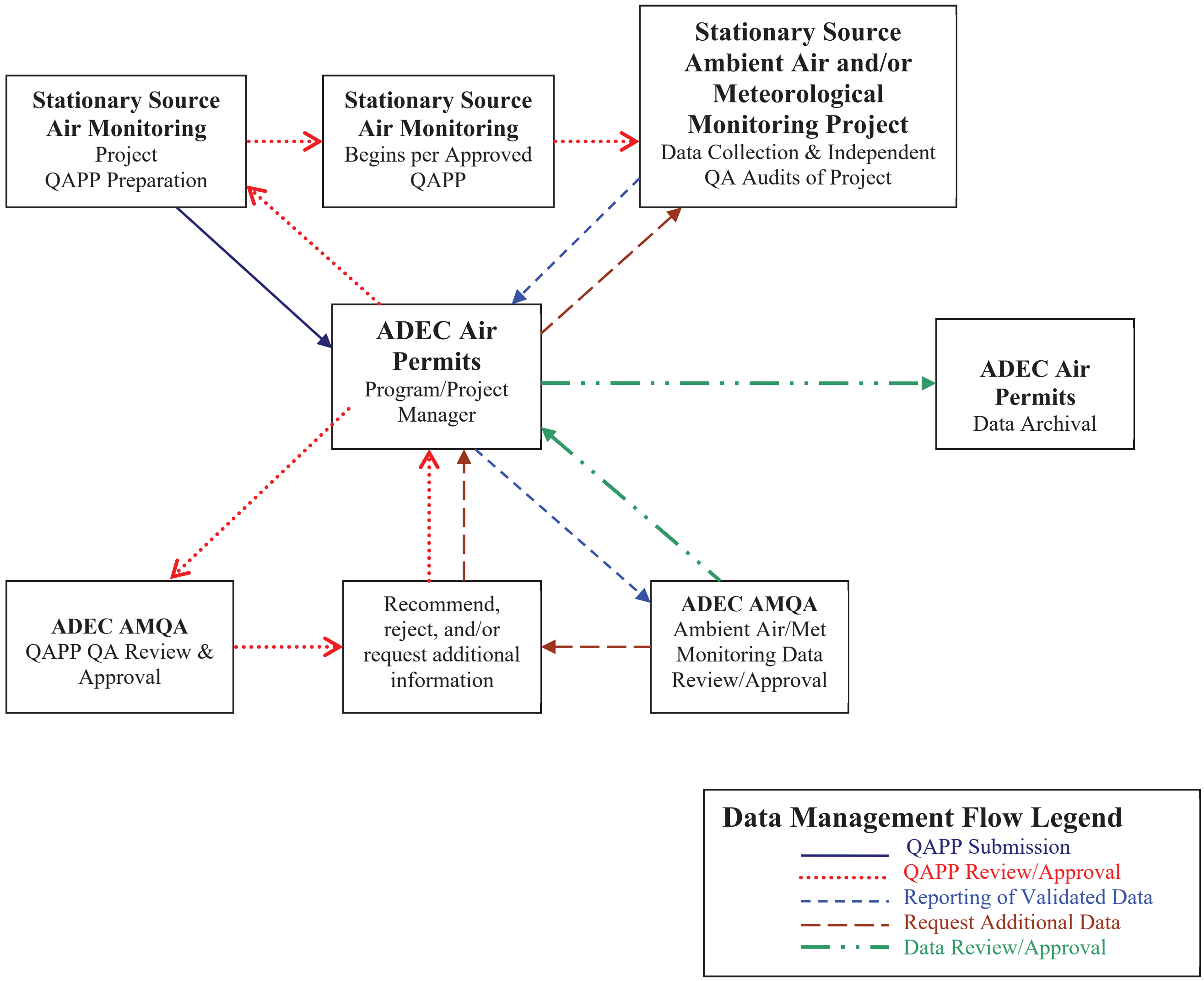


Figure B7. AMQA Data Management Flow Chart – Ambient Air & Meteorological Monitoring Conducted by Stationary Source for Regulatory Permitting Needs



There are two basic sources of data collected in support of ADEC's NCore/SLAMS/SPM/PSD ambient air monitoring network. These are:

1. Data collected via manual ambient air monitoring sampling methods. Manual methods are those methods that require manual/physical intervention by an operator/analyst to collect and measure and calculate subsequent sample results. Each sample is collected/measured as an aggregate of a preset sample collection time, usually 24-hours. These methods include:

    - PM_{10} Lo-Vol FRM ;
    - $PM_{2.5}$ FRM;
    - Lead on TSP; and
    - A variety of parameter-specific sampling systems utilizing various methodologies and sample collection media (i.e., drum samplers, dragger tube samplers, canister samplers for VOCs, sorbent trap cartridges for carbonyl compounds, etc.)

2. Data collected via continuous sampling ambient air and meteorological monitoring methods. Continuous methods are those methods that sample and analyze the pollutant of interest without required physical intervention by an operator to collect and measure the result. These methods utilize instrumentation that continuously measures and records the measured result, usually as an hourly average. These methods include:

    - Gaseous monitors (e.g., CO, NO_2, NO_y, O_3, SO_2, NH_3);
    - Continuous particulate monitors for PM_{10} and $PM_{2.5}$ (e.g., BAMs, Black Carbon—Aethalometers, Nephelometers); and
    - Meteorological parameters (e.g., wind speed, wind direction, temperature, barometric pressure, relative humidity, solar radiation).

All continuous analyzer data must include hourly values. Any group or agency operating a continuous SO_2 analyzer must report the twelve 5-minute SO_2 block averages in each hour, the maximum 5-minute block average in each hour, as well as the hourly SO_2 average. Continuous PM methods are required to sample continuously and report hourly as well as 24-hr values.

Measurement methods utilized in support of NCore/SLAMS/SPM/PSD monitoring projects will utilize specific standard operating procedures (SOPs) and method-specific data validation tables that detail the necessary steps to be taken to ensure collected/reported data is reliable and of known quality.

The specific process of data management (sample collection, measurement, verification, validation, review, and reporting) may vary depending upon overall method specific process. However, the overall goal for data management is to develop and implement the necessary steps to ensure that the data that resides in the final storage area reliably represents the data that were collected. This process begins with providing proper training to the field operators and/or lab analysts.

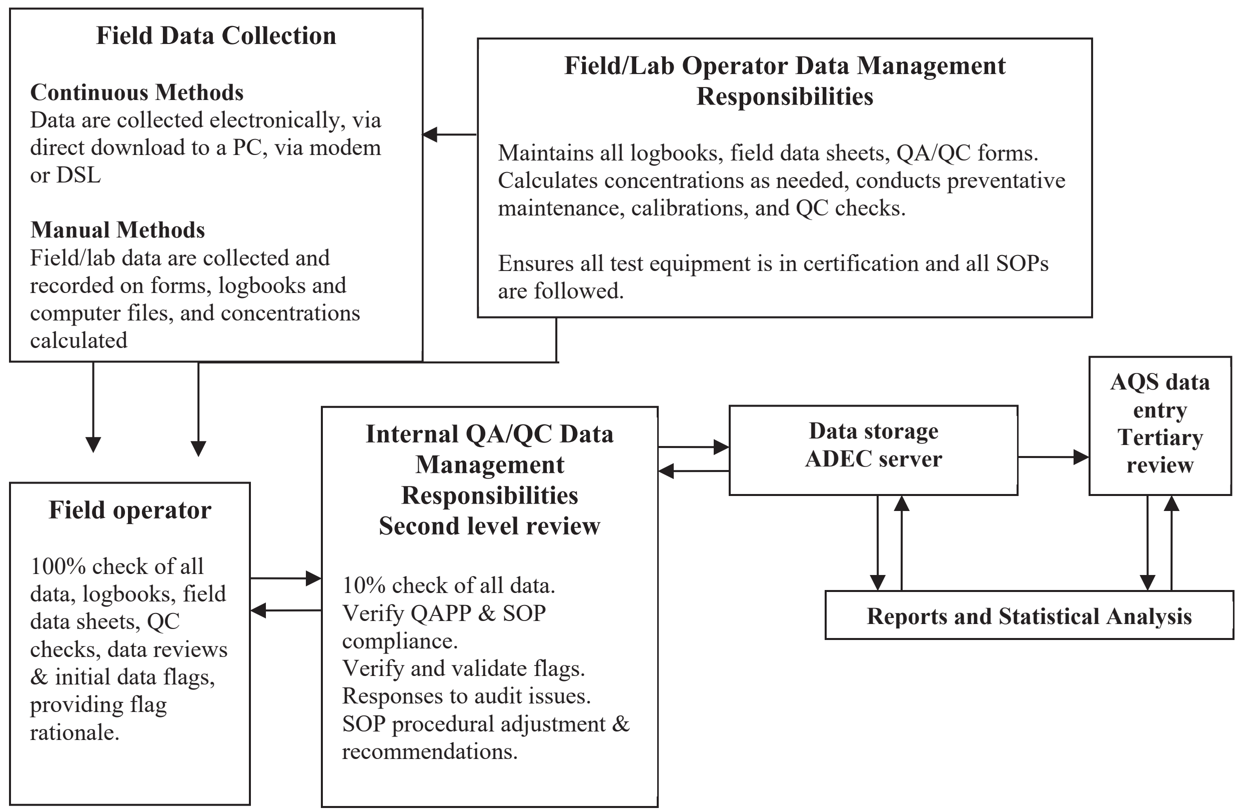
All data are first reviewed by the field/lab operators. The operator checks the collected data to ensure that the data file is complete and accurately represents the collected samples. The operator ensures all field/lab logbooks and/or data sheets are reviewed, and any questionable data is appropriately flagged with additional comments added to the file describing the reason for the flag. Data files should include raw data, instrument calibration and all subsequent quality control checks and independent audit results, plus a copy of the certification documentation.

The data then goes through a secondary review process where the field operator's comments are reviewed and appropriate actions taken regarding the data in question. This action may include flagging data, voiding data, re-evaluating SOPs, and making changes in cases where there are recurrent problems, or as corrective action response to problem areas identified in an audit. The secondary review will be conducted by a section member not immediately involved with data collection, to add an independent perspective to the data. The QA Officer will be included in any decision to flag or invalidate data and will ultimately decide the most appropriate action.

All NCore/SLAMS/SPM data collected and/or reported to ADEC are then stored on a secured state operated network server. If the data are to be submitted to AQS, they are properly formatted and uploaded to the AQS data storage system following AQS data management protocols.

Figure B8 depicts ADEC's Continuous and Manual Method Data Management Schemes.

Figure B8. Data Management of Continuous and Manual Methods



a. Data Recording

Data entry, validation, and verification functions are integrated into each monitoring method's data management scheme. Procedures for data entry are provided in method specific procedures/SOPs included in **Appendix B**.

Data for gaseous and continuous PM analyzers are collected via on-site data acquisition systems (Envidas Ultimate) and subsequently polled automatically to the central Envista database. The onsite DAS can also be accessed remotely from office computers. Periodically data are directly downloaded from the analyzers and checked against the DAS data to ensure system integrity.

Air monitoring station reports are prepared by ADEC station operators and revised when changes in the instrumentation or surrounding area occur. These reports identify the station name, station identification, date and time of the change, operator, instrument identification, parameter, scale, and units. Additionally, reports document the station location, address, GPS coordinates, elevation, and probe location. These reports will be sent to the air monitoring supervisor for review processing and archiving. Annually, an updated Network Plan including a description of SPM and SLAMS sites should be provided for public comment on the DEC web page for at least 30 days. After addressing the public comments, the document will be submitted to EPA.

The Station Operators maintain station logbooks (paper or electronic) and log sheets documenting operational and maintenance activities at the monitoring site. Station logbook/log sheets are identified with the station name, station identification, date and time of site visit, operator, instrument identification, parameter, scale, and units. Logbook/log sheets are used to document quality control checks (time, zero, span, precision, calibration, temperature, pressure, flow, etc.), maintenance, audits, equipment changes (span gas, permeation tubes, analyzer, recorder, probe, etc.), and missing or invalid data. Station records are reviewed periodically by the air monitoring supervisor, and when full, archived accordingly. Station records will be reviewed as part of oversight QA audits.

Charts documenting air monitoring data are processed by the station operator, reviewed, and archived by the respective monitoring unit. The charts will identify the station name, station number, date and time of the review, operator initials, instrument identification, parameter, scale, and units. The charts will be used to document quality control checks (time, zero, span, precision, calibration, temperature, pressure, flow, etc.), maintenance, audits, equipment changes (e.g., span gas, permeation tube, analyzer, data acquisition system, chart recorder, pen, paper, probe, etc.), and missing or invalid data.

SLAMS/SPM summary data reports should be produced annually or as directed by the project and should be published on the DEC Web page. The summary data reports will identify the project and date of issue. The report will include: station identification, pollutant parameters measured, monitoring period, max and second max value, averages, precision and bias, and units of measure. The monitoring results will be compared to the Alaska and National Ambient Air Quality Standards, where applicable.

b. Data Transformation & Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. The ambient air monitoring regulations require certain summary data to be computed and reported regularly to U.S. EPA. Other data are reduced and reported for other purposes such as station maintenance. Data transformation and reduction for criteria pollutants will follow EPA guidance. Currently the State uses scientific calculators, Windows Excel™®, R, AirVision, and the Agilaire data acquisition system (DAS) to manipulate the data.

Data Transformation

The data collected by ADEC fall into two main categories:

- Data collected using a manual method requiring subsequent laboratory analysis of samples and concentration calculations.
- Data collected using a continuous method that requires no subsequent laboratory sample analysis and concentration calculations.

Manual Method

Data that are manually collected requiring subsequent calculations to report a concentration are listed at the beginning of Section 19 and include such method parameters as filter-based PM_{10} and $PM_{2.5}$. For all these methods, only those calculations identified in the SOP for that specific method and/or listed in the CFR for that specific method are used. Currently all these calculations are done within an established Excel spreadsheet designed for that specific purpose. All the Excel spreadsheets used in this process are established forms that have been reviewed by ADEC's Air QA Officer and AMQA's lead technical personnel. As regulations and methodologies change these forms may be edited to reflect the respective changes. When a spreadsheet is edited, the edits are reviewed by lead technical staff (and as needed by the Air QA Officer) to ensure they conform to all CFR requirements with regard to calculations and content. Where possible, it is the policy of the air monitoring group to develop and maintain concentration calculation procedures that minimize the possibility of transcription and calculation errors.

On occasion, ADEC operates monitoring sites that collect data using a manual method that is not a federal or equivalent PM_{10} or $PM_{2.5}$ method. In these cases, it is ADEC's policy to follow established methodology using a two-level review process for all data concentration determinations. In some cases, these methods require laboratory analysis that cannot be performed within ADEC. In these cases, ADEC makes the best effort to ensure that the sample collection and lab analysis methods are in accordance with established procedures and are followed. Specifics detailing these methods will be developed as needed. Project plans and SOPs will be developed, reviewed, and approved by knowledgeable professionals.

Continuous Methods

Continuous sampling methods are listed at the beginning of Section 19 and include such methods as gaseous monitors, meteorological sensors, and continuous PM monitors. The method used for each type of monitoring system is specific to the monitor type, monitor manufacturer, and the data end use requirements. In all cases ADEC follows either established EPA CFR requirements or manufacturer recommended operating procedures or ADEC developed methods and SOPs. ADEC may use approved SOPs from other monitoring groups to develop the new SOPs that will be used in the future. During this developmental stage the SOP that is being used as a template will be followed.

Data Reduction

Data reduction is performed according to the needs of the project. Continuous PM data which are used in comparisons with the PM FRM data will be reduced to yield concentrations covering the same time periods and interval as the FRM data.

Data Formatting

Data formatting is performed according to the needs of the project. SLAMS and SPM data will be reformatted as required for AQS submittal. PSD quality data will be formatted as required by DEC Air Permits.

c. Data Transmittal

Data transmittal occurs whenever information is transferred from one person or location to another or copied, by hand or electronically, from one form to another. An example of data transmittal is copying raw data from a notebook onto a data entry form for keying into a computer file. Data copied from data forms and/or logbooks, and entered into computer files, will be checked at 10%. Instructions for data verification will be included in method specific SOPs.

d. Data Storage and Retention

Electronic files of Ambient Air Quality Monitoring projects and Stationary Source (e.g., PSD) Ambient Air Quality and Meteorological Monitoring projects are kept in the project manager’s office. Electronic files of validated data are maintained on an ADEC data repository (Airfacts) on the network drives managed by the AMQA Program manager and his/her staff. Validated data for all SLAMS and most SPM sites are also available from the EPA Air Quality System (AQS) Database (https://www.epa.gov/aqs).

The Division of Air Quality maintains a hard copy of the Division's Air Records Retention Schedule #183200 in the Anchorage, Juneau, and Fairbanks offices. The Division of Air Quality follows, or typically exceeds, this retention schedule. AS: Alaska Statute, Management & Preservation of Public Records, may be found at: http://www.archives.state.ak.us/pdfs/records_management/schedules/dec/air/183200.pdf.

Raw data sheets are retained on file at the respective air monitoring office for a minimum of three and often more than five years, and are readily available for audits and data verification activities. After five years, hardcopy records, and computer backup media are cataloged and boxed for storage. Data are archived for a minimum of five years. Security of data in the database is ensured by password protection.

Filter-weighing laboratory temperature and relative humidity conditions are retained on the MTL software on the laboratory server indefinitely. The server is regularly backed up on the State network system.

Official data storage for NCore/SLAMS data is AQS. In addition, ADEC will store all monitoring data on the State's Envista server, internal Air Quality Division AirTools database and since 2021 the Agilaire data acquisition system. The intent is to import as much historical data as possible. Data and log sheets will be stored in electronic format on the state-owned server and AirTools database. Data retention on the ADEC server, as well as AQS, is indefinite.

Annual and special summary data reports are developed for upper management and the public and are stored on the ADEC web page. Raw and validated data will be stored on the AQS, Envista and AirVision databases. Automated data backup is performed according to State procedures. AQS, DR DAS, Agilaire and the State network servers are all password protected systems, which only allow state authorized personnel to access and manipulate data (following state and federal procedures).

C. ASSESSMENTS AND OVERSIGHT

20. ASSESSMENTS AND CORRECTIVE ACTION

Assessments are evaluation processes used to measure the performance or effectiveness of a system and its elements. It is an all-inclusive term used to denote any of the following: audit, performance evaluation, management system review, peer review, inspection and surveillance. For the Ambient Air and Meteorological Quality Monitoring Program, assessments are:

- Network Reviews,
- Bias — Performance Evaluations (ADEC),
- Bias — Performance Evaluations (Independent Audits by EPA),
- Technical Systems Audits, and
- Data Quality Assessments.

Section 14 of this QAPP provides definitions for Quality Assessment, Quality Control and Quality Assurance. **Figure B3** (in **Section 14**) depicts Quality Assessment's relationship to Quality Control and the overarching umbrella of Quality Assurance.

a. Network Reviews

ADEC's Ambient Air Quality Monitoring program conducts network reviews of its own as time and resources permit. Detailed network assessments are conducted every five years. Network reviews and assessments are conducted to determine how well the ambient air quality monitoring system is achieving the required monitoring objectives and how it may need to be modified to continue and/or to meet its objectives (monitoring objectives are set forth in 40 CFR Part 58 Appendices D and E).

i. Network Selection

Prior to the implementation of the network review, significant data and information pertaining to the review are compiled and evaluated. Such information might include the following:

- Date of last review,
- Areas where attainment/non-attainment or re-designations are taking place or are likely to take place,
- Results of special studies, saturation sampling, point-source oriented ambient monitoring, etc.,
- Agencies which have proposed network modifications since the last network review,
- Pollutant-specific priorities such as PM_{10} problem areas, etc.
- Network files (including updated site information and site photographs),
- AQS reports,
- Air quality summaries for the past five years for the monitors in the network,
- Emissions trends reports for metropolitan areas,

- Emission information, such as emission density maps for the region in which the monitor is located and emission maps showing the major sources of emissions, and
- National Weather Service summaries for monitoring network area.

Upon receiving this information, it is checked to ensure it is the most current. Discrepancies are noted and resolved during the review. Files and/or photographs that need to be updated will also be identified. The adequacy of the location of monitors can only be determined based on stated objectives. During the network review, the stated objective for each monitoring location or site (see **Section 10**) is confirmed and the spatial scale verified and then compared to each location to determine whether these objectives can still be attained at the present location.

An on-site visit will consist of physical measurements and observations to determine compliance with the requirements, such as height above ground level, distance from trees, paved or vegetative ground cover, etc. Since many of these conditions will not change within one year, this evaluation at each site is performed every 3 years.

In addition to the items listed above, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- Installation of new monitors,
- Relocation of existing monitors,
- Siting criteria problems and suggested solutions,
- Problems with data submittals and data completeness,
- Maintenance and replacement of existing monitors and related equipment,
- Quality Assurance problems,
- Air quality studies and special monitoring programs,
- Other issues, such as community concerns,
- Proposed regulations,
- Funding.

A report of the network review should be written within two months of the review, distributed, and appropriately filed.

ii. Conformance to Network Siting Design (40 CFR Part 58 Appendix D)

Using requirements of 40 CFR Part 58 Appendix D, and Section 10 Sampling Process & Design, the network is evaluated to ensure:

- The monitoring network meets the number of monitors required by design criteria requirements, and

- The monitors are properly located based upon the monitoring objectives and spatial scale of representativeness.

Alaska has NCore/SLAMS, SPM and PSD quality category monitoring sites. ADEC and EPA Region 10 meet periodically to decide how to best achieve the monitoring objectives specified in 40 CFR Part 58 Appendix D.

PSD monitoring networks/stations are regulated by the ADEC Air Permits Program. ADEC AMQA provides technical support to the Air Permits Program on all aspects of Ambient Air Quality and Meteorological Monitoring.

iii. Conformance to Probe Siting Requirements (40 CFR Part 58 Appendix E)

Siting criteria are specified in 40 CFR Part 58 Appendix E and Section 11, Sampling Methods. Using these criteria, on-site physical measurements and observations are made to determine compliance with sample probe/monitor criteria such as: probe height and distance from potential obstructions, paved or vegetative ground cover, potential sources of point-source pollution, etc.

An on-site checklist developed by EPA Region 10 is used to evaluate the DEC monitoring network. This review is conducted annually by site operators and the completed checklist is included in the Annual Network Plan. In addition to items on this checklist, the reviewer should also:

- Ensure manifold and inlet probes/lines are clean and free of obstructions,
- Estimate sample manifold and probe/lines inside diameters and lengths,
- Inspect monitoring shelters for weather leaks, safety, and security,
- Check to ensure all sample lines are connected and free of kinks,
- Check to ensure that monitor exhausts are not likely to be reintroduced back to the sample inlet,
- Check to ensure that monitor exhausts are vented properly so as not to be a safety concern,
- Check equipment for missing parts, frayed cords, etc.,
- Record findings/observations in a field notebook and/or checklist,
- Take photographs in each cardinal direction, (both looking at and looking away from sample probe as well as the shelter's interior layout,
- Record monitoring site's GPS location (latitude/longitude/elevation), and
- Document site conditions (include any additional photographs/videotape).

b. Bias – Performance Evaluations (ADEC)

Performance evaluations are 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, air monitoring station, and/or laboratory. To estimate bias, an external instrument/standard must be compared against the field instruments collecting monitoring data. This external (independent) standard cannot be the same standard/s used to calibrate and/or perform the routine QC checks of the monitoring instruments. In addition, the individual conducting the "independent evaluation" must also be independent from routine operations and calibration(s) of the monitoring instruments. Bias is expressed as a positive or negative percentage of the "true" value.

Bias (Performance Evaluations) implemented in this air monitoring program include periodic:

- Flow rate performance audits of PM monitors,
- Laboratory audits of PM gravimetric operations,
- Lead filter (laboratory analysis) audits,
- Performance audits of gaseous ambient air monitors, and
- Meteorological performance audits.

The equations to be used to calculate results of performance audits are found in the respective monitoring methods, EPA *QA Handbook for Air Pollution Measurement Systems Volume II*, and references listed in **Table C1**, *Bias (Accuracy) Assessments*. The required frequency of performance audits and the equations used to assess gathered bias/accuracy data are listed and/or referenced in **Table C1**. In general, the corresponding equations in the referenced software (EPA Data Assessment Statistical Calculator, DASC) are suggested rather than the hand-calculated versions.

c. Bias –Performance Evaluations (Independent Audits by EPA)

EPA Performance Evaluations are conducted through the EPA regional office in the form of participation in the National Performance Evaluation Program (NPEP). The NPEP audit is a quantitative comparison of results between the equipment being tested and the equipment calibrated by another primary standard (audit standard). Successful participation requires an agreement of less than 10% between the NPEP equipment and the auditee's equipment. ADEC AMQA will participate in NPEP as arranged and agreed to with EPA Region 10.

NPEP audits will be conducted by US EPA Region 10 personnel in accordance with all applicable EPA SOPs once per year (http://www.epa.gov/ttn/amtic/npapsop.html). These audits will be conducted when necessary and if resources are available. The audit results will be summarized and reported to the ADEC Division of Air Quality director and the Air QA Officer when finalized by U.S. EPA Region 10.

d. Bias – Performance Evaluations (PSD Quality Monitoring Projects)

Bias for PSD quality monitoring operations is determined the same as for NCore/SLAMS monitoring except for the required frequency of performance evaluations (see **Table C1**) and independence of agencies/contractual firms allowed to conduct the performance evaluations.

Performance Evaluations for PSD quality monitoring operations will only be conducted by air monitoring contractors/agencies that are completely independent from the air monitoring contractor/agency responsible for the specific PSD ambient air and/or meteorological monitoring operations. Specifically, this requires that agencies/industry selecting contractors to conduct performance evaluations and/or technical systems audits must use independent contractual firms/air monitoring agencies with the requisite expertise to conduct the performance evaluations and that the agency/contractual firm must have complete managerial, fiscal, and technical independence from the agency/contractual firm conducting/managing the monitoring and laboratory operations.

PSD quality monitoring projects are required to conduct an NPEP-equivalent audit at some point during the monitoring phase of the project. EPA no longer conducts audits of PSD monitoring projects, so it is the responsibility of the agency/industry operating the monitoring project to secure a qualified independent auditor to perform the NPEP-equivalent audit.

e. Technical Systems Audits

A technical system audit (TSA) is a thorough, systematic, on-site (field & laboratory) qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system. Once every 3 years the U.S. EPA Region 10 may conduct a technical systems audit of the ADEC air-monitoring program. These audits and/or reviews may also be conducted when necessary and if resources are available. The audit results will be summarized and reported to the ADEC Division of Air Quality director and the Air QA Officer when they are finalized.

In addition to the EPA TSAs, the ADEC QA Officer may also conduct internal technical system audits of ADEC's AMQA program as time and resources allow.

EPA *QA Handbook for Air Pollution Measurement Systems, Volume II,* Appendix H contains an example TSA form.

PSD quality monitoring networks are required to have a TSA performed by an independent third-party at the beginning of a monitoring project (recommended within 30 days of start-up) and annually thereafter.

f. Data Quality Assessments

Data quality assessments are statistical and scientific evaluations of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use. Data Quality Assessments for ADEC's Ambient Air Quality Monitoring Network are reported quarterly, annually and every 3 years to the AMQA program manager and to EPA Region 10. Each parameter reported will be used to assess the reported data:

- Completeness,
- Bias, and
- Precision

i. Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50). Data completeness (DC) objectives are listed in the Measurement Quality Objectives Tables B7 and B8. The data completeness goal for NCore, SLAMS and SPM pollutants is ≥ 75% valid data/monitoring quarter and for meteorological measurements is ≥ 80% valid data/monitoring quarter. The data completeness goal for PSD pollutants is ≥ 80% valid data/monitoring quarter and for meteorological measurements is ≥ 90% valid data/monitoring quarter for four consecutive quarters. The completeness of the data will be determined for each monitoring instrument and expressed as a percentage (equations below):

Gaseous & Meteorological % DC = valid hourly data/all hours within monitoring quarter

PM_{10}/$PM_{2.5}$ /Pb on TSP % DC = valid 24-hour data/all scheduled sample run days within monitoring quarter (1/1, 1/2, 1/3, and/or1/6 sample day frequency)

ii. Bias

The term *accuracy* is frequently used to represent closeness to truth and includes a combination of precision and bias components. This term has been used throughout the CFR. In general, ADEC follows the conventions of the NIST and, more recently, of EPA (ref. NIST Report 1297 and EPA G-9) and will not use the term “accuracy”, but will describe measurement uncertainties as precision, bias, and total uncertainty (total uncertainty is the combination of both precision and bias). For the Ambient Air Quality & Meteorological Monitoring program, bias is estimated using the results of the QC checks with a known concentration performed at least every two weeks for gaseous pollutants, or monthly using known flow for particulate pollutants, and will be the major estimate of bias on an ongoing basis. The performance evaluations (performance audits) will provide another estimate of bias (see **Table C1,** *Bias Assessments* and web link to *EPA Data Assessment Statistical Calculator, DASC*). In general, the corresponding equations in the referenced DASC software are suggested rather than the hand-calculated version shown.

Table C1. Bias Assessments

Method Parameters	Bias Assessment Frequency: Single/Multi-Point Analyzer Audits	Bias Assessment Frequency: Quarterly, Annual and 3-Year Network Assessment	References
Manual (gravimetric) and continuous PM_{10}, $PM_{2.5}$, and TSP monitors	Audit flow rate percent difference, d_i, is calculated by: $d_i = \frac{Y_i - X_i}{X_i} \times 100$ where X_i is the flow rate of the audit standard and Y_i is the sampler's measured flow rate **Note 1**: for SLAMS, SPM and NCore sites each sampler audited 1/6 months. **Note 2**: for PSD quality monitoring each sampler audited 1/quarter	For specific calculations (and calculators) for determining and reporting quarterly and annual bias please refer to the federal references/web links listed in this table	*40 CFR Part 58 Appendix A section 4, Calculations for Data Quality Assessment,* https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-58/appendix-Appendix%20A%20to%20Part%2058 *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* https://www.epa.gov/system/files/documents/2022-05/Guideline%20on%20the%20Meaning%20and%20the%20Use%20of%20Precision%20and%20Bias%20Data%20Required%20by%2040%20CFR%20part%2058%20Appendix%20A.pdf *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type* https://www3.epa.gov/ttn/amtic/qareport.html
Lead on TSP	Lead Filter Strip Performance Audit $d_i = \frac{Y_i - X_i}{X_i} \times 100$ where X_i is the known concentration audit filter strip and Y_i is the lead filter strip's measured value **Note 1**: for SLAMS, SPM, NCore quality monitoring networks, each lab reporting lead on TSP is audited 1/year **Note 2**: for PSD quality monitoring network, each lab is audited 1/quarter		
Gaseous (NH_3, CO, NO_2, O_3, SO_2)	Where: Y_i =analyzer response value X_i =audit gas known value $d_i = \frac{Y_i - X_i}{X_i} \times 100$ **Note 1:** Each multipoint audit requires, at a minimum, the following audit concentration ranges: • Zero • Within 2-3x the instrument MDL • ≤ 99^{th} % of the data at the site or the network of sites in the PQAO • Near the NAAQS, or the highest 3-year conc. at the site or network of sites Report individual % Δ and avg. % Δ		

Table C1. Bias Assessments			
Method Parameters	Bias Assessment Frequency		References
	Single/Multi-Point Analyzer Audits	Quarterly, Annual and 3-Year Network Assessment	
	Report Linear Regression factors: slope, y-intercept, correlation coefficient (r^2) Report % NO_2 converter efficiency (NO_2 method) Report % NO_2 converter efficiency and % NH_3 converter efficiency (NH_3 method) **Note 2:** For SLAMS, SPM and NCore monitors, each pollutant instrument within a network audited 1/year **Note 3:** For PSD quality monitoring networks each monitor audited every monitoring quarter.		
WS, WD, VWS, VWD, σθ, σΦ, T, TΔ, SR, BP, Dew Point , RH	$\Delta = Y - X$ Where: Δ = audit differences, *Y* = sensor response, *X* = audit known value **Note:** For PSD Quality Data, Performance Audits of each sensor required semiannually		EPA-454/R-99-005 Sections 5, 8 https://www.epa.gov/sites/default/files/2020-10/documents/mmgrma_0.pdf EPA QA Handbook Volume IV https://www.epa.gov/amtic/ambient-air-monitoring-quality-assurance-guidance-
SR, Precipitation	$\%\Delta = (Y - X)X \bullet 100$ Where: %Δ = audit % difference, *Y* = sensor response, *X* = audit known value **Note:** For PSD Quality Data, audits of each sensor required semiannually		

iii. Precision

Precision is a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, or how well side-by-side measurements of the same thing agree with each other. Sometimes, as in the case of environmental measurements such as flow rate of an instrument, precision can be estimated by repeated measurements of the same thing over some time period, such as three months. It is important that the measurements be as similar as possible, using the same equipment or equipment as similar as possible. Precision represents the random component of uncertainty. This random component is what changes randomly high or low, and which, try as you might, you cannot control with the equipment and procedures you are using. Precision is estimated by various statistical techniques using the standard deviation or, if you only have two measurements, the percent difference.

Table C2, *Precision Assessments* lists references, frequency of required precision checks and the equations that are to be used to evaluate gathered precision data for NCore, SLAMS, SPM, and PSD quality monitoring networks. Some of these equations are used to evaluate frequent precision checks, some are used every quarter, annually, or as-needed. In general, the corresponding equations in the referenced software (EPA Data Assessment Statistical Calculator, DASC) are suggested rather than the hand-calculated version shown.

Table C2. Precision Assessments			
Method Parameters	**Precision Assessment Frequency**		**Reference**
	Single Point	**Quarterly Annually**	
PM_{10} – Collocated, gravimetric **$PM_{2.5}$ – Collocated, gravimetric** **Lead on TSP - Collocated**	relative percent difference, di, is calculated by: $$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$$ Where X_i is the concentration of the primary sampler and Y_i is the concentration value from the collocated sampler. Notes: • PM_{10} precision calculated for all PM_{10} measurements, however, reported only for paired values ≥ 15 µg/m³ • $PM_{2.5}$ precision calculated and reported only for paired values ≥ 3.0 µg/m³ • Pb on TSP precision calculated for all paired measurements, however, reported only for paired values with mass ≥ 0.15 µg/m³ • **Note 1**: Collocated sampling required on 1/12 day frequency for SLAMS/SPM/NCore Monitoring Networks • **Note 2**: Collocated sampling required on 1/6 day frequency for all PSD Quality monitoring projects	$$CV\_ub = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{2n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$$ The precision upper bound statistic, CVub, is a standard deviation on di with a 90 percent upper confidence limit. where, n is the number of valid data pairs being aggregated, and χ^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 di is calculated from two values with error.	*40 CFR Part 58 App A section 4.2.1 Precision Estimate for Collocated Samplers PM10, PM2.5 and Pb* *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics*

Gaseous (NH_3, CO, NO_2, O_3, SO_2)	$$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$$ Where: Y_i = analyzer response value X_i =precision gas known value Precision check gas standard (X) in range of 0.005-0.08 ppm (0.5-5 ppm for CO) and based on mean/median conc of pollutant values measured at site **Note 1:** Gaseous precision sample required at least every 2 weeks for all SLAMS, SPM, NCore and PSD quality monitoring	$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$$ The precision estimator is the coefficient of variation upper bound and is calculated using the above equation. where χ^2 0.1, n-1 is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom.	*40 CFR Part 58 App A section 4.1.2* *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type).*
Meteorological	Precision not assessed for Meteorological Parameters		

g. Corrective Actions, Corrective Actions Response & Corrective Action Reports

The ADEC and the audited organization may work together to solve required corrective actions for findings issued. As part of corrective action and follow-up, an audit finding response will be generated by the audited organization for each finding submitted by the ADEC. The audit finding response is signed by the local monitoring network manager or (where appropriate) the Laboratory Manager and sent to the ADEC Air Quality Assurance Officer and AMQA Program Manager which reviews and accepts the corrective action. The audit response will be completed within 30 days of acceptance of the audit report. The next audit of the monitoring network will ensure that the stated corrective action(s) were implemented, and corrective action(s) taken were appropriate to return routine monitoring operations to acceptable levels of precision, bias, completeness, representativeness, comparability, and detectability.

For each PSD audit finding the audit agency/audit contractor issues, a corresponding audit finding response and corrective action report will be generated and signed by the audited organization's project manager and project QA officer. This response will be included in the PSD *Quality Ambient Air Quality & Meteorological Monitoring Annual Data Report (*https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans/*).*

All corrective action reports shall, at a minimum, include the following information*:*

- Audit finding(s),
- Cause(s) of the problem(s),
- Actions taken or planned to rectify the problem(s),
- Responsibilities and timetable for the above actions taken,
- Project manager's printed name, title, signature, and date,
- Organization's QA Officer approval (printed name, signature, and date of approval),
- Statement that finding is closed or further following action is required.

All corrective action reports are to be filed with the official audit records and copies sent to the auditee and all other affected parties.

h. Revisions to ADEC AMQA QAPP

The ADEC AMQA QAPP will be reviewed and revised every five years (or as needed). Minor revisions may be made without formal comment. Such minor revisions may include changes to identified program staff, QAPP distribution list and/or minor editorial changes.

Revisions to the QAPP that affect stated monitoring Data Quality Objectives, Method Quality Objectives, method specific data validation *"critical"* criteria and/or inclusion of new monitoring methods will solicit public input/comment prior to adoption of major revisions.

Notice of proposed major revisions to the QAPP will be posted on the ADEC AMQA website with a specified formal comment period.

Only the most current QAPP revision will be posted on the ADEC AMQA website.

21. REPORTS TO MANAGEMENT

Table C3, *Reports to Management* identifies the type and content of quality-related reports and communications to management necessary to support NCore/SLAMS/SPM network operations associated with data acquisition, validation, assessment, and data reporting.

Required reports to management for the NCore/SLAMS/SPM ambient air quality monitoring program are discussed in 40 CFR Parts 50, 53, and 58. Guidance for management report format and content are provided in guidance developed by EPA's Quality Assurance Division (QAD) and the Office of Air Quality Planning and Standards (OAQPS). These reports are described in EPA *QA Handbook Volume II,* Section 16.

The DEC AMQA staff will prepare a quarterly Air Monitoring Data Quality Assessment Report for Alaska's NCore/SLAMS/SPM monitoring network that describes data quality in terms of precision, accuracy, and data completeness. This report will be sent to EPA Region 10.

Required reports to management/ADEC Air Permits Group for PSD ambient air quality and meteorological monitoring are further prescribed in the following data report format and are available online at: https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans/

Table C3. Reports to Management

QA Report Type	Contents	Presentation Method	Report Issued by	Reporting Frequency		
				As Required	Quarter	Year
Performance Audit Reports (NCore, SLAMS, SPM)	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	QA Officer/auditor	✔		✔
Performance Audit Report (PSD)	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	Responsible QA Officer/auditor	✔		✔
Corrective Action Recommendation	Description of problem(s); recommended action(s) required; time frame for feedback on resolution of problem(s)	Written text/table	QA Officer/auditor	✔		
Response to Corrective Action Report	Description of problem(s), description/date corrective action(s) implemented and/or scheduled to be implemented	Written text/table	Air Monitoring Program Manager	✔		
EPA NPAP Audit Results	Description of audit results, audit methods, standards/equipment used, and any recommendations	Written text and charts, graphs displaying results	EPA NPAP Program and/or Region 10	✔		✔

Table C3. Reports to Management						
QA Report Type	**Contents**	**Presentation Method**	**Report Issued by**	**Reporting Frequency**		
				As Required	**Quarter**	**Year**
EPA PM2.5 PEP Audit Results	Description of audit results, audit methods, standards/equipment used, and any recommendations	Written text and charts, graphs displaying results	EPA PEP Program and/or Region 10	✔		✔
Technical Systems Audits (NCore, SLAMS, SPM)	Summary of results, description of TSA areas reviewed, findings, and any recommendations	Written text and charts, graphs displaying results	EPA Region 10 QA Manager	✔		✔
Technical Systems Audits (PSD)	Summary of results, description of TSA areas reviewed, findings, and any recommendations	Written text and charts, graphs displaying results	Responsible QA Officer	✔		✔
AQS Report to EPA	Alaska NCore/SLAMS/SPM data report	Quarterly/Annual valid data & QA/QC results	ADEC-AMQA database manager		✔	✔
Annual summary data report for local monitoring networks (NCore, SLAMS, SPM)	Summary of monitoring data and associated QA/QC used to validate reported data. See PSD Quality Annual Data Report Format (above) as example.	Written text, charts, graphs, etc summarizing monitoring data for collection period	Air Monitoring Section Manager or designee			✔
Quality Assurance Report to Management	Executive summary, precision, bias and system and performance audit results	Written text, charts, graphs displaying results	ADEC Air QA Officer			✔
Network Reviews	Review results and suggestions for actions, as needed	Written text and tables, charts, graphs displaying results	ADEC AMQA Program Manager	✔		✔

D. DATA VALIDATION AND USABILITY

22. DATA REVIEW VALIDATION AND VERIFICATION REQUIREMENTS

Data review, verification, and validation are assessment techniques used to accept, reject or qualify data in an objective and consistent manner.

Data review – data review is the process that evaluates the overall data package to ensure procedures were followed and that reported data is reasonable and consistent with associated QA/QC results.

Data verification – data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

Data validation – data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set to ensure that the reported data values meet the quality goals of the environmental data operations (method specific data validation criteria).

These assessment techniques are performed by persons implementing the environmental data operations as well as by personnel "independent" of the operation, such as the respective organization's QA personnel and at some specified frequency. These activities occur prior to submitting data to AQS, or as in the PSD program, reporting data to ADEC Air Permits.

Each of the following areas of discussion are to be considered during the data review/verification/validation process.

1. **Sampling Design** – How closely the measurement(s) represent the actual environment at a given time, location, and scale of representativeness (i.e., micro, neighborhood, etc. for NCore/SLAMS/SPM and project area for PSD) is a complex issue that is considered during development of the sampling design. Each sample should be checked for conformance to the specifications, including type and location (spatial and temporal). By noting deviations in sufficient detail, subsequent data users should be able to determine the data's usability under scenarios different from those included in project planning.

2. **Sample Collection Procedures** – Details of how a sample is separated from its native time/space location are important for properly interpreting the measured results. Sampling methods, method specific data validation templates and field SOPs provide these details, which include sampling and ancillary equipment and procedures (including equipment contamination). Acceptable departures (for example, alternate equipment) from the QAPP, and the action to be taken if requirements cannot be satisfied, should be specified for each critical aspect. Validation activities should note potentially unacceptable departures from the QAPP. Comments from field surveillance on deviations from written sampling plans should also be noted.

3. **Sample Handling** – Details of how a sample is physically treated and handled during relocation from its original site to the actual measurement site are extremely important. Correct interpretation of subsequent measurements requires that deviations from “accepted/standardized” sample handling procedures and the actions taken to minimize or control the changes be detailed and justified. Data collection activities should indicate events that occur during sample handling that may affect sample integrity. At a minimum, sample containers, sample preservation and sample shipping methods should be evaluated to ensure they are appropriate to the nature of the sample and the type of data generated from the sample. Sample identity, transport and proper sample storage conditions should also be confirmed to ensure that sample integrity is preserved as it moves through the analytical process.

4. **Analytical procedures** – Each sample should be verified to ensure that the analytical procedures used to generate the data were implemented as specified (e.g., method specific data validation templates). Sample analyses deviating from specified criteria should be flagged with suitable codes so that the potential effects of the deviation can be evaluated during data quality assessment (DQA).

5. **Quality Control (QC)** – The quality control section of the QAPP specifies the QC checks that are to be performed during sample collection, handling, and analysis. These include analyses of check standards, blanks, and replicates, which provide indications of the quality of the data being produced by specific components of the measurement process. For each specific QC check, the procedure, QC check standard certified value, certification/expiration date, acceptance criteria, and corrective action (and changes) need to be specified. All measurement data need to be bracketed by acceptable QA, calibration and/or audit (accuracy) data to be considered valid. Data validity needs to document the corrective actions that were taken, which samples were affected, and the potential effect on affected data validity. Method specific QC criteria are summarized in the respective method data validation templates (**Appendix A**).

6. **Calibration** – Calibration of instruments and equipment and the information that should be presented to ensure that the calibrations:

   - were performed within an acceptable time prior to generation of measurement data;
   - were performed in the proper sequence;
   - included the proper number of calibration points;
   - were performed using **in-certification standards** that **bracketed** the range of reported measurement results otherwise, results falling outside the calibration range should be appropriately flagged or invalidated; and
   - had acceptable linearity checks and other checks to ensure that the measurement system was stable when the calibration was performed.

   Method specific calibration criteria can be found in the respective monitoring method/SOP and are summarized in the respective method data validation templates (**Appendix A**).

7. **Data Reduction and Processing** – Checks of data integrity evaluates the accuracy of "raw" data and include the comparison of important events and the duplicate keying of data to identify data entry errors.

   Data reduction involves aggregating and summarizing results so that they can be understood and interpreted in different ways. The ambient air monitoring regulations require certain summary data (e.g., precision, bias, data completeness, etc.) to be computed and reported regularly to U.S. EPA. Other data are reduced and reported for other purposes such as station maintenance, PSD data reporting, etc. DEC requires PSD quality monitoring data to be reduced and reported on an annual basis to the ADEC Air Permits Program. The required reporting formats are available online at: https://dec.alaska.gov/air/air-monitoring/quality-assurance-plans/.

23. DATA VERIFICATION AND VALIDATION METHODS

The following data verification and validation processes will provide for data that meets the Project's quality assurance criteria.

a. Data Verification Methods

Data verification is a two-step process:

1. Identify project needs for records, documentation, and technical specifications for data generation, and determining the location and source for these records.

2. Verify records that are produced or reported against the method, procedural, or contractual requirements, as per the field and analytical operations (i.e., sample collection, sample receipt, sample preparation, sample analysis and data verification records review).

***Step 1 -- Identify project needs for records, etc*:** For ambient air and/or meteorological monitoring project needs can be broken down into whether the monitoring project supports NCore, SLAMS, SPM, or PSD quality monitoring. The project needs are stated in the required monitoring project's QAPP (section A, chapter 5). The data verifier uses this and other support documents to determine the purpose of data collection and specified needs for sample collection, data generation and documentation of the analysis.

Even though requirements for NCore, SLAMS, SPM and PSD quality monitoring are standardized, planning document requirements will vary according to the specific purpose of sample collection and anticipated end-use of the collected monitoring data. These differences should be reflected in the planning documents (respective QAPP).

Project specifications may also include specifications for monitoring data (sample collection and field and/or lab analyses) and for the resulting data reports. These specifications are important in verifying that the actual methods employed (field/lab equipment as well as measurement procedures, etc. used) match what was requested. This ensures, *"verifies,"* that the specified method was used and that it met technical criteria established in the approved QAPP.

Know/determine where the records are maintained. Records may be produced by multiple personnel and maintained in multiple rooms or locations. Keeping backups of electronic records is strongly recommended. All personnel need to comply with the record-keeping procedures of the monitoring project (field, laboratory, etc). At any point in the data generation chain, the information needed for data verification needs to be available to the people responsible and the respective project requirements need to be clearly identified in the planning documents.

***Step 2 – Verify records that are produced or reported, etc*:** Step 2 compares the records produced against the project needs/requirements. The project planning document that specifies the records to be reported should be used to determine what records to verify. *Note*: In the rare absence of such an organizational specification, the determination of data to be verified may be left to the discretion of the project manager/principal investigator and the respective agency's quality assurance person. Such a determination must be justified/documented and appended to the data package for subsequent data validation.

Outputs of Data Verification

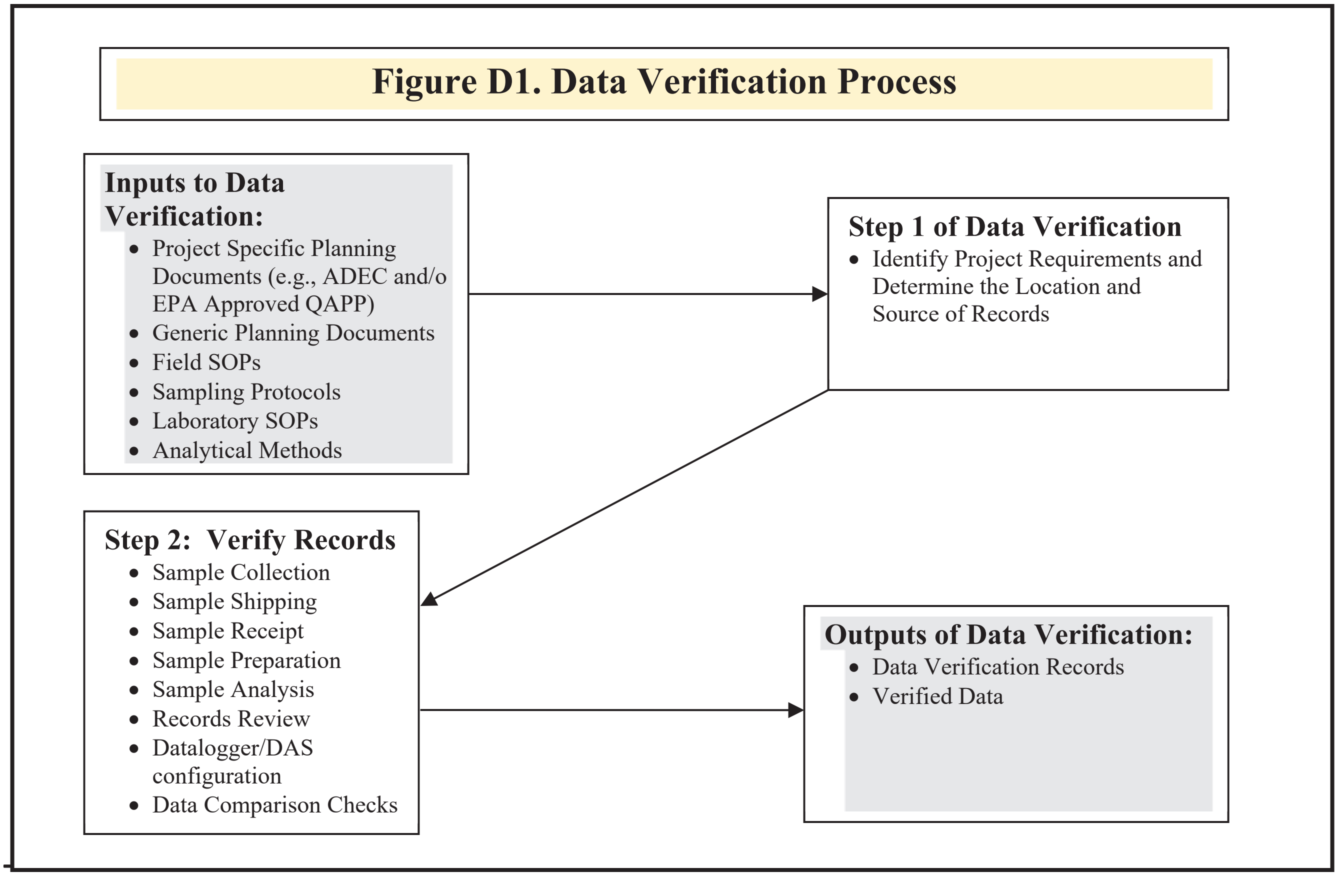
1. The first output is "***verified data***." Examples of verified data that have been checked for a variety of factors during the data verification process include:

   - Transcription errors,
   - Correct configuration of datalogger and/or DAS,
   - Correct application of dilution factors,
   - Correct application of conversion factors,
   - Correct reporting units of measure, and
   - Appropriate field and/or laboratory data qualifiers.

Any changes to the results as originally reported by the field/lab monitoring group must be accompanied by a note of explanation from the data verifier or reflected in a revised sample data report.

2. The second output of data verification is the ***"data verification record."*** This record includes a *"certification statement"* certifying the data have been verified. The statement is signed by responsible personnel either within the organization or as part of external data verification. Data verification records must also include technical non-compliance issues or shortcomings of the data produced during the field and/or laboratory activities. If the data verification identified any non-compliance issues, then the narrative must identify the records involved and indicate the appropriate corrective actions taken in response. The records routinely produced during field activities and at the analytical laboratory (commonly referred to as a data package) and other documentation such as checklists, handwritten notes, or tables should also be included as part of the data verification records. Definitions and supporting documentation for any field/laboratory qualifiers assigned also should be included.

Figure D1, *Data Verification Process*, summarizes the steps.



Note 1: For NCore, SLAMS, SPM monitoring projects performed by ADEC AMQA staff, steps 1 and 2 of data verification are the responsibility for the ADEC AMQA field and laboratory technicians.

Note 2: For NCore, SLAMS, SPM monitoring projects performed by Local Agencies, steps 1 and 2 of data verification are the responsibility of the local agency's air monitoring staff.

Note 3: For PSD quality monitoring projects performed by agencies/facilities/industry, steps 1 and 2 of data verification are the responsibility of the respective agency/facility/industry reporting data to ADEC.

b. Data Validation Methods

Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond *"data verification"* to determine the analytical quality of a specific data set. Data validation criteria are based upon the measurement quality objectives (MQOs, see section A, chapter 5) developed in a quality assurance project plan (QAPP). Data validation includes a determination, where possible, of the reasons for any failure to meet method, procedural, or contractual requirements, and an evaluation of the impact of such failure on the overall data set. Data validation applies to activities in the field as well as in the analytical laboratory.

Method specific data validation tables for ADEC criteria pollutants and meteorological parameters can be found in Appendix A. These validation tables list criteria for determining whether data under evaluation is acceptable for reporting as NCore, SLAMS, SPM, or PSD quality data.

Prior to the ADEC officially reporting or using the data to make decisions concerning air quality, air pollution abatement, or control, the data will be verified and certified by the AMQA program manager in consultation with the Air Quality Assurance Officer.

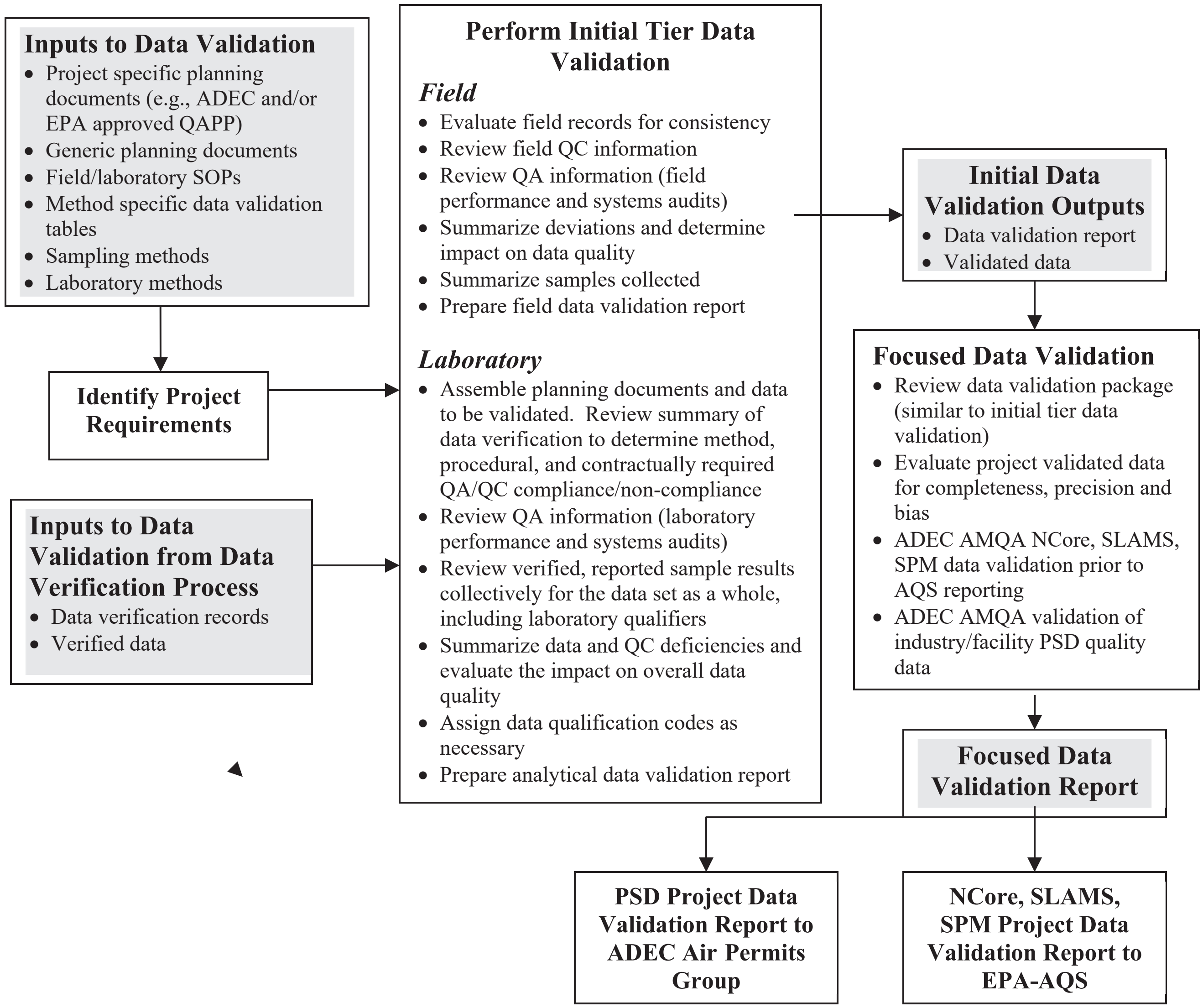
For the data to be considered valid, the following conditions must be satisfied:

- The air monitoring instrumentation must be calibrated and operated according to standard methods that have been approved for use in the ambient air and meteorological monitoring program.
- The data must be accompanied by back up documentation which meet the specifications outlined in **Section 14** of this Plan, and be identified with respect to station name, station number, date, time, operator, instrument identification, parameter, scale and units.
- The data must be bracketed by documented quality control which substantiate that they meet the criteria in **Section 14** of this plan.

Data which are reviewed and found to satisfy these criteria will be considered valid. Data that does not will be invalidated or appropriately qualified ("flagged") back to the last valid quality control check, and future data will be invalidated or qualified until it can be shown to meet the project's tolerances.

Figure D2, *Data Validation Process*, depicts the overall process.

Figure D2. Data Validation Process



Note 1: For NCore, SLAMS and SPM monitoring projects performed by ADEC AMQA staff, initial tier of data validation is the responsibility of the ADEC AMQA field and laboratory technicians. For NCore, SLAMS and SPM projects, the focused data validation step is the responsibility of the ADEC AMQA Monitoring supervisor or his/her designee.

Note 2: For NCore, SLAMS and SPM monitoring projects performed by Local Monitoring Agencies, the initial tier of data validation is the responsibility of that local monitoring agency. The focused data validation step is the responsibility of the ADEC AMQA Monitoring supervisor or his/her designee.

Note 3: For PSD quality monitoring projects performed by agencies/facilities, both tiers of data validation are the responsibility of the responsible agency/facility conducting the monitoring project. ADEC AMQA conducts an additional independent data validation/data review to ensure monitoring project conformed to ADEC AMQA PSD data quality criteria.

The primary focus of data validation is determining data quality in terms of accomplishment of the monitoring project's stated measurement quality objectives (MQOs).

Data validation is typically performed by person(s) independent of the activity which is being validated. In large organizations this is standard practice. However, in smaller organizations/agencies it is acceptable for the air monitoring technicians (who conduct the monitoring) to conduct the first tier of data validation, with the focused data validation performed by the air monitoring project's supervisor/project manager. The appropriate degree of independence is determined on a program specific basis and identified and approved in the respective QAPP.

As in the data verification process, planning documents, methods, procedures, data validation tables, verified data, etc. need to be readily available to the data validators. The data validator must be knowledgeable of the specific types of information to be validated. For this reason, it may require different individuals with specific knowledge to validate discreet components of a data set (e.g., field monitoring/measurement activities, laboratory gravimetric analyses, metals analyses, volatile organic compound analyses, etc.).

The data validator needs to be aware of signs that indicate improper field and laboratory practices that can/will affect data integrity. EPA QA/G-8*, "Guidance on Environmental Data Verification and Validation," EPA/240/R-02/004*, devotes chapter 4 to Data Integrity. This document can be found at: https://www.epa.gov/quality/guidance-environmental-data-verification-and-data-validation.

Each data validator is encouraged to familiarize themselves with this and other chapters in this guidance document.

24. RECONCILIATION WITH USER REQUIREMENTS

The DEC AMQA program will monitor air quality and collect air samples to judge compliance with the NAAQS and AAAQS, to develop or modify control strategies to prevent or alleviate pollution episodes, to observe pollution trends, and to provide a database for research and evaluation of effects of air pollution. The quality of the data collected will be based on the highest priority objective, the determination of violations of the NAAQS and AAAQS.

The DEC AMQA staff will prepare a quarterly Air Monitoring Data Quality Assessment Report for Alaska's NCore/SLAMS/SPM monitoring network that describes data quality in terms of precision, accuracy and data completeness. This report will be sent to EPA Region 10.

ADEC will review and submit quarterly monitoring data to the EPA Air Quality System (AQS) database. All monitoring data will be reviewed and validated by AMQA site operators and second level reviewers as discussed in **Sections 19** and **23** of this document. Data will again be spot-checked for validity by the AMQA AQS Specialist when entered into the database.

Data will be compared with the established MQOs and DQOs in Section 7 to ensure requirements and guidance set forth in CFR, QA Handbook Vol II, *Data Quality Assessment: A Reviewers Guide* (EPA QA/G-9), and this QAPP have been met. Only data that has been validated, verified, and qualified, as necessary, shall be accepted and submitted to AQS. If the data reviews reveal that data sets are inconsistent with the MQOs, or the underlying assumptions of the statistical tests are not supported by the data and fail to meet the criteria or objectives of the monitoring projects, then steps will be immediately taken to identify shortcomings, rectify discrepancies, and reconsider sampling design or adjustment to QC procedures as described in this QAPP.

If investigation reveals the need to modify the monitoring network or adjust QC procedures, ADEC AMQA will remain in close communication with EPA Region 10 both for assistance and to ensure proper notification.

APPENDIX A

METHOD SPECIFIC DATA VALIDATION TABLES

Met-One BAM 1020 PM_{10} & $PM_{2.5}$
$PM_{2.5}$ FRM
PM_{10} FRM & FEM LowVol
Met One SSASS $PM_{2.5}$
Meteorological Measurements
Pb on TSP FRM/FEM by ICP-MS
Gaseous (SO_2, NO_y, CO, O_3) Methods
NH_3 by chemiluminescence

These documents can be viewed at:
https://dec.alaska.gov/air/air-monitoring/guidance/data-validation-templates/

APPENDIX B

MONITORING METHODS AND STANDARD OPERATING PROCEDURES

$PM_{2.5}$ & PM_{10} Met One Beta Attenuation Mass (BAM) Monitor Model 1020
$PM_{2.5}$ FRM Thermo Partisol 2000i
$PM_{2.5}$ Met One Super SASS Speciation Monitor
PM_{10} GMW Accu-Vol FRM Hi Volume Sampler
Pb on TSP FRM/FEM by ICP-MS
CO by non-dispersive infrared radiation, gas filter correlation (NDIR-GFC)
O_3 by UV absorption
SO_2 by UV fluorescence
NO_x by chemiluminescence
NO_y by chemiluminescence
Laboratory Gravimetric Analysis of $PM_{2.5}$ Air Quality Filter Samples
Network Data Collection
Meteorological Monitoring

These documents can be viewed at:
https://dec.alaska.gov/air/air-monitoring/guidance/standard-operating-procedures/