QUALITY ASSURANCE PROJECT PLAN

for the

STATE OF ALASKA

AIR MONITORING & QUALITY ASSURANCE PROGRAM

September 28, 2009

State of Alaska
Department of Environmental Conservation
410 Willoughby Ave. Suite 303
PO Box 111800
Juneau, Alaska 99811-1800

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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3. DISTRIBUTION LIST

A hardcopy 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 (http://www.dec.state.ak.us/air/am/am_sops.htm).

Table A1: Distribution List

NAME	POSITION	AGENCY	DIVISION/BRANCH	CONTACT INFORMATION
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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 Information Administrative Services (DIAS), 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

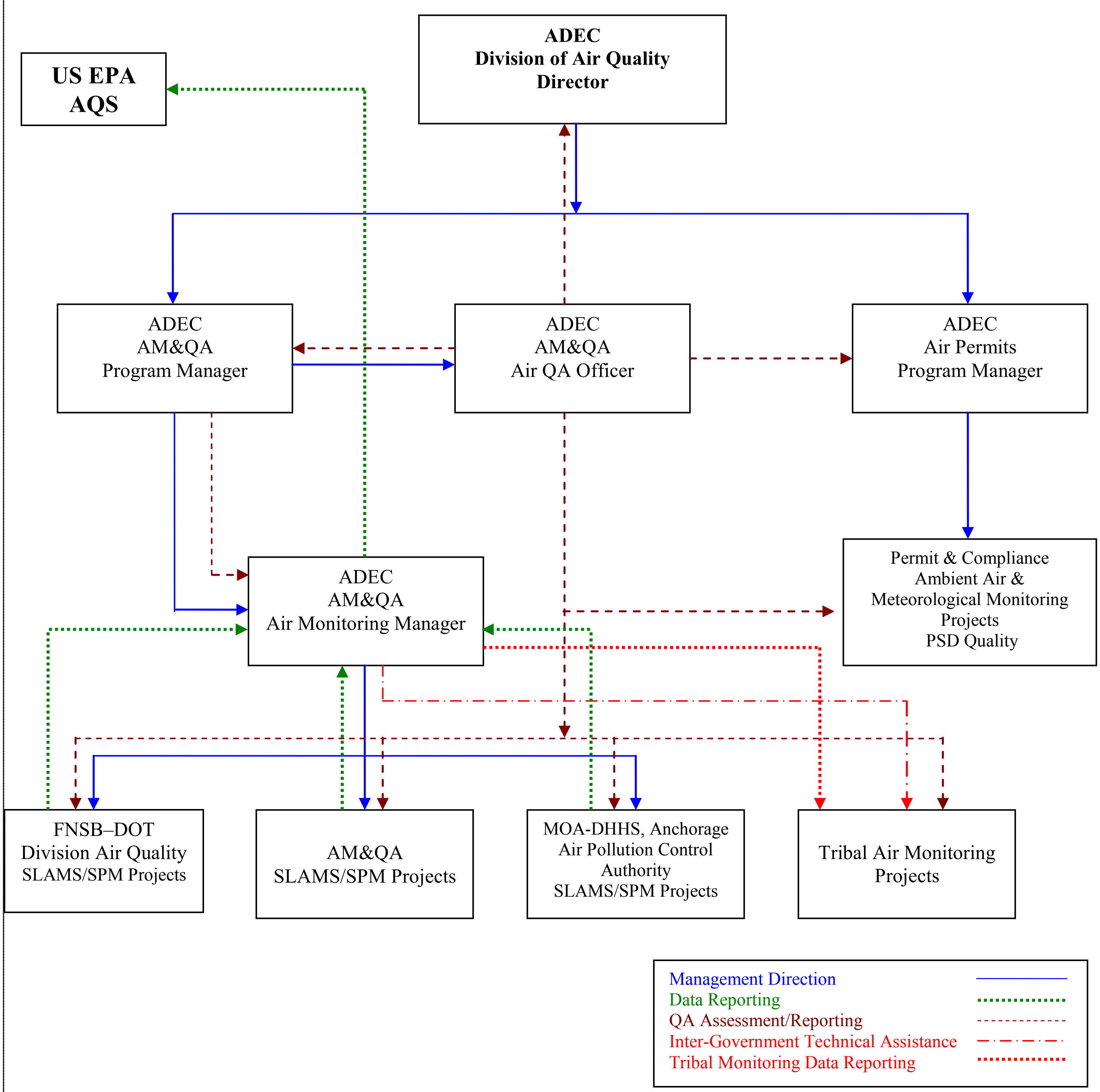


Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	Air Quality		Director	The Division of Air contains the Air Monitoring & Quality Assurance (AM&QA) Program. The AM&QA 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. The Division Director's duties include: • Maintains oversight of QA activities of AM&QA; • Maintains overall responsibility for monitoring network design & review; and • Reviews budgets, contracts, grants and proposals.
ADEC		AM&QA	Program Manager	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 AMG 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; • Provides program costs necessary for EPA allocation activities; • 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	AM&QA	Environmental Program Specialist – EPS IV (Meteorologist)	Under general direction s of the AM&QA program manager, the EPS IV (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: • Routinely evaluate weather and air pollution conditions around the state and, as needed, forecast, transport of air pollution to project 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 generating 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; • 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	AM&QA	Air QA Officer (Chemist IV)	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.

<table>
<tr><th colspan="5">Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities</th></tr>
<tr><th>Agency</th><th>Division</th><th>Program</th><th>Position Title</th><th>Responsibilities</th></tr>
<tr><td>ADEC</td><td>AQ</td><td>AM&QA</td><td>Air Monitoring Section Manager
(Environmental Program Manager 1)</td><td>Under the general direction of the AM&QA program manger, the Air Monitoring Manager is responsible for the state-wide development, management and supervision of the field monitoring and laboratory section of the Air Monitoring and Quality Assurance Program. The primary focus of this position is to determine compliance with the national ambient air quality standards. To do this the manager and her/his staff:
• Develop air quality monitoring plans to assess community-wide air pollution levels on a pollutant/multi-pollutant basis;
• Evaluate regional air pollution (visibility, wild fire smoke impacts, regional haze);
• Oversee local air monitoring projects
• Conduct air quality studies to determine pollutant levels;
• Provide emergency monitoring of man-made and/or natural air quality impacts (e.g., wild fires, volcanic eruptions);
• Assist in development of air quality control plans and State Implementation Plan control strategies; and
• Manage budgetary, fiscal, accounting, procurement and personnel responsibilities necessary for successful implementation of the section.</td></tr>
<tr><td>ADEC</td><td>AQ</td><td>AM&QA</td><td>Environmental Program Specialists (EPS), Chemists, Electronics Technician</td><td>Under the supervision of the Air Monitoring Section Manager, these positions perform all of ADEC's field monitoring and air laboratory operations. Specific duties include, but are not limited to:
• Collects, calculates and reviews of environmental data;
• Participates in training and certification activities;
• Verifies that required monitoring QA activities are performed and that measurement quality objectives are met as prescribed in the QAPP;
• Documents deviations from established procedures and methods;
• Reports all problems and corrective actions to the AM section manager and the Air QA officer;
• Assesses data quality and flagging suspect data;
• Prepares data reports for submission to the Air Quality System (AQS) database manager.
• Maintains QA records, flagging suspect data, and assessing and reporting data quality; and
• Performs and documents maintenance of field and laboratory equipment.</td></tr>
</table>

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities				
Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AM&QA	AQS Data Base Manager	Under the supervision of the AM section manager, the AQS data base manager is responsible for: • Coordinating the information management activities for NCore/SLAMS/SPM data entry; • Verifying/reviewing data reliability prior to submission of AQS data to EPA; and • Timely reporting and interpretation and ensuring timely delivery of all required NCore/SLAMS/SPM data to the AQS system.
MOA	DHHS	AAPCA	Air Quality Programs Manager	Structure - The Municipality of Anchorage (MOA) maintains the Anchorage Air Pollution Control Agency (AAPCA) which conducts ambient air monitoring within the boundaries of the MOA. This agency is within the Department of Health and Human Services. Responsibilities and Authority – The State of Alaska has delegated responsibilities to MOA for air quality monitoring. A Memorandum of Understanding between authorities of both agencies formally delineates the responsibilities of each agency. It is the responsibility of AAPCA to conduct ambient air quality monitoring within the physical boundaries of the Municipality of Anchorage in accordance with the methods, procedures and criteria established within this document. Specifically, the AAPCA responsibilities include, but are not limited to: • Monitor site preparation; • Instrument installation, operation, maintenance; corrective action(s); • Data reduction, data validation and data reporting; • Database management; • Site de-installation; • Instrument inventory control and repair; and • Contract management. In addition, the AAPCA will assist the ADEC in site selection/network reviews and quality assurance oversight auditing for ambient monitoring activities performed in the MOA.

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

Agency	Division	Program	Position Title	Responsibilities
FNSB-	DOT	Air Quality	Division Manager	Structure - Fairbanks North Star Borough (FNSB) maintains the Air Quality Division within the Department of Transportation. The ADEC has delegated responsibilities for air quality monitoring to the FNSB. A Memorandum of Understanding between authorities of both agencies has formally delineated the responsibilities of each agency. Responsibilities and Authority – Responsibilities and Authority of the Air Quality Division are identical to those listed for the Municipality of Anchorage.
Tribal Air Monitoring Organizations				Tribal Air Monitoring Support – The ADEC Division of Air Quality provides monitoring assistance to Tribal Villages as funding allows in the same fashion as it does to other non-tribal communities in Alaska (e.g., Anchorage, Fairbanks, and Juneau). 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 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.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities				
Agency	Division	Program	Position Title	Responsibilities
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 AM&QA 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, Monitoring & Quality Assurance Program web page (http://www.dec.state.ak.us/air/am). 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 http://www.dec.state.ak.us/air/am/Ambient_Air_Monitoring_QAPP_cklst_9-04.pdf http://www.dec.state.ak.us/air/am/PSD_Met_annual.pdf http://www.dec.state.ak.us/air/am/PSD_Met_qrtly.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			Responsibilities and Authority – 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, also called criteria pollutants, are: 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 provide the framework for all pertinent organizations to protect air quality. This framework provides the structure for pertinent organizations to protect air quality and for the monitoring for these criteria pollutants by State and local organizations.

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 monitoring network consists of three major categories of monitoring stations that measure the criteria pollutants. These types of stations are described below:

1. Secondary National Core (**NCore Level 2**) Multi-Pollutant Monitoring Station. Alaska will have one NCore Level 2 that will be sited to meet NCore Level 2 monitoring station criteria. The monitoring site is expected to be located in Fairbanks; however, a specific site has not been selected yet. The site will be selected, sited and installed after sufficient federal monies are allocated and made available to the AM&QA program.

2. The State and Local Air Monitoring Stations (**SLAMS,** NCore Level 3) 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 SIP requirements.

3. The Special Purpose Monitoring Stations (**SPMS**) network provides for special studies needed by the State and local agencies to support their State Implementation Plan (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 18AAC50.010) 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/m³)	**(ppm)**	**(mg/m³)**	**(ppm)**	**(mg/m³)**	**(ppm)**	**(mg/m³)**	**(ppm)**	**(mg/m³)**	**(mg/m³)**	**(ppm)**
Ammonia (NH_3)					2.1	3.0					
Carbon Monoxide (CO)	40	35			9.0	10					
Nitrogen Dioxide (NO_2)										0.100	0.053
Ozone (O_3)					**4th high 3-yr annual avg.**						
					0.041	0.080*					
Sulfur Dioxide (SO_2)			1.300	0.497			0.365	0.139		0.080	0.031
							(µg/m³) 3-year 98%		**(µg/m³)**	**(µg/m³)**	
Lead (Pb)									1.5*		
PM_{10}							150				
$PM_{2.5}$							35			15	

*New values have been developed in the NAAQS. The AAQS values will be updated when new AK regulations are adopted in FY2009.

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 data base 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 AM&QA 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 http://www.dec.state.ak.us/air/am/index.htm.

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
Performance Evaluations	EPA Region 10	1.5 valid audits/yr for primary QA orgs with ≤ 5 sites 2.8 valid audits/yr for primary QA orgs with > 5 sites
Performance Audits	ADEC	SLAMS/SPM each site monitor every 6 months
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 maps Site pictures
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory 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 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

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 are being developed by the EPA for a determination of whether or not a particular location meets the national ambient air quality standards. These data quality objectives are still in draft form. EPA decided 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 general goal is to keep the rate of these decision errors (whether or not the standard has been met) to below 5%. In order to do this, EPA looked at all the 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 DQO subsequently were translated into the measurement quality objective (MQO) for each parameter **(Table 7)**. This document does not describe the 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

In order 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 in order 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). It 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 every two weeks for gaseous pollutants, or monthly for particulate pollutants, will be the major estimate of bias on an ongoing basis, and the 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 AM&QA 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 which data really represent 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, and is fully explained in element 10. The goal is to measure the pollutant concentrations representative of what most people breathe in our many diverse population centers--microclimates throughout Alaska.

Detectability – Defined as the lowest value that a method procedure can reliably discern a measured response above background noise. In other words, detectability is the level below which the instrument cannot reliably discriminate from zero. Because there is always 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-M&QA 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 correct, 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. Comparability is important so that data sets within one part of the country can be compared with another area or data from another year.

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 MQO's 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	EPA $PM_{2.5}$ FRM sampler,	EPA QA Handbook Vo II method 2.12, ADEC $PM_{2.5}$ QAPP		24-hr ± 1hr	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±5% Δ (16.7lpm), Accuracy Flow: ≤±4% Δ	CV≤ 10% for paired values≥3 ug/m³	1/3 day, 1/12 collocated 15% of sites	EPA siting guidelines for PM_{10} and $PM_{2.5}$
$PM_{2.5}$and PM_{10} Continuous Methods	R&P TEOM 1400a, Met One BAM 1020, EPA PM_{10} continuous FEM	ADEC M&QA Met One 1020 BAM SOP, EPA QA guidance criteria for continuous PM	≥75 %	≥ 75% aggregate hours/day	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** **$PM_{2.5}$ Design Flow**: ≤±5% Δ (16.7lpm) **PM_{10} Design Flow**: ≤±5% Δ (16.7lpm) PM_{10} **PM_{10} & $PM_{2.5}$ Accuracy Flow:** ≤±4% Δ		Continuous, hourly average, collocated 1/12 with like continuous PM	
$PM_{2.5}$ Aethalometer Continuous Method	Magee Scientific Aethalometer		≥75 %	≥ 75% aggregate hours/day	SPM ≥ 75% all sample days	**Flow audit** Design Flow: ≤±7.5% Δ (5.0 lpm), Accuracy Flow: ≤±10% Δ			
PM_{10} FRM/FEM HiVol Method	EPA FRM/FEM sampler	EPA QA Handbook Vol II Method 2.11, ADEC method 4.2		24-hr ± 1hr	SLAMS≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±10% Δ (1.13m³/min) Accuracy Flow: ≤±7% Δ	CV≤ 10% for paired values≥15 ug/m³	1/3 day, 1/12 collocated 15% of sites	
PM_{10} –FRM Low Volume Method	EPA FRM/FEM sampler			24-hr ± 1hr	≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±10% Δ (16.7lpm), Accuracy Flow: ≤±7% Δ	CV≤ 10% for paired values≥15 ug/m³	1/3 day, 1/12 collocated 15% of sites	
EPA $PM_{2.5}$ Speciation Method	Met One SSASS	EPA $PM_{2.5}$ Speciation QAPP http://www.epa.gov/ttn/amtic/files/ambient/pm25/spec/finlqmp.pdf		24-hr ± 1hr	SLAMS≥ 75% all sample days	**Flow audit** Design Flow: ≤±10% Δ (6.7lpm), Accuracy Flow: ≤±10% Δ		1/3 day,	
Lead on TSP	EPA FRM/FEM sampler and analytical method	EPA QA Handbook Vol II method 2.8, ADEC method 4.4		24-hr ± 1hr	SLAMS≥ 75% all sample days PSD ≥ 80%	**Flow audit** 1.1 m³/min≥ Design Flow≤1.7m³/min Accuracy Flow: ≤±10%Δ	CV≤ 10% for paired values0.15≥ ug/m³	1/3 day, 1/12 collocated 15% of sites	EPA siting guidelines for Pb on TSP,ADEC method 4.4.1
CO	EPA FRM/FEM	EPA QA Handbook Vol II method 2.6 ADEC method 4.05	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and .995 ≥ r^2 ≤ 1.000	90% CL CV ≤± 15%	Continuous	EPA siting criteria for CO, ADEC CO method 4.05.1

Table A7 Alaska Ambient Air Quality Monitoring MQOs

Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
NH_3	NO_2 EPA FRM/FEM approved analyzer with NH_3 converter	ADEC NH_3 method (4.10)	≥75 %		≥75% all hours	Mean absolute Δ ≤±15% Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$ NO_2 converter efficiency ≥96 % NH_3 converter efficiency ≥90%	90% CL CV ≤± 15%	Continuous	ADEC NH_3 method 4.10.1
$NO\text{-}NO_x\text{-}NO_2$	EPA FRM/FEM	EPA QA Handbook Vol II method 2.3 ADEC method 4.07	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$ NO_2 converter efficiency ≥96 %	90% CL CV ≤± 15%	Continuous	EPA siting guidelines for NO_2, ADEC method 4.07.1
O_3	EPA FRM/FEM	EPA QA Handbook Vol II http://www.epa.gov/ttn/amtic/files/ambient/qaqc/ozone4.pdf	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 10%, Linear regression criteria: Slope ≤± 10%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$	90% CL CV ≤± 10%	Continuous	EPA siting criteria for O_3
SO_2	EPA FRM/FEM	EPA QA Handbook Vol II method 2.9 ADEC method 4.06	≥75 %		SLAMS≥75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$	90% CL CV ≤± 15%	Continuous	EPA siting guidelines for SO_2, ADEC method 4.06.1

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 Damping Ratio 0.4 at 1.2kg/m^3 or Overshoot ≤ 25% at 1.2kg/m^3					± 5° includes ± 3° from sensor mount	Continuous, 1 min sample interval, hourly avg	
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/m^2 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	
Barometric	Aneroid Barometer	Range -600 to 100 Mb					± 3 Mb (0.3	Continuous, 1 min interval	

Table A8 Alaska Meteorological Monitoring MQOs

Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
Pressure	0.5 Mb	Accuracy ± 3Mb					kPa)	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 observed	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 Pollution Training Institute (http://www.epa.gov/air/oaqps/eog/course_topic.html), U.S. EPA Quality Assurance Division (QAD), U.S.EPA Office of Air Quality Planning and Standards (OAQPS), American Society for Quality Control (ASQC) 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	Air Pollution Control Orientation Course	422	X		X	APTI
2	Principles and Practices of Air Pollution Control,	452		X		APTI
3	Mathematics Review for Air Pollution Control	100	X		X	APTI
4	Orientation to Quality Assurance Management	QA1				EPA QAD
5	Introduction to Ambient Air Monitoring, PM2.5 Monitoring Update,	434			X	APTI
6	General Quality Assurance Considerations for Ambient Air Monitoring	471	X		X	APTI
7	Basic Air Pollution Meteorology	409	X		X	APTI
8	Data Quality Objectives Workshop	QA2				QAD
9	Chain of Custody Procedures for Samples and Data	443	X		X	APTI
10	Quality Assurance Project Plan	QA3				QAD
11	Atmospheric Sampling	435		X		APTI
12	Network Design for Monitoring $PM_{2.5}$ & PM_{10} in Ambient Air	433	X		X	APTI
13	Analytical Methods for Air Quality Standards	464		X		APTI
14	Beginning Environmental Statistical Techniques	473A	X		X	APTI
15	Quality Assurance for Air Pollution measurement Systems	470		X		APTI
16	Site Selection for Monitoring SO_2	436	X		X	APTI
17	AQS Training (annual AQS conference)					OAQPS
18	Data Quality Assessment	QA4				QAD
19	Management Systems Review	QA5				QAD
20	Introduction to Environmental Statistics, SI	473B	X			APTI
21	Quality Audits for Improved Performance	QA6				AWMA
22	Statistics for Effective Decision Making	STAT 1				ASQC

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**
422	x	x	x		x	x	x
452	x		x		x	x	x
100	x	x					
QA1					x	x	x
434	x	x	x	x	x	x	x
471	x	x	x	x	x	x	x
409	x		x		x	x	x
QA2					x	x	x
443	x	x	x	x	x	x	
QA3			x		x	x	x
435	x	x	x		x	x	
433			x		x	x	
464		x	x		x	x	
473A	x	x	x	x	x	x	x
473B					x	x	x
470			x		x	x	x
436	x		x		x	x	
QA4					x	x	x
QA5					x	x	x
473B	x	x	x	x	x	x	x
QA6						x	x
AQS Conf.				x			
STAT1			x		x	x	x

9. DOCUMENTS AND RECORDS

ADEC's Quality Management Plan for Ambient Air Monitoring describes document and records procedures for the Ambient Air Monitoring Program. This document may be found at http://www.dec.state.ak.us/air/doc/aq_qmp_sep06.PDF.

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 July 1 of each year for the data collected from January 1 to December 31 of the previous year. The AM&QA 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 Contract	ADEC-AM&QA Anchorage/Juneau
Site Information	Network description Site characterization file Site maps Site Pictures	ADEC-AM&QA Anchorage/Juneau
Environmental Data Operations	QA Project Plans Standard Operating Procedures (SOPs) Field notebooks Inspection/Maintenance records Laboratory notebooks Sample handling/custody records	ADEC-AM&QA Anch.&Juneau/FNSB/MOA " ADEC-AM&QA Anch.&Juneau/FNSB/MOA/ADEC AM&QA Laboratory (Juneau)
Raw Data	Any original data (routine and QC data) including data entry forms	ADEC AM&QA Laboratory (Juneau)/Anch/FNSB/MOA
Data Reporting	Air quality index report Annual SLAMS air quality information Data/summary reports Journal articles/papers/presentations	ADEC-AM&QA Anch.&Juneau/FNSB/MOA ADEC-AM&QA Anchorage/Juneau ADEC-AM&QA Anch.&Juneau/FNSB/MOA
Data Management	Data algorithms Data management plans/flowcharts Data Management Systems	ADEC AM&QA Laboratory (Juneau) ADEC-AM&QA Anchorage ADEC AM&QA Anch/Juneau Lab
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits	ADEC-AM&QA Anchorage/Juneau " " ADEC-AM&QA Anch.&Juneau/FNSB/MOA " "

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 National Core Level 2 and 3 (SLAMS), SPM monitoring network 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	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/netrev98.pdf
Criteria & non-Criteria Pollutants	QA Handbook for Air Pollution Measurement Systems, Vol 2: Part 1, Section 6.0 Sampling Process Design	EPA AMTIC	http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf
Criteria & non-Criteria Pollutants	40CFR Part50	EPA AMTIC	http://www.epa.gov/ttn/amtic/40cfr50.html
Criteria & non-Criteria Pollutants	40CFR Parts 53 and 58	EPA AMTIC	http://www.epa.gov/ttn/amtic/40cfr53.html
CO	Selecting Sites for Carbon Monoxide Monitoring	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-75-077.pdf
NO_2, O_3	Site Selection for the Monitoring of Photochemical Pollutants	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-78-013.pdf
NH_3	Method for the Determination of Ammonia (NH_3) by Chemiluminescence	ADEC Method 4.10	ADEC Ambient Air Quality Method 4.10
O_3	Guidance on Ozone Monitoring Site Selection	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/r-98-002.pdf
O_3	Guideline on Modification to Monitoring Seasons for Ozone	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/modozsea.pdf
SO_2	Optimum Site Exposure Criteria for SO_2 Monitoring	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-77-013.pdf
PM_{10}, $PM_{2.5}$	Network Design and Optimal Site Exposure Criteria for Particulate Matter	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-87-009.pdf
PM_{10}	Guideline for PM_{10} Episode Monitoring Methods	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-83-005.pdf
Pb on TSP	Guidance for Siting Ambient Air Monitors Around Stationary Lead Sources	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/pbgde997.pdf
Pb on TSP	Optimum Sampling Site Exposure Criteria for Lead	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-84-012.pdf

Table B1	Air Quality & Meteorological Sample Process & Design Documents		
Pb on TSP	Guideline for short-Term Lead Monitoring in the Vicinity of Point Sources	EPA AMTIC	http://www.epa.gov/ttnamtic/files/ambient/criteria/reldocs/oa12-122.pdf
Meteorological Measurements	Meteorological Monitoring Guidance for Regulatory Modeling Applications, Section 3.0 Siting & Exposure	EPA SCRAM	http://www.epa.gov/scram001/guidance/met/mmgrma.pdf
Meteorological Measurements	QA Handbook for Air Pollution Measurement Systems, Vol 4, Meteorological Measurements Version 1.0 (Draft)	EPA AMTIC	http://www.epa.gov/ttnamtic/files/ambient/met/draft-volume-4.pdf
PSD Criteria and Non Criteria Pollutants	Ambient Monitoring Guidelines for Prevention of Significant Deterioration	EPA AMTIC	http://www.epa.gov/ttn/amtic/files/ambient/criteria/reldocs/4-87-007.pdf

10.1 Network Objectives

NCore Level 2 Monitoring Objectives The ADEC NCore Level 2 Monitoring site will be one of 75 nation-wide multi-pollutant sites focusing on community-wide air quality assessment. Assuming EPA provides adequate funding, the ADEC's plan for a Level 2 NCore monitoring site will be submitted to EPA by July 1, 2009 and operational by January 1, 2011. The NCore parameters to be measured are listed in **Table B2**. The intent of the NCore monitoring site will be to:

- Represent ambient concentrations over an urban scale, or
- Represent ambient concentrations over a neighborhood scale if location is representative of many similar neighborhoods;
- Represent an area impacted by mobile source emissions;
- Represent an area not influenced by local emission sources that are not impacting the entire urban area;
- Remain a long-term site with reasonable assurance of 5+ year "permission" period;
- Be collocated with an STN, PAMS, NATTS and CASTNET site where possible;
- Have room for multiple gas monitors and associated equipment, integrated samples, meteorology; and
- Have potential ground footprint that allows accessibility for TTP audit vehicle.

NCore Level 3 (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.

10.2 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 five communities over 15,000 people: Anchorage, Fairbanks, Juneau, Wasilla/Palmer and Ketchikan. 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
Max Concentration	Micro, middle, neighborhood, sometimes urban
Population	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General/Background	Neighborhood, regional
Regional Transport	Urban, regional

Welfare-Related	Urban, regional

Table B4 summarizes spatial scales for appropriate NCore Level 2, SLAMS and SPM monitoring sites.

Table B4 Spatial Scales Appropriate for NCore Level 2, SLAMS, SPM Monitoring Sites

Spatial Scale	**Scales for NCore Level 3 (SLAMS and SPM)**							**Scales for NCore Level 2**						
	CO	NO_2	O_3	SO_2	Pb	PM_{10}	$PM_{2.5}$	CO	NO_2	O_3	SO_2	Pb	PM_{10}	$PM_{2.5}$
Micro	•				•	•	•	•				•	•	•
Middle	•	•	•	•	•	•	•					•	•	•
Neighborhood	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Urban		•	•	•	•	•	•		•	•				•
Regional			•	•	•	•	•							•

10.3 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 monitors are required to report hourly values. Continuous PM methods are required to sample continuously and report hourly as well as 24-hr values.

All integrated PM_{10} and Pb-TSP 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 six days following the EPA national sampling schedule. Every 3rd day sampling is encouraged to adequately represent PM concentrations. In cases where PM concentrations approach the NAAQS/AAAQS, every day sampling is required.

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 6th day with EPA regional office waiver. In cases where $PM_{2.5}$ concentrations are within 85 – 115% of the NAAQS/AAAQS, every day sampling is required.

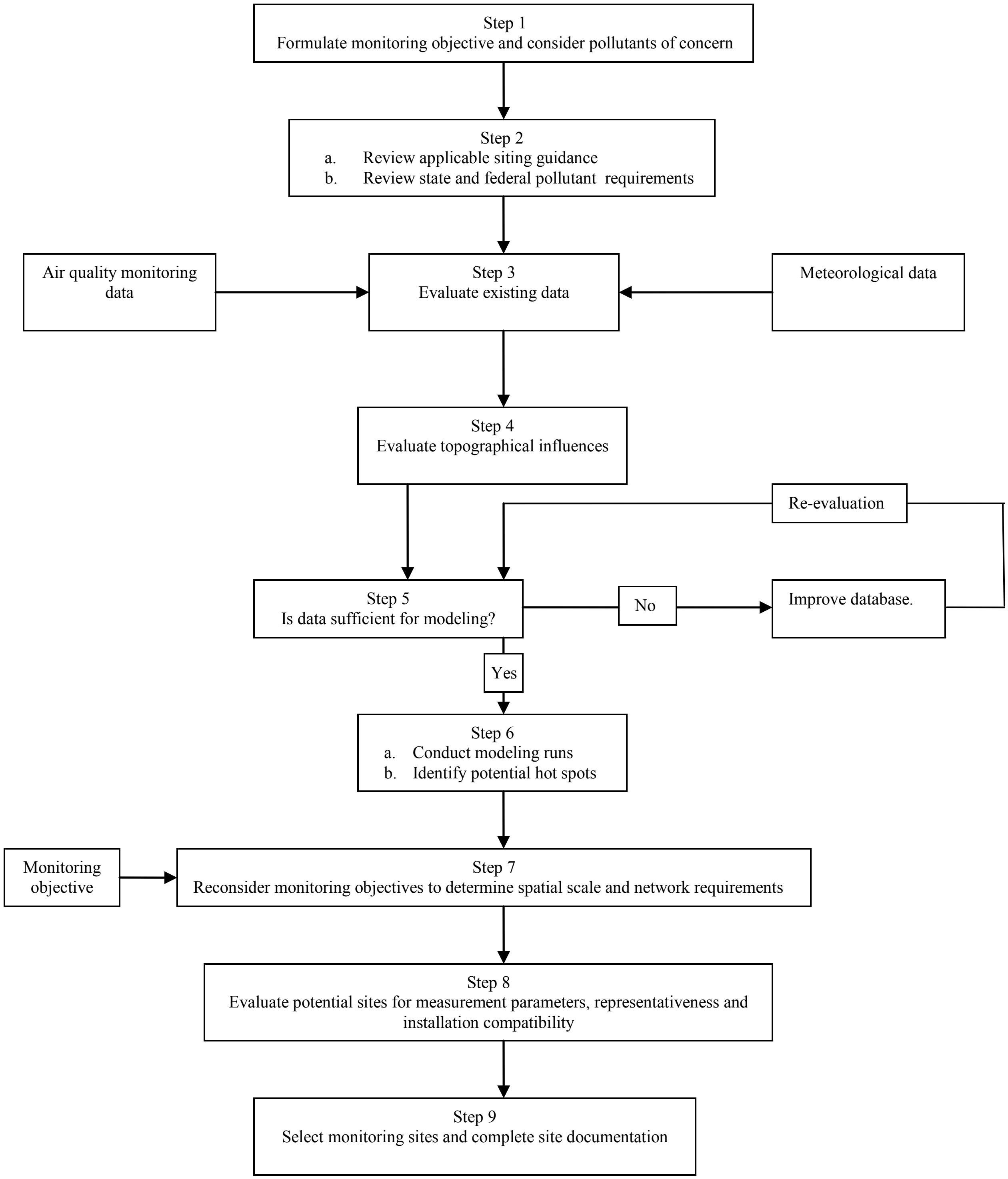
The EPA National Sampling Schedule is updated yearly and is available from the following web link: http://www.epa.gov/ttn/amtic/calendar.html.

10.4 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 will contain 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. Final selection of the NCORE site has not yet been determined. Installation and operation of the site will be dependent upon receipt of federal monies and man power to operate the site.

SLAMS and SPM sites are selected to meet as much as possible guidance documents listed in **Table B1**. Siting criteria not met are documented with sufficient reasons to justify the selection. Flow Chart**, Figure B1**, depicts the overall monitoring site selection process.

Figure B1 Monitoring Site Selection Process



10.5 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 (http://www.dec.state.ak.us/air/am/index.htm).

Table B5 ALASKA NCore Level 2 and SLAMS/SPM MONITORING NETWORK

Network	Site ID		Ambient Air Quality Parameters Monitored											
			CO	NO_2	O_3	Pb	SO_2	$PM_{2.5}$ FRM	PM_{10} FRM	PM_{10} FEM	$PM_{2.5}$ Spec.	$PM_{2.5}$ Continuous	PM_{10} Continuous	$PM_{10-2.5}$ FEM
Anchorage-MOA	16th & Garden	SLAMS	■					■*	■				■	■
	Turnagain	SLAMS	■											
	Parkgate-Eagle River	SPM	■						■					■
	Allstate Bldg.-Tudor Road	SLAMS							■*				■	
	8th & L Street	SPM	■											■
Fairbanks-FNSB	To be selected	NCore Level 2	■					■*			■	■		
	State Office Bldg.	SLAMS						■*			■	■		
	Peger Rd	SPM									■	■		
	2nd & Cushman (Old Post Office)	SLAMS	■											
	North Pole	SPM						■			■	■		
ADEC Kenai	To be determined													■
ADEC Juneau	Floyd Dryden School							■		■			■	
ADEC - MatSu	Butte (Harrison Court)	SPM						■	■				■	
	Wasilla Fire Station	SPM						■						■
	Palmer	SPM												■

* = collocated PM monitors

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.

11.1 Environmental Control

Monitoring stations should be designed for functionality and with the station operator in mind, considering safety, ease of access to instruments, optimal work space and security. **Table B6** lists recommended environmental control parameters for monitoring shelters. Continuous temperature measurement is strongly recommended inside monitoring shelters to ensure temperature is maintained within required shelter temperature criteria for all gaseous monitors (15° - 30°C, ±2°C SD/24-hrs.). Ambient air monitoring data collected outside this shelter temperature criteria needs to be flagged and evaluated regarding 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 http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf , Section 7.2
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 monitoring equipment	Method description or manufacturer's specs. EPA monitoring shelter criteria unless otherwise specified.	Regulated temperature conditioning (EPA criteria 20° – 30°C ±2°C SD/24-hr). Alaska variance 15° – 30°C ±2°C SD/24-hr) system, continuous temperature recorder, electric cooling and heating only
Temperature	$PM_{2.5}$-FRM, if inside monitoring shelter	EPA-Alaska Modification	http://www.epa.gov/ttn/amtic/files/cfr/recent/akmod799.pdf Alaska Modification for operating $PM_{2.5}$ FRM within monitoring shelter with sample probe to outside shelter
Temperature	All PM continuous monitors	Alaska continuous PM method Requirement	Operated within temperature controlled monitoring shelter with sample inlet line sampling air at ambient temperature conditions.
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.

Table B6 Environmental Control Parameters for Monitoring Shelters			
Safety	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.		

11.2 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 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, 316 or better stainless steel). Water traps should be configured into the sampling system to remove condensate that may accumulate in the sample line upstream of any monitoring equipment. Please see http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf , Section 7.2 for recommended design configurations of sampling probes and manifolds

11.3 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 to the sample 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 >10 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.

11.4 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 to 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]	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	3 – 15	>1	>10
CO [D,E,G]	Micro, Middle (300 km) Neighborhood (1 km)	3 ± 0.5; 3 – 15	>1	>10
O_3 [C,D,E]	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	3 – 15	>1	>10
NO_2 [C,D,E]	Middle (300 m) Neighborhood, and Urban (1 km)	3 – 15	>1	>10
NH_3 [C,D,E]	Middle (300 m) Neighborhood, and Urban (1 km)	3 – 15	>1	>10
Pb [C,C,E,F,H]	Micro, Middle, Neighborhood, Urban and Regional (1 km)	2 – 7 (micro); 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)
PM_{10} [C,D,E,F,H]	Micro, Middle, Neighborhood, Urban and Regional	2 – 7 (micro); 2 – 15 (all other scales)	>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 (micro); 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 drip line of tree(s) and must be ≥10 meters from the drip line when trees(s) act as an obstruction.

[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 must be classified as middle scale.

[E] ≡ Must ≥ 270° unrestricted air flow 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 bed, 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 HiVol and Low-Vol samplers must be met. For collocated Low Volume 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.

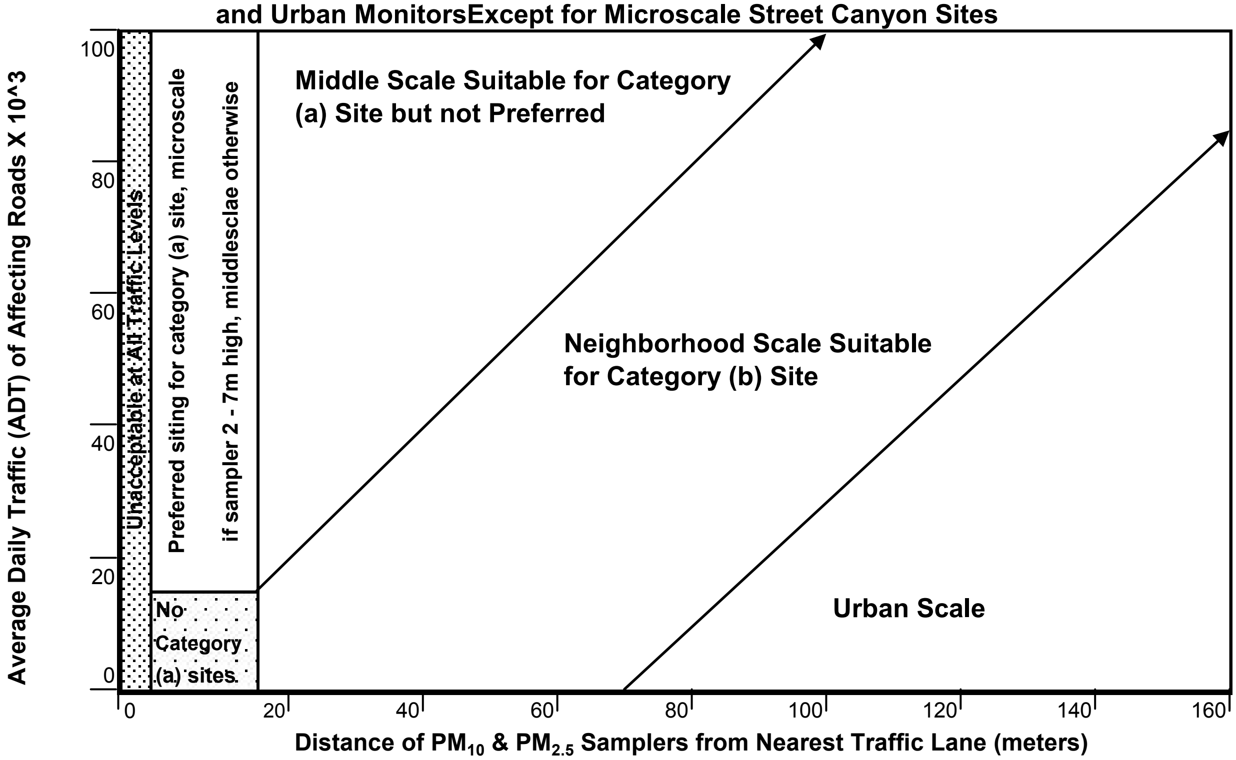
Table B9 summarizes spacing of probes from roadways. This information can be found in 40CFR part 58 Appendix E.

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	NO_2	CO	Pb		
	Neighborhood & Urban	Neighborhood & Urban	Neighborhood	Micro	Middle	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



11.5 Monitoring Methods

Federal Reference and Equivalent Methods

Monitoring methods used to support Level 2 NCore, Level 3 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: http://www.epa.gov/ttn/amtic/criteria.html. The EPA QA Handbook for Air Pollution Measurement Systems, Volume II, Part II provides specific Federal Reference Method procedures for the measurement of the ambient air quality criteria pollutants. A list of these methods can be found under the EPA AMTIC web site: http://www.epa.gov/ttnamti1/qabook.html .

DEC Approved Monitoring Methods

DEC maintains an inventory of "DEC approved" Ambient Air Quality Monitoring Methods and Standard Operating Procedures. These methods, SOPs and other QA guidance documents can be found on the DEC M&QA web site: http://www.dec.state.ak.us/air/am/index.htm, 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, web link: http://www.epa.gov/ttn/amtic/files/ambient/met/draft-volume-4.pdf;
- EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005, web link: http://www.epa.gov/scram001/guidance/met/mmgrma.pdf; and
- Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-87-007.

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-6^{th}-sampling day frequency. Comparability (least squares fit) between the PM_{10} FRM method and the continuous PM_{10} method must be:

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

The collected data must adequately represent 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 air shed pending ADEC M&QA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ PM_{10} method comparability may be required for new locations. The following 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),"* (http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/aqidqor2.pdf) provides guidance on developing acceptable inter-method comparability.

$PM_{2.5}$ Continuous Method Analyzers and Procedures

Even though EPA has given federal equivalent method (FEM) 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-6^{th}-sampling day frequency. Comparability (least squares fit) between the $PM_{2.5}$ FRM method and the continuous $PM_{2.5}$ method must be:

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

The collected data must adequately represent sufficient density of data 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 M&QA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ $PM_{2.5}$ method comparability may be required for new locations. The following 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),"* (http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/aqidqor2.pdf) provides guidance on developing acceptable inter-method $PM_{2.5}$ comparability.

11.6 Good Field Measurement Practices

Good Field Measurement Practices (GFMPs) refer to general practices that relate to many, if not all of 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 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 method.

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.

12.1 Sample Labeling and Identification

Sample labeling and identification will follow the specific procedures in the respective method/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.
- Sample transport container will have a unique identification to preclude the possibility of sample interchange.
- Sample will be properly handled to ensure there is no contamination and that the sample analyzed is actually the sample taken under the conditions reported.
- Sample collected will 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.).

If strip charts are used to record sample data from automated analyzers, they must be clearly identified. Information must be recorded so as not to interfere with any chart recorded data. If the strip chart is long, information should be placed at periodic intervals on the chart. Markings should be indelible and permanently affixed to each strip chart.

12.2 Sample Retrieval

In order to protect the integrity of each sample, samples need to be carefully removed from monitoring equipment/devices and place in sealed and non-reactive containers. Specific sample retrieval procedures may be found in the respective monitoring method/SOP.

12.3 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. For a list of these methods, please go to: http://www.epa.gov/ttn/amtic/criteria.html. The EPA QA Handbook for Air Pollution Measurement Systems, Volume II, Part 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 web site http://www.epa.gov/ttnamti1/qabook.html.

ADEC AM&QA 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 DEC M&QA web site: http://www.dec.state.ak.us/air/am/index.htm. 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.

13.1 Standard Operating Procedures (SOPs)

In order 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 the Preparation of Standard Operating Procedures EPA QA/G-6. This document is available through the EPA Quality System Homepage and web link, http://www.epa.gov/quality/qs-docs/g6-final.pdf.

It is the policy of ADEC that SOPs be written by the individual/s who are performing the procedures that are 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. In general, approval of SOPs occurs during approval of the QAPP. QA personnel (or their designees) with appropriate training and experience review and approve the SOPs.

13.2 Good Laboratory Practices (GLPs)

GLPs refer to general practices that relate to many, if not all of the 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, should be cause to generate a method.

In 1982, the Organization for Economic Co-operation 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

13.3 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 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	QA Guidance Document 2.12 Reference	Information Provided
Filter Checks				
Unexposed filter integrity check	Every filter	No defects	40CFR Part 50 App. L Sec. 10.2 2.12 Sec. 7.5	± Contamination of filter blanks from moisture gain/loss or other contaminants
Exposed filter integrity check				
Lot Blanks	9 filters/lot	< 15 µg between weighings	2.12 Sec. 7.7	
Exposure Lot Blanks	3 filters/lot	< 15 µg between weighings	2.12 Sec. 7.7	
$PM_{2.5}$ Filter Holding Times				
Pre-sampling	All filters	< 30 days before sampling	Part 50 App l Sec 8.3 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 & 7 hrs)	40CFR Part 50 App. L Sec.3.3 and http://www.epa.gov/ttn/amtic/files/ambient/pm25/filtere.pdf	
Post-sampling Weighing		≤ 10 days at 25°C from sample end date, or ≤ 30 days at 4°C from sample end date	40CFR Part 50 App. L Sec. 7.4.15	
Filter Conditioning Environment				
Time Range	All filters	24 hrs minimum	Part 50 App l Sec 8.2 2.12 Sec. 7.6 Summary of Guidance; Filter conditioning and Weighing Facilities and Procedures for $PM_{2.5}$ Reference and Class I Equivalent Methods (http://www.epa.gov/ttnamti1/files/ambient/pm25/qa/balance.pdf)	Controls established to minimize potential mass gain/loss contamination due to moisture
Temperature Range		24-hr mean, 20° – 23° C		
Temperature Control		± 2° C SD over 24-hr		
Humidity Range		24-hr mean 30% - 40% RH or < 5% sampling RH bu > 20% RH		
Humidity Control		± 5% RH SD over 24-hr		
Pre/Post Filter Conditioning RH		Difference in 24-hr means ≤ ± 5%RH	Part 50 App. L Section 8.3.2	
Balance		Located in filter conditioning environment	Part 50 App. L Section 8.3.3	
Calibration/Verification				
Micro Balance Readability	At purchase	1 µg	40CFR Part 50 App. L Sec 8.1 2.12 Sec 4.3.6	Required balance sensitivity
Micro Balance Repeatability	1/year	1 µg	2.12 Sec 4.3.6	Required balance precision
Balance Calibration	1/yr	Manufacturers spec.	2.12 sec 7.2	Verification of equipment operation
Lab Temp. Calibration	6 month	±2° C	2.12 Sec 3.3	Verification of equipment operation
Lab Humidity Calibration	6 month	±2% RH	2.12 Sec. 3.3	Verification of equipment operation

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

Requirement	Frequency	Acceptance Criteria	QA Guidance Document 2.12 Reference	Information Provided
Calibration standards				
Working Mass Stds.	3-6 month	25 µg	2.12 Sec 4.3 and 7.3	Working standards verification
Primary Mass Stds.	1/yr	25 µg	2.12 Sec 4.3 and 7.3	Transfer standards certification
Temperature Standards	1/yr	± 0.1 °C resolution, ± 0.5 °C accuracy	2.12 Section 4.2	Transfer standard certification
Humidity Standards	1/yr	±2% RH		Transfer standard certification
QC Checks				
Zero Balance Check	Prior to every weighing			Balance bias/stability
Balance Check (100 mg and 200 mg)	beginning, every 10th samples, end	≤3 µg	2.12 Sec. 7.9	
Field Filter Blank	10% or 1/weighing session	< 30 µg between weighings	40CFR Part 50 App. L,, Sec 8.3 2.12 Sec 7.7	Overall filter handling/contamination
Lab Filter Blank.	10% or 1/weighing session	< 15 µg between weighings	40CFR Part 50 App. L,, Sec 8.3 2.12 Sec 7.7	Contamination of lab blank due to moisture control, etc.
Duplicate Filter Weighing	1/weighing session	< 15 µg between weighings	2.12 Sec 7.11	Weighing repeatability/filter stability
Bias				
Balance Audit	1/yr	±15 µg for unexposed filters	2.12 Sec 10.2	Laboratory technician operation

Table B11 Laboratory QC Criteria for Analysis of PM_{10} Hi-Vol Filters

Requirement	Frequency	Acceptance Criteria	Fed Register & EPA QAQA Guidance Document	Information Provided
Filter Checks				
Unexposed filter integrity check	Every filter	No defects	2.11 Section 4.2	Filter integrity/damage
Exposed filter integrity check				
Filter Conditioning Environment				
Time Range	All filters	24 hrs minimum	2.11 Sections 1.2.3, 2 and 4	Environmental controls set to control moisture and static electricity contamination from net particulate analysis
Temperature Range		24-hr mean, 15° – 30° C		
Temperature Control		± 3° C SD over 24-hr		
Humidity Range		24-hr mean 20% - 45% RH		
Humidity Control		< ± 5% RH SD over 24-hr		
Pre/Post Filter Conditioning RH		Difference in 24-hr means ≤ ± 5%RH		
Calibration/Verification				
Analytical Balance Readability	At purchase	0.1 mg	2.11 Sections 2.0 and 4.5	Verification of equipment operation
Analytical Balance Repeatability	1/year	0.5 mg		
Analytical Balance Calibration	1/yr	Manufacturers spec.		
Lab Temp. Calibration	3 month	±0.5° C,	2.11 Section s 1.1.2	
Lab Humidity Calibration	3 month	±6% RH	2.11 Section s 2.0	
Unexposed filter integrity check	Every filter	No defects	2.11 Sections 4.0, 4.1, 4.2, 4.6	Sample contamination
Exposed filter integrity check	Every filter	No defects		
Calibration standards				
Working Mass Stds.	3-6 month	≤ ± 0.5 mg of NIST traceable	2.11 Sec 2 .14.3 and 4.5	Working standards verification
Mass Transfer Stds.	1/yr	ANSI/ASTM Classes 1, 1.1 or 2, indiv mass std accuracy ≤± 0.025mg from NIST accredited weights & measures lab or NVLAP accredited lab	2.11 sec 1.2.4, 9.0	Transfer standards certification
Temperature Standards	1/yr	± 0.1 °C resolution, ± 0.1 °C accuracy, NIST/ASTM traceable	2.11 Sections 1.12	Transfer standard certification
Humidity Standards	1/yr	±2% RH, NIST/ASTM traceable	2.11 Sections 2.0	Transfer standard certification
QC Checks				
Zero Balance Check	Prior to every weighing	≤ ± 0.1 mg	2.11 sections 4.4 and 4.5	Verification of analytical balance accuracy
Balance Checks (bracketing expected range of unexposed and exposed sample filters e.g., 1.0g - 5.0g)	beginning, every 10th samples, end	≤ ± 0.5 mg		
Field Blanks	10% of filters			Filter contamination
Filter Transport Blanks	1/batch of shipped filters			Integrity of filter shipments
Replicate un-exposed Filter Weighing	10% each of pre- and post-	< ± 2.8 mg difference	2.11 section 4.5.3	Lab technician filter handling

Table B11 Laboratory QC Criteria for Analysis of PM_{10} Hi-Vol Filters

Requirement	Frequency	Acceptance Criteria	Fed Register & EPA QAQA Guidance Document	Information Provided
Replicate un-exposed Filter Weighing	exposed filters/weighing session	< ± 5.0 mg difference		procedures
Bias				
Balance Audit	1/yr	≤ ±5 mg of audit stds that bracket routine weights of un exposed and exposed sample filters (3g, 5g)		Laboratory technician operation

14. QUALITY CONTROL (QC)

14.1 Definitions

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

Even with such a clear-cut difference defined, identifying the differences between the two can be hard. Basically, QC involves evaluating a product, activity and/or service. By contrast, QA is designed to make sure processes are sufficient to meet the end objectives. Simply put, QA ensures a product or service is manufactured, implemented, created, or produced in the right way; while QC evaluates whether or not 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 such items as 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 Ambient Air & Meteorological Monitoring Program.

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

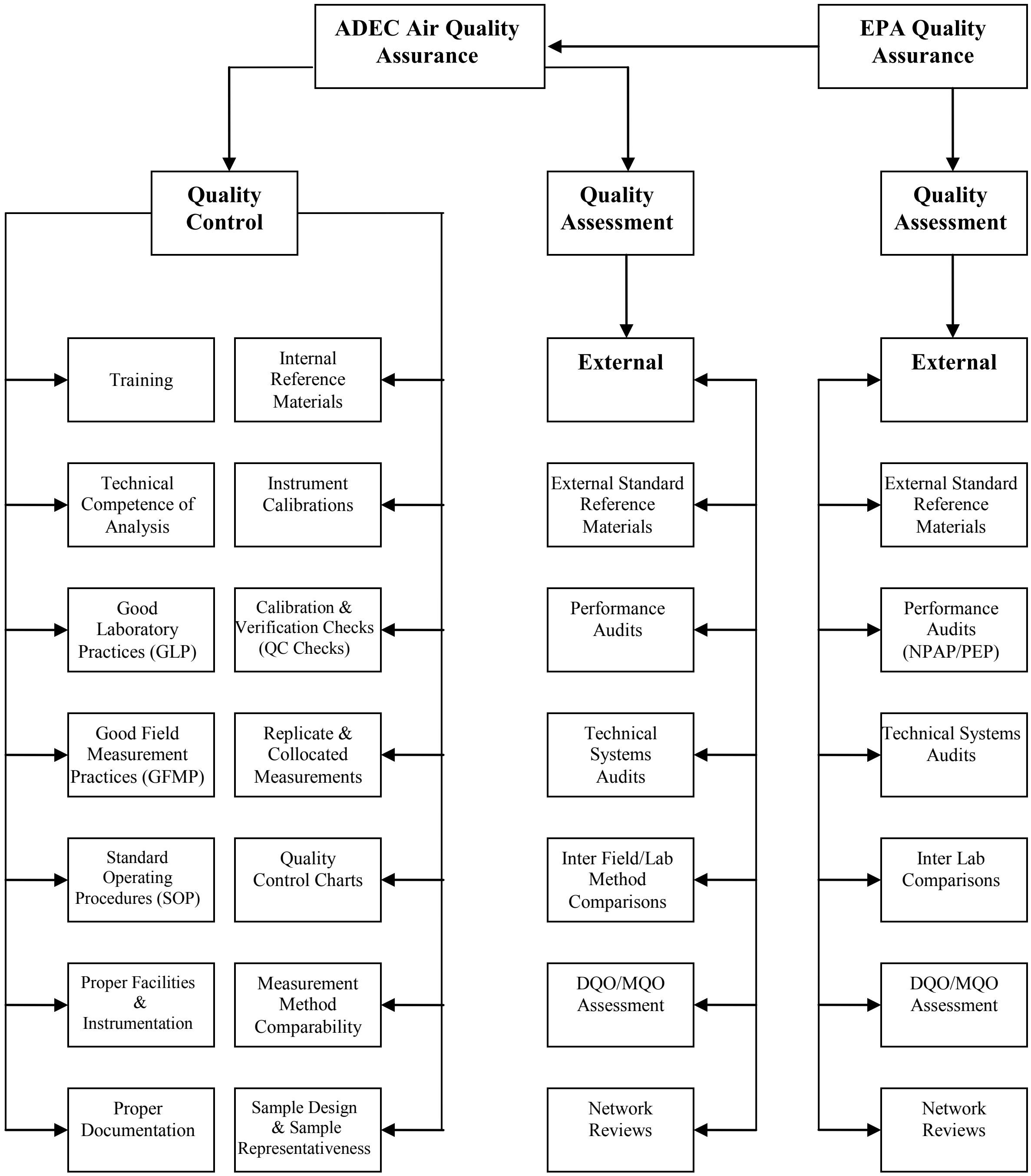
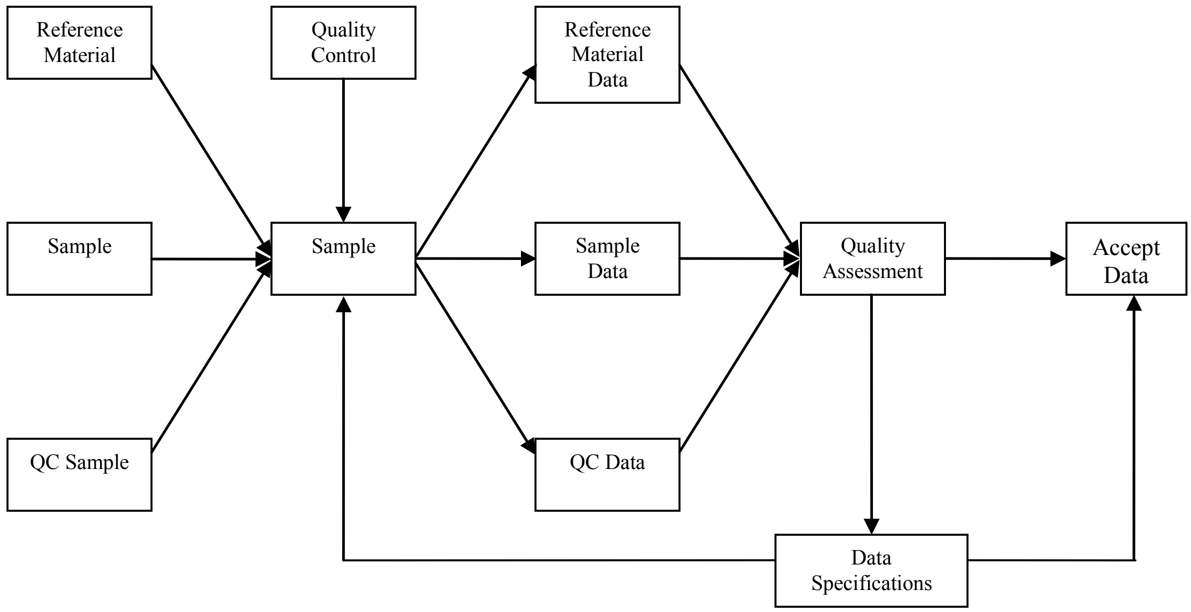


Figure B4 describes the overall process of accepting routine data.

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



14.2 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 in order to validate/report reliable monitoring data.

14.3 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 and every criterion on the Critical Table should be invalidated unless there are compelling reason and justification for not doing so. Basically, 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 criteria 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.

14.4 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 (i.e., 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 AM&QA 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.

15.1 Procurement and Acceptance Testing of Equipment

The Air M&QA Program Manager with support form the Air Monitoring Section Manager will be 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. Acceptance test reports are to be prepared and archived by the Air Monitoring Section Manager or his/her designee.

15.2 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 AM&QA Program.

The Station Operators are responsible for performing routine preventive and corrective maintenance. They will prepare maintenance reports that will be reviewed and archived by the Air Monitoring Section Manager or his/her designee. Each monitoring site and/or laboratory will maintain a log book 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.

Major maintenance and repair will be performed by or under the direction of the AM&QA Section Electronic Technician. Equipment will be maintained according to frequencies developed by the Air Monitoring Section Manager, or as a default by the maintenance frequency recommended in the respective instrument manual or monitoring method/SOP.

15.3 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 must 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 the respective monitoring agency.

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 traceabilities (showing the standard's certified traceability over range of intended use),
- Identification of calibration equipment used, and
- Person conducting the calibration.

16.1 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, which is different than a multipoint verification) 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).

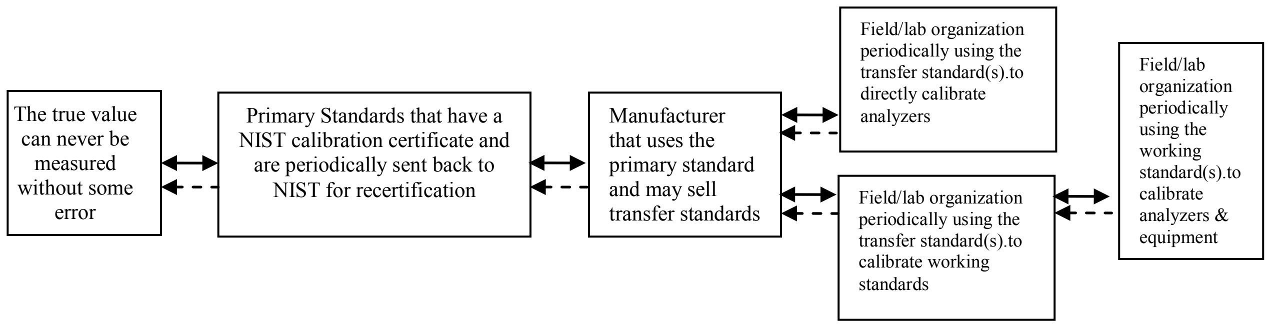
Calibration activities follow a two step process:

- Certifying the calibration standard (this may be a thermometer kept in the office except when it is used for calibrations, a flow rate transfer standard, a barometer, or whatever is appropriate to the sensor or instrument being calibrated) 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.

16.2 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[36], 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™ (NTRM™) 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 2 and 4.

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

16.3 Multi-point Calibrations

Gaseous Analyzer Multi-point Calibrations (e.g., CO, O_3, NH_3, 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 match 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, after major repairs, after failure of a zero/span or one-point QC check or performance audit, and at specified frequencies.

Most analyzers have zero and span adjustment controls, which are adjusted based upon zero and span test concentrations (80 – 90% FS), respectively to provide the desired scale range within the analyzers specifications. 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. Analyzer zero and span controls often interact with each other, so adjustments may have to be repeated several times to obtain the desired final adjustment. 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 used for subsequent ambient air measurements.

The analyzer measured responses are plotted against the respective test gas concentrations, and the best fit linear (or non-linear if appropriate) curve fit 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:

$$y = m \bullet x + b$$

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

When this calibration relationship is subsequently used to compute concentration measurements (x) from the analyzer response readings (y), the formula is transposed to:

$$x = (y - b)/m$$

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 on a quarterly basis (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 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, 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:

$$y = m \bullet x + b$$

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

When this calibration relationship is subsequently used to compute concentration measurements (x) from the analyzer response readings (y), the formula is transposed to:

$$x = (y - b)/m$$

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 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).

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

A zero/span QC check is a simplified two-point analyzer calibration 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 encouraged. Frequent 2-point calibration (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 out-of-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).

Before any adjustment is made to the analyzer's zero or span settings, the "unadjusted" or "as found" measurement must be recorded. Subsequent adjustment to the analyzer's zero/span can then proceed. After completing analyzer adjustments, a post-adjusted (or "as left") zero/span measurement must be performed and recorded. These "as found" and "as left" zero/span measurements obtained prior to and after the calibration adjustment provides valuable information for:

- Confirming the validity of (or invalidating) the measurements obtained preceding the calibration,
- Monitoring the analyzer's calibration drift, and
- Determining the frequency of recalibration.

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, unadjusted zero and span responses, and final adjusted zero/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 will 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 ll, Part ll.

16.5 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 encouraged. One-point QC check concentrations must be within 16% to 20% of an analyzer's calibrated full-scale measurement range.

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 is to be used in the quality control (QC) program, a reference response for the check must be obtained immediately following a level 1 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 similar to level 1 zero/span checks.

16.6 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 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 on a monthly basis, 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 out-of-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., $\leq 2.5\mu m$ for $PM_{2.5}$ $\leq 10\mu m$ for PM_{10}, and $\leq 35\mu m$ 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, Parts I and II.

16.7 Data Reduction Using Calibration Information

An analyzer/particulate monitor/meteorological sensor's response calibration curves relate the measurement system's response to actual concentration units of measure, and the response of most measurement system's 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).

16.8 Validation of Ambient Data Based Upon Calibration Information

When zero, span and/or precision drift validation limits are exceeded, ambient measurements should be invalidated back to the most recent point in time where such measurements are known to be valid. Usually this point is the previous calibration (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 should be regarded as invalid until the next subsequent 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. Method specific data validation tables may be 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 are monitoring site specific. 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, the ADEC has not formalized the types of additional data that may be needed in support of the monitoring program. Possible data bases 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, 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). Various air quality staff are responsible for separate or discrete parts of the data management process:

- The site operators are responsible for data download from instruments or data loggers to laptops or work computers. They assemble data files, which includes raw data, calibration information and certificates, QC checks (routine checks and audits), data flags, operator comments and meta-data where available. These files are stored on a DEC network drive or emailed to the secondary reviewer.
- Secondary reviewers are responsible for QC review, data reformatting for AQS (if necessary), and reporting to the program manager
- The program manager is responsible for final data certification
- AQS data entry staff conducts a final review (tertiary review) and submits the validated SLAMS/SPM data to AQS.

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

Figure B6, AM&QA Data Management Flow Chart – NCore/SLAMS/SPM

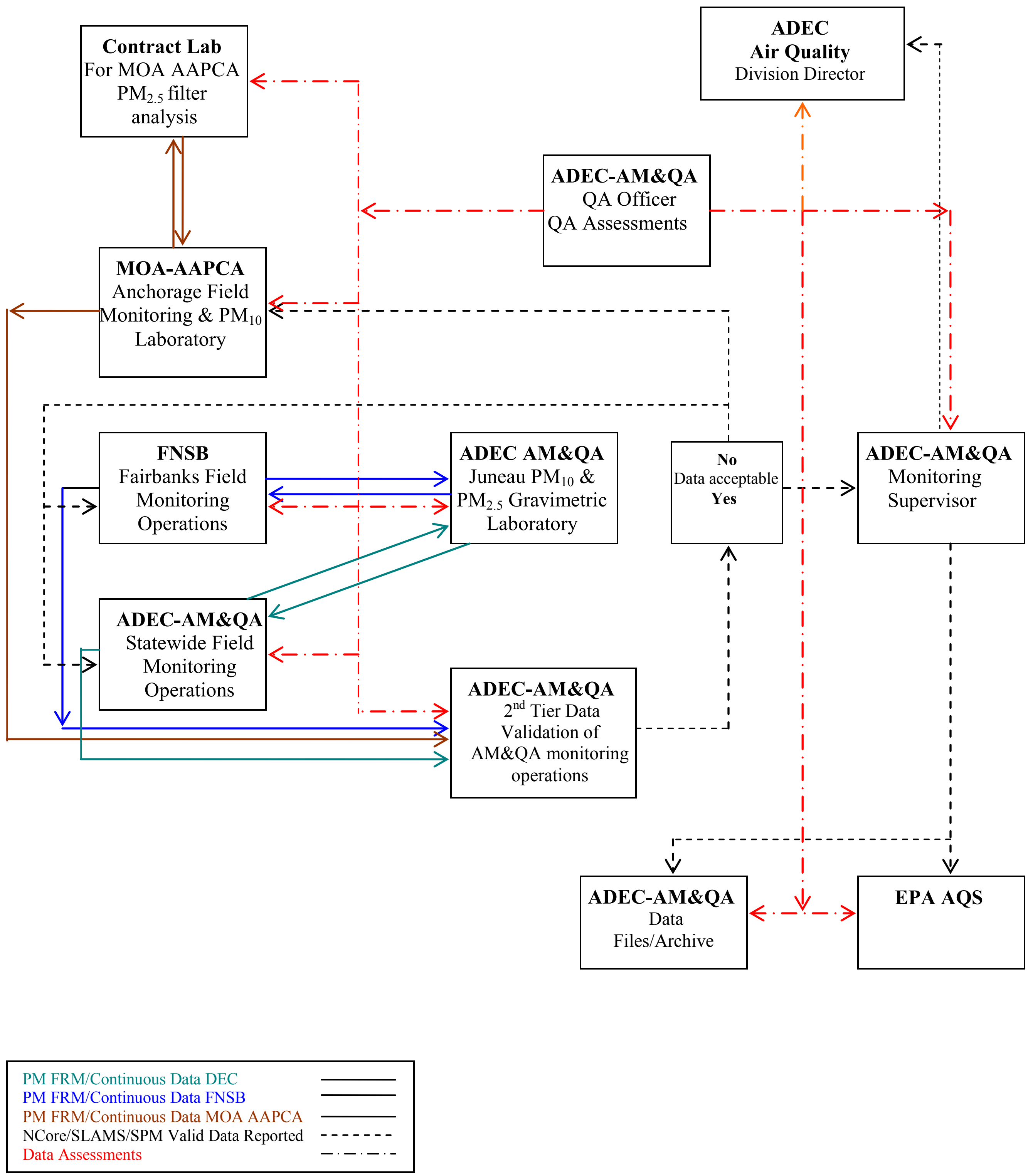
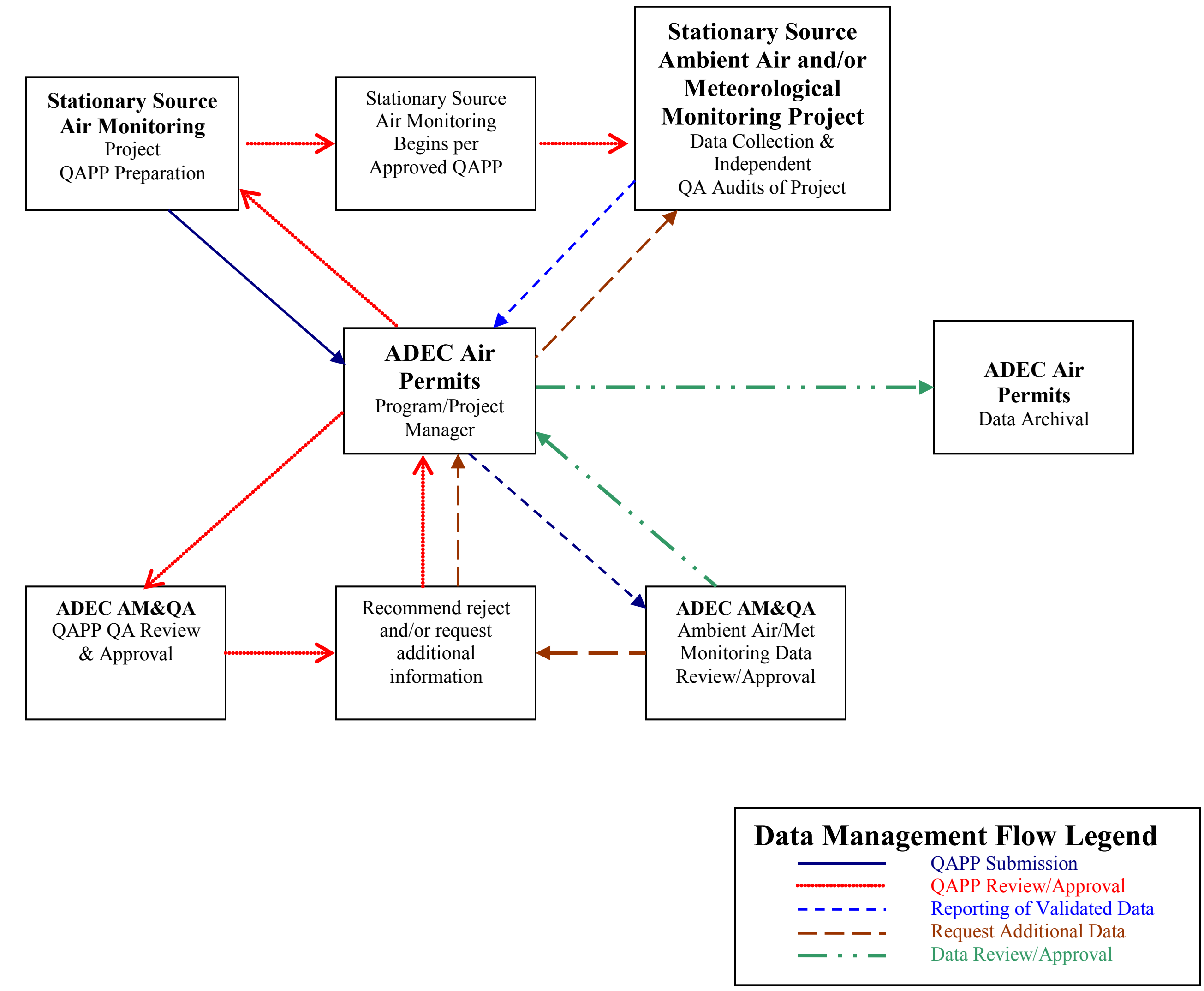


Figure B7, AM&QA Data Management Flow Chart – Ambient Air & Meteorological Monitoring Conducted by Stationary Source for Regulatory Permitting Needs



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} HiVol FRM and PM_{10} LoVol 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, O_3, SO_2, NH_3);
   - Continuous particulate monitors for PM_{10} and $PM_{2.5}$ (e.g., TEOMs, BAMs, Black carbon—Aethalometers, Nephelometers); and
   - Meteorological parameters (e.g., wind speed, wind direction, temperature, barometric pressure, relative humidity, solar radiation,).

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 go 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.

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.

Figures B8 and B9 depicts ADEC's Manual and Continuous Method Data Management Schemes.

Figure B8, Data Management of Manual Methods

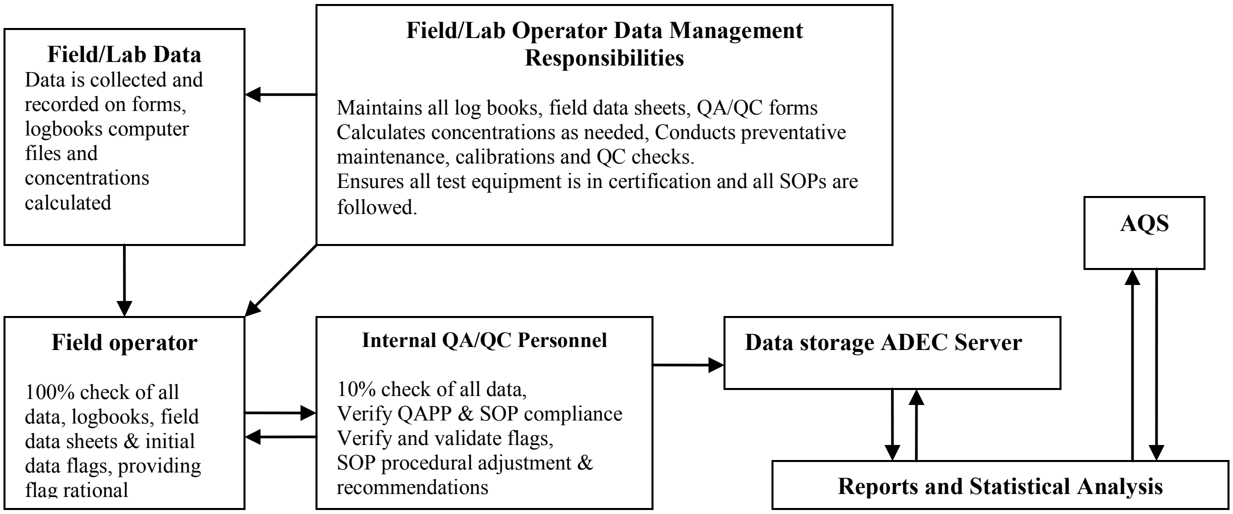
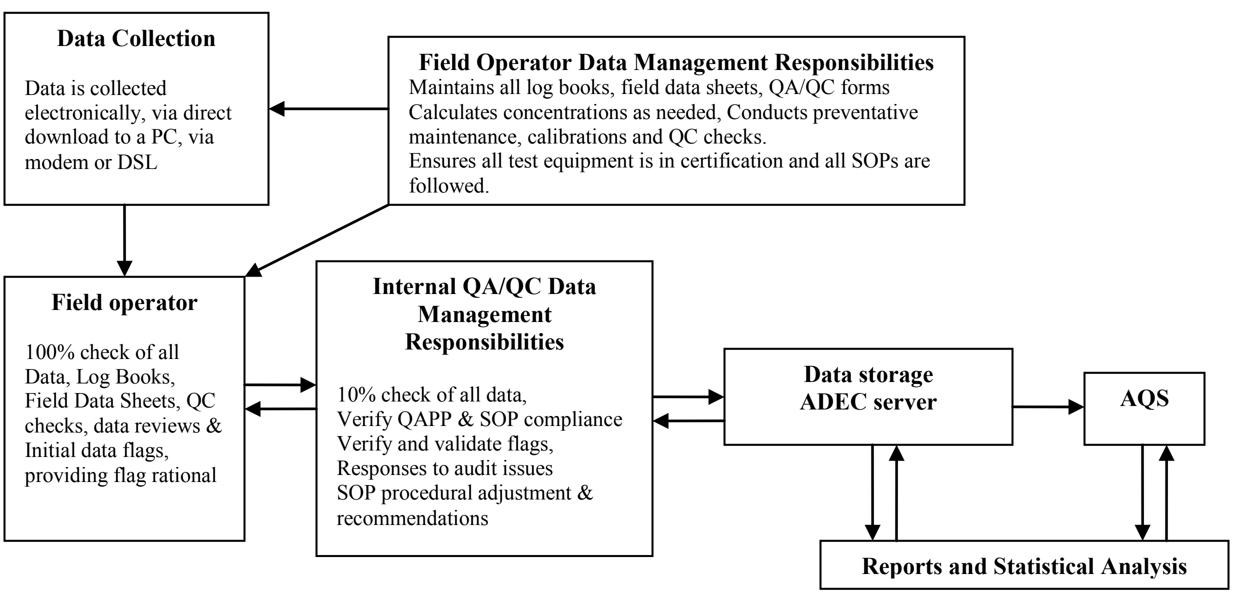


Figure B9, Data Management of Continuous Methods



19.1 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 analyzers are continuously collected via on-site data acquisition systems and accessed either remotely from office computers or downloaded onto computers on-site.

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.

Air monitoring equipment calibration reports will be prepared and sent to the air monitoring supervisor for review, processing and archiving.

The Station Operators maintain station logbooks/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. Log book/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, pen, paper, probe, etc), and missing or invalid data. Station records are reviewed periodically by the air monitoring supervisor, and when full, archived by the respective monitoring unit (AM&QA, FNSB, MOA-AAPCA, etc.) 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, date of issue and author. 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 National Ambient Air Quality Standards, where applicable.

19.2 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 and Windows Excel™® software to manipulate the data. In the future some of the data reduction and transformation will be accomplished in the DR DAS data acquisition system.

Data transformation

The data collected by ADEC can 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 PM_{10} and $PM_{2.5}$. For all of 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 of these calculations are done within an established Excel spreadsheet designed for that specific purpose. All of the Excel spreadsheets used in this process are established forms that have been review by ADECs Air QA officer and AM&QA'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 the 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 the 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 can not 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 of type of monitoring system is specific to the monitor type, monitor manufacturer, and the data end use requirements. In all cases the ADEC follows either established EPA CFR requirements or manufacturer recommended operating procedures or ADEC developed methods and SOPs. The ADEC is currently in the process of developing and/or updating some of these SOPs. In some cases the ADEC is attempting to reduce the level of work needed to develop these SOPs. In these cases the ADEC is using 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 data which are used in comparisons with the 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.

19.3 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.

19.4 Data Storage and Retention

Hard copy files (paper 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 maintained on ADEC network drives managed by the AM&QA Program manager and his/her staff. Validated data is also available from the EPA Air Quality System (AQS) Database (http://www.epa.gov/ttn/airs/airsaqs/index.htm).

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 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 years, and are readily available for audits and data verification activities. After three years, hardcopy records, and computer backup media are cataloged and boxed for storage. Data archival policies for the data are listed in following table. Security of data in the database is ensured by password protection.

Official data storage for NCore/SLAMS data is AQS. In addition DEC will store all monitoring data on the DR DAS server (Washington Department of Ecology (DOE) server). The intent is to import as much of the historical data as possible. Data and log sheets will be stored in electronic format on the state owned server in station specific folders. Data retention on the DEC and DOE server, as well as AQS, are indefinite.

Annual and special summary data reports are developed for upper management and the public and are stored on the DEC web page. Raw and validated data will be stored on the AQS, DR DAS, and State network servers. Automated data backup is performed according to DOE and State procedures. AQS, DR DAS, 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.

20.1 Network Reviews

Network Reviews are conducted annually by Region 10 of ADEC's Ambient Air Quality Monitoring program. ADEC conducts network reviews of its own and other monitoring networks/agencies under its umbrella as time and resources permit. Network reviews are conducted to assess 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 40CFR Appendices D and E).

20.1.1 Network Selection

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

- Date of last review,
- Areas where attainment/non-attainment, redesignations 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, and
- 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 area,
- 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 the information it is checked to ensure it is the most current. Discrepancies are noted on the checklist and resolved during the review. Files and/or photographs that need to be updated will also be identified. 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) are reconfirmed and the spatial scale re-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 the 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 included in the checklists, 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, **and most importantly**
- Funding.

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

20.1.2 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:

- Monitoring network meets number of monitors required by design criteria requirements, and
- Monitors are properly located based upon the monitoring objectives and spatial scale of representativeness.

Alaska only has SLAMS, SPM and PSD quality category monitoring sites. Except for $PM_{2.5}$ (SLAMS) monitoring stations, the number and location of monitors required is not specified in regulations. Instead, ADEC and EPA Region 10 meet periodically to decide how to 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 AM&QA provides technical support to the Air Permits Program on all aspects of Ambient Air Quality and Meteorological Monitoring.

20.1.3 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.

EPA QA Manual Volume II Part I Appendix 15 contains an on-site checklist for use in evaluating monitoring networks. 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).

20.2 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. In order to estimate bias, an external instrument/standard must be compared against the field instruments collecting monitoring data. This external (independent) standard can not be the same standard/s as 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 Part I Section 15, 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.

20.3 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 Audit Program (NPAP). NPAP are blind audits provided through the mail to the agency/industry participating in the audit. The auditee is aware of the parameter to be measured but is unaware of the true concentration of the audit standard. The NPAP 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 NPAP equipment and the auditee's equipment. ADEC AM&QA will participate in NPAP as arranged and agreed to with EPA Region 10.

The National Performance Evaluation Program (NPEP) and/or the National Performance Audit Program (NPAP) 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/npepqa.html). These audits will be conducted when necessary and if resources are available. The audit results will be summarized and reported to DEC Division of Air Quality director and the Air QA Officer when they are finalized by U.S. EPA Region 10.

PSD quality monitoring projects are required to participate in the NPAP audit program, however participation is dependent upon funding and audit equipment availability through EPA.

20.4 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.

20.5 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 conducts a technical systems audit of the ADEC air-monitoring program. EPA may stagger these technical systems audits with ADEC such that once every six years EPA Region 10 conducts the systems audit and once every 6 years the ADEC QA Officer conducts the systems audit such that every 3 years a technical systems audit of ADEC's AM&QA program is performed. 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 DEC Division of Air Quality director and the Air QA Officer when they are finalized.

EPA QA Handbook for Air Pollution Measurement Systems Volume II Part I Section 15 contains an example TSA form.

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

20.6 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 AM&QA program manager and to EPA. Region 10. Each parameter reported will assess the reported data:

- Completeness,
- Bias, and
- Precision

20.6.1 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 correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50). Data Completeness 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%C valid data/monitoring quarter. 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)

20.6.2 Bias

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 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 manual checks with a known concentration performed every two weeks for gaseous pollutants, or monthly 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 50 % of network audited frequency every 6 months, and each network sampler audited 1/ year. **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	• *40CFR Part 58 Appendix A section 4, Calculations for Data Quality Assessment,* http://www.epa.gov/ttn/amtic/files/ambient/pm25/092706sign.pdf • *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* http://www.epa.gov/ttn/amtic/parslist.html • *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type* http://www.epa.gov/ttn/amtic/parslist.html • See EPA QA Handbook Volume II Part 1 Appendix 15 Section 3 for audit procedures • See respective ADEC Gaseous monitoring Methods for audit procedures
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 2/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 6% to 16% of analyzer full scale (FS) • Within 30% to 40% of analyzer FS • Within 70% to 90% of analyzer FS • Report individual % Δ and avg. % Δ • 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 with 25% of a network audited each quarter **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 Section 5. http://www.epa.gov/scram001/guidance/met/mmgrma.pdf

TABLE C1 BIAS ASSESSMENTS

Method Parameters	Bias Assessment Frequency		References
	Single/Multi-Point Analyzer Audits	Quarterly, Annual and 3-Year Network Assessment	
SR, Precipitation	$\%\Delta = (Y - X)X \cdot 100$ Where: %Δ = audit % difference, *Y* = sensor response, *X* = audit known value **Note:** For PSD Quality Data, Audits of each sensor required semiannually		EPA QA Handbook Volume IV (revised draft) http://www.epa.gov/ttn/amtic/files/ambient/met/draft-volume-4.pdf

20.6.3 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

The equations and references in **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 on an ongoing basis to evaluate frequent precision checks, some are used every quarter and 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/m^3 • $PM_{2.5}$ precision calculated and reported only for paired values ≥ 3.0 µg/m^3 • Pb on TSP precision calculated for all paired measurements, however, reported only for paired values with mass ≥ 0.15 µg/m^3 • **Note 1**: Collocated sampling required on 1/12 day g 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 (Equation 11). 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.	• 40CFRPart 58 App A section 4.2.1 Precision Estimate from Collocated Samplers and section 4.3.1 Precision Estimate(PM2.5 & PM10-2.5) http://www.epa.gov/ttn/amtic/parslist.html • *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).*
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) recommended in range of 16 to 20% of instrument full scale response. **Note 1:** Gaseous precision sample at 15 – 20% of analyzer FS response required on every 2 week frequency 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.	• 40CFRPart 58 App A section 3.2.1 http://www.epa.gov/ttn/amtic/parslist.html • *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**		

20.7 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 AM&QA 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 PSD quality monitoring, each 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 (http://www.dec.state.ak.us/air/am/PSD_Met_annual_1-1.pdf).*

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

- Audit finding(s)
- Cause of the problem(s)
- Actions taken or planned to be taken 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 identifying if finding is closed or further following action is required.

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

20.8 Revisions to ADEC AM&QA QAPP

Annually the ADEC AM&QA QAPP will be reviewed and revised 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 AM&QA web site with a specified formal comment period/window.

Only the most current QAPP revision will be posted on the ADEC AM&QA web site.

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, and in general are discussed in various sections of 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 Part 1, Section 16.

Required reports to management/ADEC Air Permits Group for PSD ambient air quality and meteorological monitoring are further prescribed in the following two data report formats and are available online at http://www.dec.state.ak.us/air/am/index.htm:

- *PSD Quality Ambient Air Quality & Meteorological Monitoring Annual Data Report Format*
- *PSD Quality Ambient Air Quality & Meteorological Monitoring Summary Data Report Format*

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	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 and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	EPA NPAP Program and/or Region X	✔		✔
EPA PM2.5 PEP Audit Results	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	EPA PEP Program and/or Region X	✔		✔
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 X QA Manager, ADEC Air QA Officer	✔		✔
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 valid data & QA/QC results	ADEC-AM&QA data base 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 and 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	EPA Regional Office	✔		✔

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 organizations 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 DEC Air Permits.

Each of the following areas of discussion is 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 and location 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 samples are representative of its native environment 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; 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 on data integrity evaluate 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 a quarterly (summary results only) and annual basis to the ADEC Air Permits Program. The required reporting formats are available online at: http://www.dec.state.ak.us/air/am/index.htm.

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.

23.1 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 is stated in the required monitoring project's QAPP (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.

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 a number of personnel and maintained in a number of rooms or locations. 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 (respective QAPP) 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

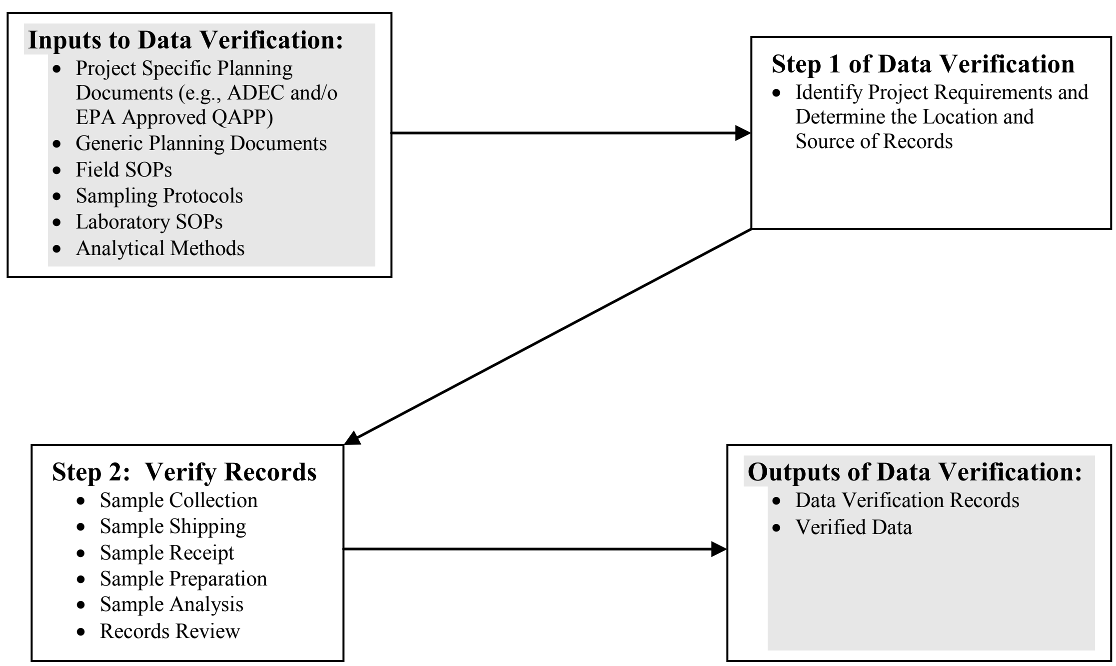
1. The first output is "***verified data***." Examples of verified data that have been checked for a variety of factors during the data verification process include:
    - Transcription errors,
    - Correct application of dilution factors,
    - Correct application of conversion factors,
    - Correct 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.

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

Figure D1: Data Verification Process



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

Note 2: For NCore, SLAMS, SPM monitoring projects performed by Local Agencies, steps 1 and 2 of data verification is the responsibility for 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 is the responsibility of the respective agency/facility/industry reporting data to ADEC.

23.2 ***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 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 and/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 M&QA program manager in consultation with the Air Quality Assurance Officer.

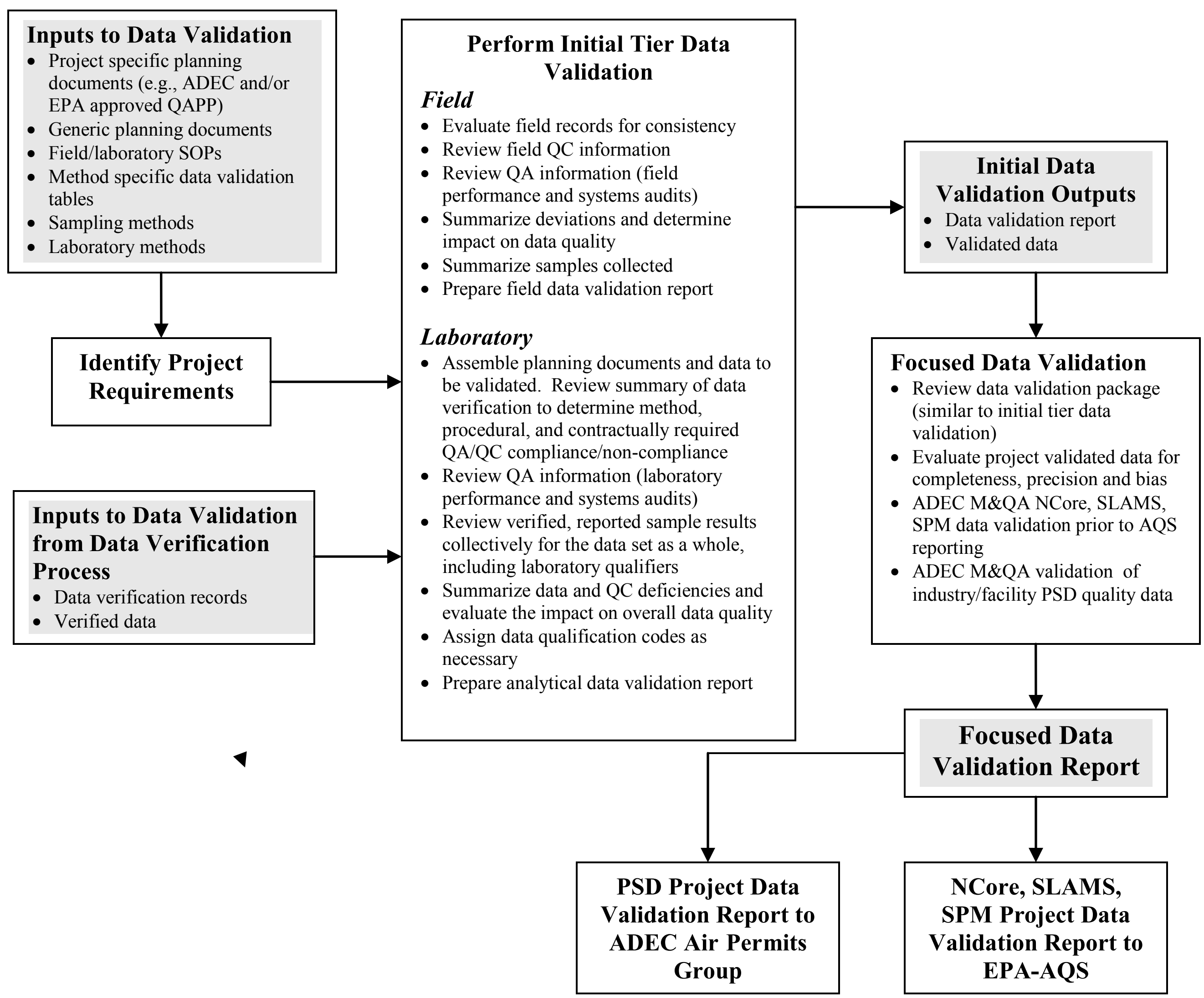
In order for the data to be considered valid the following conditions must be satisfied:

- 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 do not, will be invalidated back to the last valid quality control check and future data will be invalidated 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 AM&QA staff, initial tier of data validation is the responsibility for the ADEC AM&QA field and laboratory technicians. For NCore, SLAMS and SPM projects, the focused data validation step is the responsibility of the ADEC AM&QA 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 AM&QA 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-AM&QA conducts an additional independent data validation/data review to ensure monitoring project conformed to ADEC-AM&QA 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 5 to Data Integrity. This document can be found at: http://www.epa.gov/quality1/qs-docs/g8-final.pdf . Each data validator is encouraged to familiarize themselves with this and other chapters in this guidance document.

24. RECONCILIATION WITH USER REQUIREMENTS

The Air Quality Assurance Officer 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 posted on the ADEC website at http://www.dec.state.ak.us/air/am/index.htm.

APPENDIX A

METHOD SPECIFIC DATA VALIDATION TABLES

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

APPENDIX B

MONITORING METHODS AND STANDARD OPERATING PROCEDURES

PM_{10} GMW Accu-Vol FRM Hi Volume Sampler
PM_{10} & $PM_{2.5}$ Met-One Beta Attenuation Mass (BAM) Monitor Model 1020
$PM_{2.5}$ FRM R&P Partisol 2000
$PM_{2.5}$ R&P 1400a Tapered Element Oscillating Microbalance (TEOM)
$PM_{2.5}$ R&P 1400a Tapered Element Oscillating Microbalance w/ 8500 FDMS (TEOM/FDMS)
$PM_{2.5}$ Met-One Super SASS Speciation Monitor
$PM_{2.5}$ Magee Scientific Aethalometer
Thermo Electron 48(c) Carbon Monoxide Monitor
O_3 by UV absorption
SO_2 by UV fluorescence
NO_x by chemiluminescence
NH_3 by chemiluminescence
Laboratory Gravimetric Analysis of $PM_{2.5}$ Air Quality Filter Samples
Network Data Collection
Meteorological Monitoring

These documents can be viewed at:
http://www.dec.state.ak.us/air/am/index.htm