GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

QUALITY ASSURANCE PROJECT PLAN

FOR THE

PM10 AMBIENT AIR MONITORING PROGRAM

AT STATE AND LOCAL AIR MONITORING STATIONS (SLAMS)

DRAFT

NOVEMBER 2002

Acronyms and Abbreviations

AIRS	Aerometric Information Retrieval System
AMTAC	Air Monitoring Technical Advisory Committee
ANSI	American National Standards Institute
APS	Air Pollution Specialist
APTI	Air Pollution Training Institute
AQDAS	Air Quality Data Acquisition System
AQDB	Air Quality Data Branch
AQDRS	Air Quality Data Review Section
AQM-C	Air Quality Monitoring - Central
AQM-N&OS	Air Quality Monitoring - North and Operations Support
AQM-S	Air Quality Monitoring - South
AQSB	Air Quality Surveillance Branch
ARB	Air Resources Board
ASTM	American Society for Testing and Materials
AWMA	Air and Waste Management Association
CAA	Clean Air Act
CFR	Code of Federal Regulations
DAS	data acquisition system
DQA	data quality assessment
DQOs	data quality objectives
ELB	Engineering and Laboratory Branch
EMAD	Emissions, Monitorning, and Analysis Division
FEM	Federal equivalent method
FIPS	Federal Information Processing Standards
FRM	Federal reference method
GBUAPCD	Great Basin Unified Air Pollution Control District
GIS	geographical information systems
GLP	good laboratory practice
GPS	global positioning system
HVAC	heating ventilation and air conditioning
ILS	Inorganic Laboratory Section
LIMS	laboratory information management system
LPM	liters per minute
MLD	Monitoring and Laboratory Division
MOU	Memorandum of Understanding
MQAG	Monitoring and Quality Assurance Group
MQOs	measurement quality objectives
NAAQS	National Ambient Air Quality Standards
NAMS	national air monitoring station
NIST	National Institute of Standards and Technology
NPAP	National Performance Audit Program
OAQPS	Office of Air Quality Planning and Standards
OARM	Office of Administration and Resources Management
ORD	Office of Research and Development

PAMS	Photochemical Assessment Monitoring Stations
PE&S	Program Evaluation and Standards
PM2.5	particulate matter $\leq$ 2.5 microns
POC	pollutant occurrence code
PTFE	polytetrafluoroethylene
Q_a	sampler flow rate at ambient (actual) conditions of temperature and pressure.
QA	quality assurance
QA/QC	quality assurance/quality control
QAAR	quality assurance annual report
QAPP	quality assurance project plan
QAS	Quality Assurance Section
QMOSB	Quality Management and Operations Support Branch
QMP	quality management plan
R&P	Rupprecht & Patashnick
SA	System audit
SIPS	State Implementation Plans
SLAMS	state and local air monitoring stations
SOP	standard operating procedure
SPM&DS	Special Purpose Monitoring and Data Support
SPMS	special purpose monitoring stations
T_a	temperature, ambient or actual
TSD	Technical Support Division
TSP	total suspended particulate
U.S. EPA	United States Environmental Protection Agency
V_a	air volume, at ambient, actual, or volumetric conditions
VOC	volatile organic compound
WAM	Work Assignment Manager

1.0 Quality Assurance Project Plan Identification and Approval

Title: Great Basin Unified Air Pollution Control District (GBUAPCD) Quality Assurance Project Plan (QAPP) for the PM10 Ambient Air Monitoring Program at State and Local Air Monitoring Stations (SLAMS)

The attached QAPP for the PM10 Ambient Air Quality Monitoring Program is hereby recommended for approval and commits the District to follow the elements described within.

Great Basin Unified Air Pollution Control District

1) Signature: _____ Date:_____
Duane Ono - Deputy Air Pollution Control Officer

California Air Resources Board

1) Signature: _____ Date:_____
Mike Miguel - Manager, Quality Assurance Section

U.S. EPA Region IX

1) Signature: _____ Date:_____
John Kennedy - Chief, Air Division - Technical Support Office

2) Signature: _____ Date:_____
Vance S. Fong, P.E., - Manager, Policy and Management Division,
Quality Assurance Office

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3.0 Distribution List

A copy of this QAPP has been distributed to the individuals in Table 3-1.

Table 3-1 Distribution List

GREAT BASIN STAFF

Dr. Ellen Hardebeck Air Pollution Control Officer	Mr. Duane Ono Deputy APCO	Mr. Bill Cox Director of Technical
Mr. Christopher Lanane Air Monitoring Specialist	Mr. Mike Horn Instrument Tech. II	Mr. R. Guy Davis Instrument Tech. II
Mr. Paul Doubt Laboratory Technician I	Mr. Dan Johnson Instrument Tech. II	Mr. H. Gabriel Ibarra Instrument Tech. II

CALIFORNIA AIR RESOURCES BOARD STAFF

MLD Division Chief Mr. William V. Loscutoff	PTSD Division Chief Mr. Bob Fletcher	MLD ELB Mr. Russell Grace
PTSD AQDB Mr. Bob Effa	MLD QMOSB Mr. Jeff Cook	MLD AQSB Mr. Peter Ouchida
MLD QAS Mr. Mike Miguel	MLD AQSB Mr. Curt Schreiber	MLD AQSB Mr. Ken Stroud

OTHER GOVERNMENT AND INDUSTRY

U.S. EPA Region IX Mr. John Kennedy, Chief	U.S. EPA Region IX Mr. Bob Pallarino	U.S. EPA Region IX Mr. Matthew Plate
U.S. EPA Region IX Ms. Catherine Brown	U.S. EPA Region IX Mr. Manny Aquitania	U.S. EPA Region IX Mr. Vance Fong

4.0 Project/Task Organization

4.1 Roles and Responsibilities

Federal, State, and local agencies all have important roles in developing and implementing satisfactory air monitoring programs. As part of the planning effort, U.S. EPA is responsible for developing National Ambient Air Quality Standards (NAAQS), defining the quality of the data necessary to make comparisons to the NAAQS, and identifying a minimum set of QC samples from which to judge data quality. The State and local organizations are responsible for taking this information and developing and implementing a system that will meet the data quality requirements. Then, it is the responsibility of both U.S. EPA and the State and local organizations to assess the quality of the data and take corrective action when appropriate. The responsibilities of each organization follow.

4.1.1 Office of Air Quality Planning and Standards (OAQPS)

OAQPS is the organization 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 U.S. 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 State and local agencies 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.

Within the OAQPS Emissions Monitoring and Analysis Division, the Monitoring and Quality Assurance Group (MQAG) is responsible for the oversight of the Ambient Air Quality Monitoring Network. MQAG has the following responsibilities:

- ensures that the methods and procedures used in making air pollution measurements are adequate to meet the programs objectives and that the resulting data are of satisfactory quality
- operates the National Performance Audit Program (NPAP) and the FRM Performance Evaluation
- evaluates the performance, through technical systems audits and management systems reviews, of organizations making air pollution measurements of importance to the regulatory process
- implements satisfactory quality assurance programs over U.S. EPA's Ambient Air Quality Monitoring Network
- ensures that national regional laboratories are available to support chemical speciation and QA programs
- ensures that guidance pertaining to the quality assurance aspects of the Ambient Air Program are written and revised as necessary

- renders technical assistance to the U.S. EPA Regional Offices and air pollution monitoring community

4.1.2 U.S. EPA Region IX Office

U.S. 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 quality assurance responsibilities of U.S. EPA's Region IX Office, in regards to the Ambient Air Quality Program, are the coordination of quality assurance matters at the Regional levels with the State and local agencies. This is accomplished by the designation of U.S. EPA Regional Project Officers who are responsible for the technical aspects of the program including:

- review QAPPs by Regional QA Officers who are delegated the authority by the Regional Administrator to review and approve QAPPs for the Agency
- support the FRM Performance Evaluation Program
- evaluate quality system performance, through technical systems audits and network reviews whose frequency is addressed in the Code of Federal Regulations and Section 20
- act as liaisons by making available the technical and quality assurance information developed by U.S. EPA Headquarters and the Region to the State and local agencies, and make U.S. EPA Headquarters aware of the unmet quality assurance needs of the State and local agencies

California ARB will direct technical and QA questions to Region IX.

4.1.3 California ARB

The ARB's mission is to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the State. By legislative mandate, the ARB has oversight of California's air pollution control program with the responsibility for improving and maintaining the air quality in the State.

40 CFR Part 58 defines a State Agency as "the air pollution control agency primarily responsible for the development and implementation of a plan (SIP) under the Act (CAA)". Section 302 of the CAA provides a more detailed description of the air pollution control agency.

40 CFR Part 58 defines the Local Agency as "any local government agency, other than the state agency, which is charged with the responsibility for carrying out a portion of the plan (SIP)".

The major responsibility of State and local agencies is the implementation of a satisfactory monitoring program, which would naturally include the implementation of an appropriate quality assurance program. The Great Basin Unified Air Pollution Control District is the responsible local agency for Inyo, Mono, and Alpine Counties including four (4) nonattainment areas for

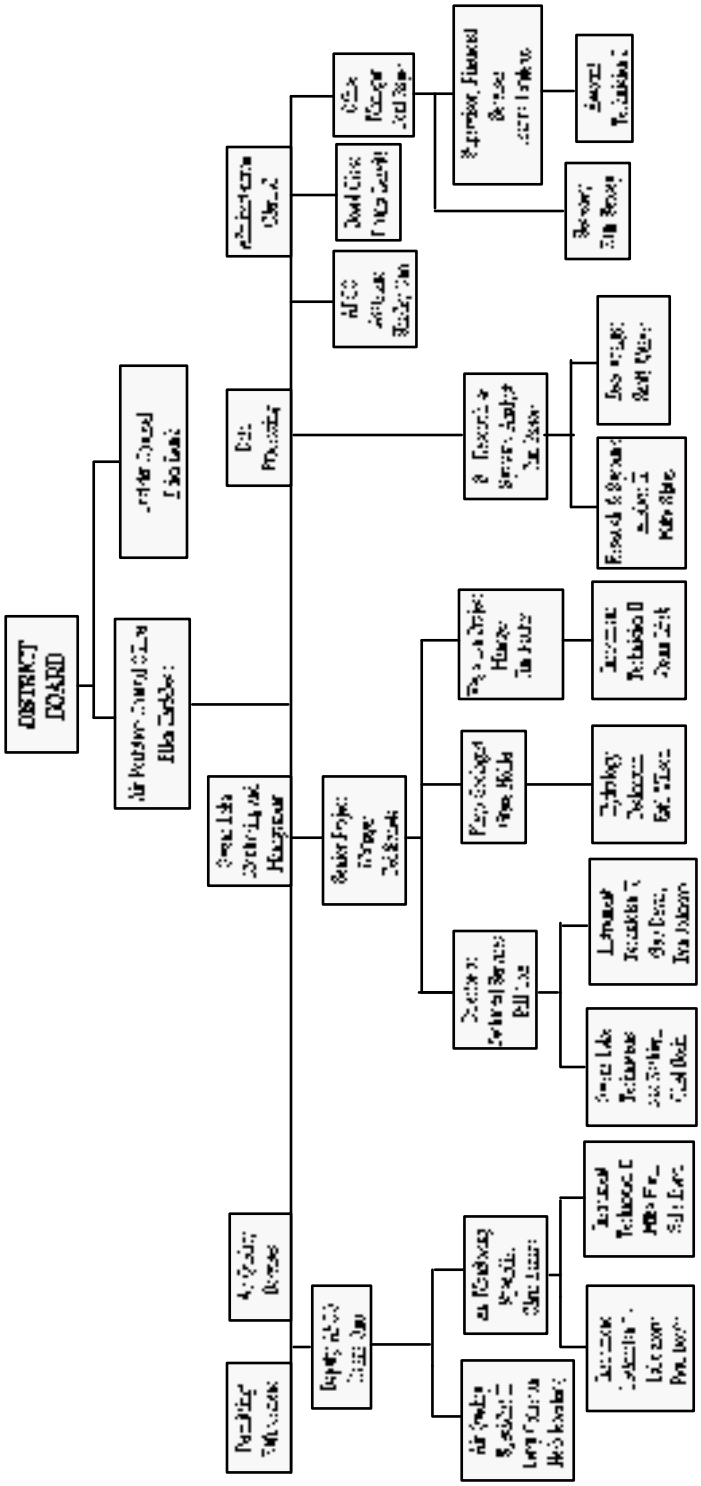
PM-10: the Owens Valley, the Town of Mammoth Lakes, the Mono Basin, and the Inyo County portion of the Searles Valley.

4.1.4 Great Basin Unified APCD

The Great Basin Unified Air Pollution Control District (GBUAPCD) is charged with the protection of the public health and welfare from the adverse affects of air pollution. To this end, it is the GBUAPCD's responsibility to develop long-range comprehensive programs to achieve and maintain federal and state air quality standards. The GBUAPCD is responsible for the implementation of the air quality monitoring program and the enforcement of federal, state, and local rules and regulations governing air quality at the local level.

The GBUAPCD is required to implement a comprehensive quality assurance program covering all aspects of the air monitoring program. The GBUAPCD's air quality monitoring responsibilities include: operation, maintenance, and calibration of field monitors; operation, maintenance, and calibration of laboratory equipment used for filter processing; internal quality assurance audits of monitoring equipment; reporting of the collected data.

The GBUAPCD is loosely divided into six groups: permitting and enforcement, contract management, technical services, vegetation sciences, data processing, and administration. The organizational structure of the GBUAPCD is shown in Figure 4.1.



The Technical Services Group consists of two sections: the air quality monitoring section and the soils and hydrological sciences section. The air quality monitoring section (AQMS) handles all of the air quality and meteorological monitoring throughout the GBUAPCD that includes: particulate matter (PM) monitoring, both filter-based and continuous, pollutant gas continuous monitoring and meteorological monitoring. The AQMS also operates and maintains the GBUAPCD's ARB-certified PM-2.5 laboratory, in which all of the PM filters collected throughout the GBUAPCD are processed.

The AQMS conducts internal quality assurance (QA) audits of the monitors throughout the network. The AQMS has one dedicated staff person who is responsible for auditing the GBUAPCD's PM monitors quarterly and the meteorological sensors semiannually. The auditor produces reports after each audit that are submitted to the air monitoring specialist and the instrument technician responsible for site operations at the station audited. The AQMS also participates in the EPA National Performance Audit Program (NPAP) for PM-10 monitors. The ARB conducts annual audits of the monitors throughout the network and of the GBUAPCD's laboratory.

The Data Processing Group is also involved in the processing and validation of all of the air quality data collected throughout the GBUAPCD, including PM data, continuous monitor data, and meteorological data. They are responsible for uploading validated data to the EPA's Aerometric Information and Retrieval System (AIRS), and for archiving the data at the GBUAPCD offices.

4.1.4.1 Personnel

The people involved in the GBUAPCD's PM-10 monitoring program and their responsibilities relating to that program are described in detail below.

Air Pollution Control Officer - Dr. Ellen Hardebeck

Dr. Hardebeck serves the Great Basin Unified Air Pollution Control District Board of Directors as the chief administrator of the GBUAPCD, overseeing all GBUAPCD activities.

Deputy Air Pollution Control Officer - Duane Ono

The Deputy Air Pollution Control Officer oversees the QA and Lab personnel responsible for air quality monitoring, quality control, and quality assurance for the GBUAPCD, including: installation, operation, maintenance, calibration, internal quality assurance auditing of all GBUAPCD monitoring and laboratory equipment. The Deputy APCO is also involved in monitoring experiment design at Owens Lake and Mono Lake.

Air Monitoring Specialist - Christopher Lanane

The Air Monitoring Specialist supervises the day-to-day operation of the monitoring network. The Air Monitoring Specialist's responsibilities include participating in and overseeing all activities relating to:

- supervision of instrument technicians
- monitoring station siting, permitting, and installation
- monitoring station design and construction
- field sampler installation, operation, maintenance, and calibration
- state-of-the-art laboratory design and construction
- laboratory sample handling and analysis
- field data collection and validation
- internal quality assurance activities
- acting as liaison between GBUAPCD and other regulatory agencies on air quality monitoring issues
- quality assurance program plan documentation and development

Instrument Technician II - Field Operations - Dan Johnson, Gabe Ibarra, Guy Davis

Each Instrument Technician II/Field Operations is involved in the ongoing monitoring activities conducted by the GBUAPCD and is responsible for carrying out the following activities:

- operates, calibrates, installs, maintains and repairs air monitoring, meteorological, data acquisition, and particulate sampling, instrumentation
- transports PM filters from laboratory to monitoring stations and back again
- retrieves, and edits (Level I Data Validation) air quality data collected from the operation of the air monitoring equipment
- troubleshoots, repairs, retrofits, modifies and acceptance tests ambient air monitoring, meteorological, data acquisition, particulate sampling, automatic calibration and test instrumentation
- responsible for adhering to the guidelines specified in the Manufacturer's Operation Manual and the Standard Operating Procedure(s) (SOP) for the monitoring equipment

Instrument Technician II - Quality Assurance - Mike Horn

The Instrument Technician II/Quality Assurance is responsible for conducting system and performance audits for the air quality monitoring program by adhering to U.S. EPA regulations and guidelines and SOPs. Responsibilities include:

- conducting quality assurance performance and system audits for the criteria pollutant program and preparing and issuing appropriate reports and findings
- developing quality assurance SOPs and methodologies
- verifying that all required QA activities were performed as required in the QAPP
- analyzing and evaluating ambient air quality data and making recommendations regarding its quality, accuracy, and validity (Level II Data Validation).

Instrument Technician II - Laboratory - Paul Doubt

The Instrument Technician I/Laboratory is responsible for carrying out required tasks and ensuring the data quality result of the tasks by adhering to guidance and protocol specified by the appropriate guidelines, e.g. PM2.5 QAPP and SOPs, for the lab activities. Those responsibilities include:

- weighing PM filters before and after sampling
- processing filter mass data
- maintaining the laboratory atmospheric conditioning system
- receiving PM filters in the laboratory from the field
- participating in the development and implementation of the QAPP
- participating in the development of data quality requirements (overall and laboratory) with the appropriate QA staff
- writing and modifying SOPs
- verifying that all required QA activities are performed and that measurement quality standards are met as required in the QAPP
- following all manufacturer's specifications
- performing and documenting preventative maintenance of all laboratory equipment
- documenting deviations from established procedures and methods
- report all problems and corrective actions to management
- assessing and reporting data quality
- preparing and delivering reports to management
- flagging suspect data

Data Processing - Senior Research & Systems Analyst - Jim Parker
Research & Systems Analyst II - Mike Slates
Contract Data Analyst - Scott Weaver

The Senior Research & Systems Analyst oversees all of the data processing activities of the GBUAPCD. The data processing personnel are responsible for coordinating the information management activities of the GBUAPCD's air quality monitoring program, which includes the PM2.5 Ambient Air Monitoring Program. Specific responsibilities include:

- ensuring that data and information collected for the monitoring program are properly captured, stored, and transmitted for use by program participants
- developing local data management standard operating procedures
- ensuring that information management activities are developed within reasonable time frames for review and approval
- following good automated data processes
- coordinating the development of the information management system with data users
- ensuring the development of data standards for data structure, entry , transfer, and archive
- ensuring adherence to the QAPP where applicable
- ensuring access to data for timely reporting and interpretation processes
- ensuring timely delivery of all required data to the U.S. EPA's AIRS system

5.0 Problem Definition/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 (PM10, PM2.5), sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. In 1969, the first State Ambient Air Quality Standards were promulgated by California for total suspended particulates, photochemical oxidants, sulfur dioxide, nitrogen dioxide, and carbon monoxide. In 1970, the Federal 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 for the monitoring of these criteria pollutants by State and local organizations through the Air Quality Monitoring Program.

The criteria pollutant defined as particulate matter is a general term used to describe a broad class of substances that exist as liquid or solid particles over a wide range of sizes. As part of the Ambient Air Quality Monitoring Program, U.S. EPA measures two particle size fractions; those less than or equal to 10 micrometers aerodynamic diameter (PM10), and those less than or equal to 2.5 micrometers aerodynamic diameter (PM2.5). This QAPP focuses on the QA activities associated with PM10. For documentation of activities relating to PM2.5, please see the District's, Quality Assurance Project Plan for the PM2.5 Ambient Air Monitoring Program at State and Local Air Monitoring Stations, March 2001.

The general background and rationale for the implementation of the PM10 ambient air monitoring network can be found in the Federal Register. Some of the findings are listed below.

The characteristics, sources, and potential health effects of larger or "coarse" particles (from 2.5 to 10 micrometers (µm) in diameter) and smaller or “fine" particles (smaller than 2.5 µm in diameter) are very different.

- Coarse particles come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads from vehicle traffic.

- Fine particles are generally emitted from activities such as industrial and residential combustion and from vehicle exhaust. Fine particles are also formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds that are emitted from combustion activities and then become particles as a result of chemical transformations in the air.

- Coarse particles can deposit in the respiratory system and contribute to health effects such as aggravation of asthma. U.S. EPA's "staff paper" concludes that fine particles, which also deposit deeply in the lungs, are more likely than coarse particles to contribute to the health effects (e.g., premature mortality and hospital admissions) found in a number of recently published community epidemiological studies. Although some

studies find that adverse health effects are more strongly associated with high PM10 levels and the coarse fraction.

- These recent community studies find that adverse public health effects are associated with exposure to particles at levels well below the current PM standards for both short-term (e.g., less than 1 day to up to 5 days) and long-term (generally a year to several years) periods.

- These health effects include premature death and increased hospital admissions and emergency room visits (primarily among the elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (among children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms.

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

1. To judge compliance with and/or progress made towards meeting the National Ambient Air Quality Standards and the California Ambient Air Quality Standards,
2. To develop, modify or activate control strategies that prevent or alleviate air pollution episodes,
3. To observe pollution trends throughout the region, including non-urban areas,
4. To provide a data base for research and evaluation of effects.
5. To call health advisories and to initiate supplemental control requirements such as “no-burn days.”

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 concentrations 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 source or source categories
- 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

The monitoring network consists of four major categories of monitoring stations that measure the criteria pollutants, including PM10 and PM2.5. These stations are described below.

The **SLAMS** consist of a network of ~ 3,500 monitoring stations whose size and distribution is largely determined by the needs of State and local air pollution control agencies to meet their respective SIP requirements. There are XX SLAMS PM10 sites in California.

The National Air Monitoring Stations (**NAMS)** (~1,080 stations) are a subset of the SLAMS network with emphasis being given to urban and multi-source areas. In effect, they are key sites under SLAMS, with emphasis on areas of maximum concentrations and high population density.

The Photochemical Assessment Monitoring Stations (**PAMS**) network is required to measure ozone precursors in each ozone non-attainment area that is designated serious, severe, or extreme. The required networks will have from two to five sites, depending on the population of the area. There is a phase-in period of one site per year starting in 1994. The ultimate PAMS network could exceed 90 sites at the end of the five-year phase-in period

Special Purpose Monitoring Stations (SPMS) provide for special studies needed by the State and local agencies to support their SIPs and other air program activities. The SPMS are not permanently established and, thus, 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 from SPMS are used for SIP purposes, they must meet all QA and methodology requirements for SLAMS monitoring.

This QAPP focuses only on the QA activities of the SLAMS and NAMS network and the objectives of this network which include any sampler used for comparison to the National Ambient Air Quality Standards (NAAQS).

Throughout this document, the term *decision maker* will be used. This term represents individuals that are the ultimate users of ambient air data and therefore may be responsible for activities such as setting and making comparisons to the NAAQS, and evaluating trends. Since there is more than one objective for this data, and more than one decision maker, the quality of the data (see Element 7) will be based on the highest priority objective, which was identified as the determination of violations of the NAAQS. This QAPP will describe how the GBUAPCD PM10 Ambient Air Quality Monitoring Program intends to control and evaluate data quality to meet the NAAQS data quality objective.

5.2 Specific PM10 Issues in the Great Basin

The National Ambient Air Quality Standard (NAAQS) for PM10 has been violated in two air basins and one town within the District sufficiently for all three areas to be designated as nonattainment for PM10: the Mono Basin, the Town of Mammoth Lakes, and the Owens Valley Regional Planning (OVRP) Area. State implementation plans are in place for all three areas and monitoring of PM10 continues within all three to determine compliance with the Federal and State standards.

The PM10 problem in the Mono Basin and the OVRP is associated with wind blown dust resulting from the exposed saline lakebeds. These lakebeds were exposed as a result of the water-gathering activities conducted, in both cases, by the City of Los Angeles. The PM10 problem in the Town of Mammoth Lakes occurs seasonally and is a result of the combination of alpine community meteorology, wood smoke associated with dwelling heating, and entrained dust from the application of cinders to ice-and-snow-covered roads to improve traction.

6.0 Project/Task Description

6.1 Description of Work to be Performed

In general, the measurement goal of the PM10 Ambient Air Quality Monitoring Program is to estimate the concentration, in units of micrograms per cubic meter ($\mu g/m^3$), of particulates less than or equal to 10 micrometers (µm) aerodynamic diameter that have been either collected on a filter or measured by an equivalent method. For the SLAMS/NAMS network, the primary goal is to compare the measured PM10 concentrations to the annual and 24-hour National Ambient Air Quality Standard (NAAQS) for PM10. The national primary and secondary ambient air quality standards for PM10 are 50 micrograms per cubic meter ($\mu g/m^3$) annual arithmetic mean concentration and 150 $\mu g/m^3$ 24-hour average concentration measured in ambient air. A description of the PM10 NAAQS and the corresponding calculation can be found in Title 40 of the Code of Federal Regulations (CFR), Part 50, Appendix K. In addition, 40 CFR part 50 Appendices J and M Sections 2.1, also provide the following summary of the measurement principle:

> " An air sampler draws ambient air at a constant flow rate into a specially shaped inlet where the suspended particulate matter is inertially separated into one or more size fractions within the PM10 size range. Each size fraction in the PM10 size range is then collected on a separate filter over the specified sampling period. The particle size discrimination characteristics (sampling effectiveness and 50% cutpoint) of the sampler inlet are prescribed as performance specifications in 40 CFR Part 53.
>
> Each filter is weighed (after moisture equilibration) before and after use to determine the net weight (mass) gain due to collected PM10. The total volume of air sampled, measured at the actual ambient temperature and pressure is determined from the measured flow rate and the sampling time. The mass concentration of PM10 in the ambient air is computed as the total mass of collected particles in the PM10 size range divided by the volume of air sampled, and is expressed in micrograms per actual cubic meter($\mu g/m^3$)."

The following sections will describe the measurements required for the routine field and laboratory activities for the network as well as those measurements necessary to fulfill the requirements of the EPA Aerometric Information Retrieval System (AIRS) data base.

6.2 Field Activities

The performance requirements of the air sampler has been specified in 40 CFR Part 50, Appendix M of the 7/18/97 Federal Register Notice[1] . Table 6.0.1 summarizes some of the more critical performance requirements.

Table 6.0.1 Design/Performance Specifications

Equipment	Acceptance Criteria	Reference
Filter Design Specs.	see reference	40 CFR Pt. 50, App.M:
Size		Sec 7.2
Medium	Various	Sec 7.2.1
Pore size	Dependent on sample	Sec 7.2.1
Collection	Dependent on coll. eff.	Secs. 7.2.1, 7.2.2
efficiency	99%	Sec. 7.2.2
Integrity		
Alkalinity	±5 µg/m3	Sec. 7.2.3
	<25microequivalnts/gm	Sec. 7.2.4
Sampler Performance Specs.		
Sampling Effectiveness:		
Liquid Particles		
Solid Particles		40 CFR Part53.40,
50% Cutpoint		
Precision	± 5% of predicted ideal	Table D-1
	≤ ± 5% > liquid particles	Table D-1
Flow Rate Stability	10.0 ± 0.5 µm aero. dia.	Table D-1
	5 µg/m3, conc < 80µg/m3	Table D-1; 40 CFR Part 50 App. M, Sec.
	and ± 7%, conc >80µg/m3	4.1
	Avg flow within ± 5% of initial	Table D-1
	in 24 hrs,	
Accuracy	All flow rates measured over 24	Table D-1
	hours w/in 10% of initial flow	
	rate	
	Sampler and Audit flow rate	40 CFR Pt. 58, App.A, Ref. 7
	within ± 10% and Sampler flow	
	rate within ± 10% of inlet design	
	flow rate	

The air monitors deployed throughout the District are certified by the U.S. EPA as meeting the requirements specified in the Federal Register as either reference or equivalent method PM10 monitors. Other than the required federal reference or equivalent air sampler, there are no special personnel or equipment requirements. Element 15 of the QAPP lists all the equipment requirements for the GBUAPCD PM10 data collection operations.

6.2.1 Field Measurements

Table 6.0.2 represents the field measurements that must be collected along with the sample data. This information is presented in Title 40 CFR Part 50 Appendix M. In most cases, these measurements are made by the air sampler and are stored in the instrument for downloading by the field operator during routine visits.

Table 6.0.2 Field Measurement Requirements

Information to be provided	Appendix M section reference	Availability				Format	
		Any-time[a]	End of period b	Visual display c	Data output d	Digital reading[e]	Units
Flow rate	7.1.4	--	—	--	*	XX.X	L/min
Flow rate, average for the sample period	7.1.4	*	_	*	*	XX.X	L/min
Flow rate, CV, for the sample period	7.1.4	*	_	*	*	XX.X	%
Flow rate, 5-min average out of spec. (FLAG)[f]		*	*	*	*	On/Off	
Sample volume, total	7.1.4, 5	*	_	*	*	XX.X	m^3
Temperature, ambient, 30-second interval		*	*	*	*	XX.X	°C
Temperature, ambient, min., max., average for the sample period	9.6	*	_	*	*	XX.X	°C
Barometric pressure, ambient, 30-second interval		*	*	*	*	XXX	mm Hg
Barometric pressure, ambient, min., max., average for the sample period	9.6	*	_	*	*	XXX	mm Hg
Filter temperature, 30-second interval		*	*	*	*	XX.X	°C
Filter temperature, differential, 30-minute interval, out of spec. (FLAG)[f]		*	*	*	*	On/Off	
Filter temperature, maximum differential from ambient, date, time of occurrence		*	*	*	*	X.X, YY/MM/DD HH:mm	°C, Yr/Mo/ Day Hr min
Date and time	9.8, 9.9	*	—	*	*	YY/MM/DD HH:mm	Yr/Mo/ Day Hr min
Sample start and stop time settings	9.8	_	_	_	*	YY/MM/DD HH:mm	Yr/Mo/ Day Hr min
Sample period start time	9.8	—	_	_	*	YYYY/MMM/DD HH:mm	Yr/Mo/ Day Hr min
Elapsed sample time	9.11	*	_	_	*	HH:mm	Hr min
Elapsed sample time out of spec. (FLAG)[f]		*	_	*	*	On/Off	
Power interruptions >1 min, start time of first 10		*	_	*	*	1HH:mm, 2HH:mm, etc.	Hr min
User-entered information, such as sampler and site identification	9.9	*	_	*	*	As entered	

- Provision of this information is required.
* Provision of this information is optional. If information related to the entire sample period is optionally provided prior to the end of the sample period, the value provided should be the value calculated for the portion of the sampler period completed up to the time the information is provided.
• Indicates that this information is also required to be provided to the AIRS data bank.

a Information is required to be available to the operator at any time the sampler is operating, whether sampling or not.

b Information relates to the entire sampler period and must be provided following the end of the sample period until reset manually by the operator or automatically by the sampler upon the start of a new sample period.

c Information is available to the operator visually.

d Information is available as digital data at the sampler's data output port following the end of the sample period until reset manually by the operator or automatically by the sampler upon the start of a new sample period.

e Digital readings, both visual and data output, shall have no less than the number of significant digits and resolution specified.

f Flag warnings may be displayed to the operator by a single-flag indicator or each flag may be displayed individually. Only a set (on) flag warning must be indicated; an off (unset) flag may be indicated by the absence of a flag warning. Sampler users should refer to Section 10.12 of Appendix L and, more specifically, to Appendix M regarding the validity of samples for which the sampler provided an associated flag warning.

In addition to the measurements collected in Table 6.0.2, the following information identified in Table 6.0.3 will be recorded by some monitors. These parameters are explained in *Guidance Document 2.12*[2]

Table 6.0.3 Additional Field Measurements

Parameter	Parameter Code	Frequency	Units	Comment
Monitor ID	MONID	Every sample event	see AIRS	Unique AIRS Monitor ID that include the combination of STATE, COUNTY, SITE, PARAMETER, and POC fields
Site Name	SITENAM	Every sample event	AAA...	Unique site name associated with the site
Sampler ID	SAMPID	Every sample event	AAXXX	Sampler model number or unique bar code number associated with the model number
Filter ID	FID	Every sample event	AXXXXX	Unique filter ID of filter given by the weighing laboratory.
Filter Integrity flag	FFIF	Every sample event		INV-Invalid Sample (No Flag) Valid Sample
Site Operator Initial	SOI	Every sample event	AAA	Initials of the site operator setting up the sampling run
Site Operator Final	SOF	Every sample event	AAA	Initials of the site operator completing the sampling run
Free Form Notes	FFM	As needed	AAA....	Free form notes about the sampling run

Note: "AAA" denotes an alphabetic character and "XXX" denotes a numeric character.

6.3 Laboratory Activities

Laboratory activities for the PM10 program include preparing the filters for the routine field operator, which includes three general phases:

Pre-Sampling weighing

- Receiving filters from the U.S. EPA/ARB
- Checking filter integrity
- Conditioning filters
- Weighing filters
- Storing prior to field use
- Packaging filters for field use
- Associated QA/QC activities
- Maintaining analytic and micro- balances at specified environmental conditions
- Equipment maintenance and calibrations

Shipping/Receiving

- Shipping filters to/Receiving filters from the field and logging these in
- Storing filters
- Associated QA/QC activities (see Element 12)

Post-Sampling Weighing

- Checking filter integrity
- Stabilizing/weighing filters
- Data downloads from field data loggers, e-mail, or data forms completed by operators
- Data entry into District spreadsheet
- Associated QA/QC activities

- Data upload to AIRS
- Storing filters/archiving

The details for these activities are included in various Elements of this document as well as in *Guidance Documents 2.10 and 2.11*[2]. Table 6.0.4 provides the performance specifications of the laboratory environment and equipment.

Table 6.0.4 Laboratory Performance Specifications

Equipment	Acceptance Criteria
Microbalance	Resolution of 1 µg, repeatability of 1 µg
Analytical Balance	Resolution of 0.1 mg, repeatability of ± 0.5 mg
Balance environment	Climate-controlled, draft-free room or chamber or equivalent, stable work surface. Mean relative humidity between 20 and 45 percent, with a variability of not more than ±5 percent standard deviation over 24 hours. Mean temperature should be held between 15 and 30 °C, with a variability of not more than ±3°C standard deviation over 24 hours.
Mass reference standards, microbalance	Standards up to 200 mg*, individual standard's tolerance less than 25 µg, handle with smooth, nonmetallic forceps
Mass reference standards, analytical balance	Standards between 1 and 5 grams**, individual standard's tolerance less than 0.5 mg, handle with smooth nonmetallic forceps

* For the following reasons, the multipoint calibration for the microbalance for this method will be at zero, 100 and 200 mg: 1) the required sample collection filters weigh between 100 and 200 mg; 2) the anticipated range of sample loadings for the 24-hour sample period is rarely going to be more than a few 100 µg; and 3) the lowest, commercially available check weights that are certified according to nationally accepted standards are in the single milligram range. Since the critical weight is not the absolute unloaded or loaded filter weight, but the difference between the two, microgram standard check weights are not necessary to ensure data quality, as long as proper weighing procedure precautions are taken for controlling contamination or other sources of mass variation in the procedure (see SOP in Appendix B).

** The multipoint calibration for the analytical balance for this method shall be at 1.000 and 5.000 grams, with the zero checked prior to and after the calibration mass check. Reasons for this approach are: 1) the sample collection filters (high-volume) weigh between 1 and 5 grams, 2) the range of sample loadings for the 24-hour sample period is generally within the 1 to 5 gram range, and 3) since the critical weight is not the absolute unloaded or loaded filter weight, but the difference between the two, gram standard check weights are not necessary to ensure data quality, as long as proper weighing procedure precautions are taken for controlling contamination or other sources of mass variation in the procedure (see SOP in Appendix B).

6.3.1 Laboratory Measurements

With the exception of the shipping/receiving, which is discussed in detail in Element 12, Table 6.0.5 lists the parameters that will be required to be recorded for pre and postsampling weighing laboratory activities.

Table 6.0.5 Laboratory Measurements

Parameter	Frequency	Units	Comments
Filter Conditioning[1]			
Start Date	every filter	YY/MM/DD	Date of start of conditioning period
Start Time	every filter	XX.XX	Start hour and minute of conditioning
Filter Number	every filter	AXXXXX AXXXXXLB AXXXXXFB	Unique filter ID of routine filter, Lab Blank (LB), Field Blank (FB)
Relative Humidity	continuous	XX%	% relative humidity value for conditioning session based upon readings of continuous data collected by datalogger
Temperature	continuous	XX^{o}C	temperature value for conditioning session based upon readings of continuous data collected by datalogger
End Date	every filter	YY/MM/DD	Date of end of conditioning period
End Time	every filter	XX.XX	End hour and minute of conditioning
Presampling Filter Weighing			
Date	every filter	YY/MM/DD	Date for presampling run of filters that can then be associated with each filter
Filter Lot Number	every filter	AAAXXX	Lot number associated with filter
Balance Number	every filter	AAXXXXX	Unique balance ID for balance used in pre-weighing
Analyst	every filter	AAA	Initials of the technician preweighing filters

Relative Humidity	continuous	XX%	%relative humidity value for weighing session based upon readings of continuous data collected by datalogger
Temperature	continuous	XX^{o}C	temperature value for weighing session based upon readings of continuous data collected by datalogger
Filter Number	every filter	AXXXXX AXXXXXLB AXXXXXFB AXXXXXRW	Unique filter ID of routine filter, Lab Blank (LB) Field Blank (FB) Flow Check Filter (FC) and Duplicate Filter Weight (Reweigh, RW)
QC Sample Number	every QC check	AXXXXXLB1 AXXXXXLB2 AXXXXXLB3	Unique ID for calibration checks and or other types of QC samples used
Presampling Mass, 46.2mm dia. filters	every filter	XXX.XXX mg	Mass of the filter in mg.
Presampling Mass, 8"x10" filters	every filter	X.XXXX gm	Mass of the filter, in grams
Monitor ID[2]	Every sample	see AIRS	Unique AIRS Monitor ID that include the combination of STATE, COUNTY, SITE, PARAMETER, and POC fields
Free Form Notes	As needed	AAA...	Preweighing Free Form notes
Postsampling Filter Weighing Date	 every filter	 YY/MM/DD	 Date for postsampling run of filters that can then be associated with each filter
Balance Number	every filter	AAXXXX	Unique balance ID for balance used in postweighing
Analyst	every filter	AAA	Initials of the technician postweighing filters
Relative Humidity	continuous	XX%	% relative humidity value for weighing period based upon readings of continuous data collected by datalogger
Temperature	continuous	XX^{o}C	temperature value for weighing period based upon readings of continuous data collected by datalogger
Filter Number	every filter	AXXXXX AXXXXXLB AXXXXXFB AXXXXXRW	Unique filter ID of routine filter, Lab Blank (LB) Field Blank (FB) and Duplicate Filter Weight (Reweigh, RW)
QC Sample Number	every QC check	AXXXXXLB1 AXXXXXLB2 AXXXXXLB3	Unique ID for calibration checks and or other types of QC samples used
Postsampling Mass, 46.2 mm dia. filters	every filter	XXX.XXX mg	Mass of the filter in mg.
Postsampling Mass, 8"x10" filters	every filter	X.XXXX gm	Mass of the filter in grams
Net Mass, 46.2 dia. filters	every filter	XXX.XXX mg	Net weight (Postsampling Mass - PreSampling Mass) - in mg of PM2.5
Net Mass, 8"x10" filters	every filter	X.XXXX gm	Net weight (Postsampling Mass - PreSampling Mass) - in grams of PM10
Free Form Notes	as needed	AAA...	Postweighing free form notes

Note: For units, "AAA", denotes an alphabetic character and "XXX" denotes a numeric character.

Environmental conditions (relative humidity and temperature) in the laboratory will be continuously recorded. Pre- and postweighing of filters will only occur after compliance with specified environmental limits during filter conditioning and weighing periods is verified.

2- The Monitor ID may be assigned at sampling rather than pre-assigned during presampling weighing.

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 (PE), management systems review (MSR), peer review, inspection, or surveillance. Definitions for each of these activities can be found in the glossary (Appendix A). Element 20 will discuss the details of the GBUAPCD's assessments.

Table 6.0.6 provides information on the parties implementing the assessments and their frequency.

Table 6.0.6 Assessment Schedule

Assessment Type	Assessment Agency	Frequency
System Audit	U.S. EPA Regional Office, ARB's QA Section	1 every 3 years, Anually
Network Review	U.S. EPA Regional Office, and Planning and Technical Support Division	every year 1/year
FRM Performance Evaluation	U.S. EPA Regional Office	25% of sites/year/4 times per year.
Data Quality Assessment	ARB'S QA Section, and Planning and Technical Support Division	every year

6.6 Project Records

The GBUAPCD will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision and maintenance of documents and records. Table 6.0.7 represents the categories and types of records and documents which are applicable to document control for PM10 information. Information on key documents in each category is explained in more detail in Element 9.

Table 6.0.7 Critical Documents and Records

Categories	Record/Document Types
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and Training Training Certification Quality management plan Document control plan U.S. EPA Directives Grant allocations Support Contract

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 SLAMS air quality information Data/summary reports Journal articles, papers, presentations
Data Management	Data algorithms Data management plans/flowcharts PM10 Data Data Management Systems
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits

References

1. Title 40 Code of Federal Regulations Part 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere, August 7, 1987

2. Title 40 Code of Federal Regulations Part 50, Appendix M, Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere, July 18, 1997

3. U.S. EPA Quality Assurance Guidance Document 2.10: Monitoring PM10 in Ambient Air Using a Dichotomous Sampler, September 1997.

4. U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Part II, Quality Assurance Guidance Document 2.11: Monitoring PM10 in Ambient Air Using a High Volume Sampler, September 1997.

7.0 Quality Objectives and Criteria for Measurement Data

7.1 Data Quality Objectives (DQOs)

Data quality objectives (DQOs) are qualitative and quantitative statements derived from the DQO Process that clarify a program's technical and quality objectives, define the appropriate type of data, and specify the tolerable levels of decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. By applying the DQO Process to the development of a quality system for PM10, the District guards against committing resources to data collection efforts that do not contribute to a defensible decision. The DQOs were based on the data requirements of the regulations governing PM10 data collections and processing. Regarding the quality of the PM10 measurement system, the objective is to control precision and bias in order to reduce the probability of errors. The District acknowledges these objectives represent the minimum necessary to achieve the project goals of a complete and defensible dataset, and will strive to exceed these minimums.

1. *The DQO is based on the National Ambient Air Quality Standards (NAAQS*).

The PM10 standards are a 50 $\mu g/m^3$ annual average and a 150 $\mu g/m^3$ 24-hour average. The annual standard is met when the annual arithmetic means over the past three years is less than or equal to 50 $\mu g/m^3$. Due to rounding, the 3-year average does not meet the NAAQS if it equals or exceeds 50.5 prior to rounding. The 24-hour average standard is met when the 3-year average of the number of daily PM10 exceedances is less than or equal to one.

2. *The limits on precision are based on the smallest number of sample values in a three-year period.*

Since the requirements allow one-in-six day sampling and a 75% data completeness requirement, the minimum number of values in a three-year period is 137. It can be demonstrated that obtaining more data, either through more frequent sampling or the use of spatial averaging, will lower the risk of attainment/non-attainment decision errors at the same precision and bias acceptance levels.

Representativeness, completeness, measurement bias, measurement comparability

7.2 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. In order to meet DQOs, guidelines must be put in place to insure the accuracy and proper interpretation of the data collected. Measurement quality objectives (MQOs) are designed to evaluate and control various phases (sampling, preparation, analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs. Information regarding these objectives and their use can be found in the U.S. EPA's Quality Assurance Handbook, Volume II[2]. MQOs can be defined in terms of the following data quality indicators:

Accuracy - Accuracy has been a term frequently used to represent closeness to "truth" and includes a combination of precision and bias error components. This term has been used

throughout 40 CFR and in some of the Elements of this document. Based on District and ARB performance audits, PM10 flow rate data shall be within ±10% of the true value.

Precision - a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions. This is the random component of error. Precision is estimated by various statistical techniques using some derivation of the standard deviation. For ambient particulate concentration measurements, precision shall be expressed in terms of a coefficient of variation.

Representativeness - a measure of the degree which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Spatial and temporal data representativeness shall be achieved by assuring that criteria are met for station siting as defined in federal regulations, and that air quality measurements and statistics are compiled.

Detection Limit - a measure of the capability of an analytical method to distinguish low concentrations of a specific analyte.

Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50). In addition, the District shall strive to obtain at least 75% data completeness, while maintaining the precision and accuracy objectives. Data completeness (DC) for a single pollutant at a single site (SS) is defined as:

$$\%DC = \frac{(\text{total number of samples possible}) - (\text{Samples lost to calibration}) - (\text{samples lost to downtime})}{\text{total number of samples possible}} \times 100$$

Data completeness for the reporting organization (RO) for a single pollutant shall be defined as:

$$\%DC_{RO} = \frac{1}{n} \sum_{I=1}^{n} \%DC_{SS_I}$$

Where n = the number of stations reporting

Comparability - a measure of confidence with which one data set can be compared to another. Data comparability shall be achieved through the use of uniform procedures and U.S. EPA designated reference or equivalent methods Districtwide.

For each of these attributes, acceptance criteria can be developed. Various parts of Title 40 CFR have identified acceptance criteria for some of these attributes as well as *Guidance Documents 2.10 and 2.11*. In theory, if these MQOs are met, measurement uncertainty should be controlled to the levels required by the DQO. Tables 7.1, 7.1a, and 7.1b list the MQOs for the District's PM10 program. More detailed descriptions of these MQO's and how they will be used to control and assess measurement uncertainty will be described in Elements 14 and 23, as well as in the SOPs (Appendix B and Appendix E) of this QAPP.

Note: Tables 7.1, 7.1a, and 7.1b are currently in works-in-progress and will be incorporated into the QAPP when they are developed and approved.

8.0 Special Training Requirements

Personnel assigned to the PM10 ambient air monitoring activities will meet the educational, work experience, responsibility, personal attributes, and training requirements for their positions. Records on personnel qualifications and training will be maintained in personnel files and will be accessible for review during audit activities. Records of additional training completed by District technicians will be maintained by the District Quality Assurance Auditor. Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. Training is aimed at increasing the effectiveness of employees and the District.

8.1 Ambient Air Monitoring Training

Appropriate training is available to employees supporting the Ambient Air Quality Monitoring Program, commensurate with their duties. Such training may consist of classroom lectures, workshops, forums, teleconferences, and on-the-job training.

The District trains supervisors, management, field and laboratory staff by several means. Supervisors and management at the District hold and attend U.S. EPA, ARB, and District meetings to stay informed about new monitoring programs and equipment as it they are developed. District monitoring and laboratory staff training for the PM10 program is conducted by sending staff to U.S. EPA, ARB, professional association, and/or equipment manufacturer-sponsored training sessions, meetings, and seminars. Hands-on training is also provided by District staff. Elements of theses training sessions many include sampler set-up, operation, calibration, maintenance, and repair.

District staff has and will participate in U.S. EPA and AWMA sponsored training courses as they are made available. District staff will attend PM10 ambient air monitoring training courses, workshops, forums, etc., on a continuing basis. In addition, GBUAPCD staff will provide additional training on laboratory and sampler operations as needed.

9.0 Documentation and Records

The following information describes the District's document and records procedures for the PM10 Program. In U.S. EPA's QAPP regulation and guidance, U.S. EPA uses the term "reporting package," which is defined as all the information required to support the concentration data reported to U.S. EPA, including all data required to be collected as well as data deemed important by the District under its policies and records management procedures. Table 9.0.1 identifies these documents and records.

9.1 Information Included in the Reporting Package

9.1.1 Routine Data Activities

The District has a records management system that allows for the efficient archive and retrieval of records. The PM10 information will be included in this system. Table 9.0.1 includes the documents and records that will be filed according to the statute of limitations discussed in Element 9.3.

Table 9.0.1 PM10 Reporting Package Information

Categories	Record/Document Types
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and training Quality management plan Document control plan U.S. EPA Directives Grant allocations Support Contract(s)
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	All original data (routine and QC data) including data entry forms
Data Reporting	Annual SLAMS air quality information Data/summary reports Quarterly QC reports

Data Management	Data algorithms Data management plans/flowcharts PM10 Data Data Management Systems Quarterly QC reports
Quality Assurance	Network reviews Data quality assessments QA reports System audits Response/Corrective action reports Performance Audits

9.1.2 Annual Summary Reports Submitted to U.S. EPA

As indicated in 40 CFR Part 58, the GBUAPCD shall submit to the U.S. EPA Administrator, through the Region IX Office, an annual summary report of all the ambient air quality monitoring data from all 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 report will contain the following information:

PM10

Site and Monitoring Information.

- City name (when applicable)
- county name and street address of site location
- AIRS-AQS site code
- AIRS-AQS monitoring method code

Summary Data

- Annual arithmetic mean (µg/m^3) as specified in 40 CFR part 50, Appendix N (Annual arithmetic mean NAAQS is 50µg/m^3)
- All daily PM10 values above the level of the 24-hour PM10 NAAQS (150 µg/m^3) and the dates of occurrence.
- Sampling schedule used as once every 6 days, every day, etc.
- Number of 24-hour average concentrations in the ranges listed in Table 9.0.2:

Table 9.0.2 PM10 Summary Report Ranges

Range	Number of Values

($\mu g/m^3$)	
150 to 350	
350 to 420	
420 to 500	

GBUAPCD management will certify that the annual summary is accurate to the best of their knowledge. This certification will be based on the various assessments and reports performed by the organization, in particular, the Annual QA Report discussed in Element 21 that documents the quality of the PM10 data and the effectiveness of the quality system.

9.2 Data Reporting Package Format and Documentation Control

Table 9.0.1 represents the documents and records, at a minimum, that must be filed into the reporting package. The details of these various documents and records will be discussed in the appropriate elements of this document.

All raw data required for the calculation of a PM10 concentration, the submission to the AIRS database, and QA/QC data, are collected electronically or on data forms that are included in the field and analytical methods Elements. All hardcopy information will be filled out in indelible ink. Corrections will be made by striking one line through the incorrect entry, initialing this correction, and placing the correct entry alongside the incorrect entry, if this can be accomplished legibly, or by providing the information on a new line.

9.2.1 Documentation

The District will issue notebooks and blank copies of all applicable forms to each field and laboratory technician. The notebooks will be associated with the individual and the PM10 Program. Although data entry forms are associated with all routine environmental data operations, the notebooks can be used to record additional information about these operations.

Field notebooks - Notebooks will be issued for each sampling site. The notebooks will contain the appropriate pages for the notation of information that may or may not be included on the data or calibration and maintenance forms.

Field Log Forms - The data forms for routine operations, calibration, inspection and maintenance and all applicable SOPs will provided to the station operators. Completed forms will be submitted to the District with each month's dataset.

Lab Notebooks - Notebooks will also be issued for the laboratory. These notebooks will be associated with the PM Program. One notebook will be available for general comments/notes; others will be associated with, the temperature and humidity recording instruments, the freezer, calibration equipment/standards, and the micro- and analytical balances used for this program.

Sample shipping/ receipt- The laboratory will package samples for shipping and will receive samples directly. Lab notebooks and filter sample data forms will be utilized for sample

shipping and receiving information and data will be entered into the laboratory PM data spreadsheet.

9.2.2 Electronic Data Collection

It is anticipated that certain instruments will provide an automated means for collecting information that would otherwise be recorded on data entry forms. Information on these systems are detailed in Elements 18 and 19. In order to reduce the potential for data entry errors, automated systems will be utilized where appropriate and will record the same information that is found on data entry forms. These data will be downloaded from the instruments and sent to the District's Bishop office, via e-mail or hand-carried, for incorporation into the data reporting package.

9.3 Data Reporting Package Archiving and Retrieval

As stated in 40 CFR part 31.42, in general, all the information listed in Table 9.0.1 will be retained for a minimum of three years from the final date in a given dataset, i.e. information for the 2000 monitoring year would be retained at least until January 1, 2004. However, if any litigation, claim, negotiation, audit or other action involving the records has been started before the expiration of the three-year period, the records will be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular three-year period, whichever is later. The District will extend this policy in order to store records for three full years past the year of collection. For example, any data collected in calendar year 1999 (1/1/99 - 12/31/99) will be retained until, at a minimum, January 1, 2003; unless the information is used for litigation purposes.

10.0 Sampling Design

The goal of the PM10 monitoring program is to provide ambient data that support the District, State, and Federal air quality programs. These data include aerosol mass measurements and chemically resolved, or speciated data. Mass measurements are used principally for PM10 national ambient air quality standards (NAAQS) comparison purposes in identifying areas that do or do not meet the PM10 NAAQS and in supporting area designations as attainment or nonattainment. Chemically resolved data serve the implementation needs associated with developing emission mitigation approaches to reduce ambient aerosol levels. These needs include emissions inventory and air quality model evaluation, source attribution analysis, and tracking emission control programs.

The District has developed a PM10 monitoring network to implement the PM10 NAAQS. The District's PM10 network is designed to collect ambient PM10 data as required by Title 40 CFR Parts 50 and 58. The ambient data from this network are being used for designating areas as attainment or nonattainment for the PM10 air quality health standards, developing control programs, and tracking the progress of these control programs. The network design and sampling schedule were developed using criteria specified in 40 CFR Part 58.

The overall District network consists of three sub-networks: Mono Basin, Mammoth Lakes, Owens Valley; and other minor source-specific monitoring sites. The sub-networks are set up to monitor areas that have been determined to be nonattainment for PM10. The minor-source-specific sites are generally short-term stations (less than five years) set up to monitor small sources and may be monitored for meteorology only, depending on the emissions.

The Mono Basin network is currently comprised of three monitoring stations located around the perimeter of Mono Lake: Simis Ranch on the north side; Lee Vining, the nearest population center, located southwest of the Lake; and Mono Shore, located on the northeast shore of Mono Lake at the point of maximum source impact. The Mono Basin source, the exposed playa of Mono Lake, is in the process of mitigation. Monitoring is conducted to determine the progress of that mitigation.

The Mammoth Lakes monitoring network currently consists of a single monitoring station in the Town of Mammoth Lakes. Data collected from this station are used by the Town to forecast no-burn days and are used to measure the progress of mitigation measures currently in use in the Town.

The Owens Valley monitoring network in its present form consists of six monitoring stations located around the shore of the Owens Dry Lake and at the population centers located around the Lake. Sites are located in the communities of Lone Pine, Keeler, and Olancha, and at other high-impact areas, including Dirty Socks Spring, and two other locations along Highway 190 on the south shore of Owens Lake.

Element 10.1, below, describes the rationale for the placement of collocated samplers throughout the District's monitoring network.

10.1 Rationale for the Placement of Collocated Samplers

In order to estimate the precision and bias of the various PM10 samplers, the U.S. EPA requires that for each method designation the PM10 sites must be collocated on the following basis: for a network of 1 to 5 sites, select one (1) site; for 6 to 20 sites, select two (2) sites; for more than 20 sites, select three (3) sites. The District has deployed six (6) monitoring stations operating PM10 samplers (Table 10.0.1) in the vicinity of Owens Lake. The District has deployed three (3) monitoring stations operating PM10 samplers in the vicinity of Mono Lake. To satisfy the minimum requirement for collocated samplers in the District, two stations operate collocated PM10 samplers in the vicinity of Owens Lake and one station operates collocated PM10 samplers in the vicinity of Mono Lake.

Table 10.0.1 Summary of Manual PM10 Stations Deployed in the Great Basin Unified Air Pollution Control District

Monitoring Location	Number of Samplers		
	Primary	Collocated	Total
Owens Lake	6	2	8
Mono Lake	3	1	4
Total	9	3	12

The District selected collocated PM10 sites based on the following criteria listed in order of importance:

- Measured or estimated PM10 concentrations - monitoring sites with high measured PM10 concentrations or high estimated PM10 concentrations were selected to operate collocated samplers.

- Geographical representation - the network was designed to ensure geographical representation throughout the District because varying meteorological and air quality conditions may influence the precision and bias of various PM10 samplers.

- Practical considerations - the monitoring sites selected to operate collocated PM10 samplers had to have enough platform room to maintain 2-4 meter spacing between primary and collocated sampler and adequate power available.

Each collocated sampler must be operated concurrently with its associated primary sampler. The one-in-six day sampling schedule was selected, as a minimum, for collocated samplers so that the sampling days are distributed evenly over the year and over the seven days of the week.

The adequacy of the quality assurance of the PM10 network will be reviewed during the annual network review and, if needed, additional collocated sites will be selected.

11.0 Sampling Methods Requirements

11.1 Purpose/Background

This method provides for measurement of the mass concentration of particulate matter having a nominal aerodynamic diameter of 10 micrometers (PM10) in ambient air over a 24-hour period for purposes of determining whether the primary and secondary national ambient air quality standards (NAAQS) for particulate matter specified in 40 CFR Part 50.6 are met. The measurement process is considered to be non-destructive, and the PM10 sample obtained can be subjected to subsequent physical or chemical analyses.

11.2 Sample Collection and Preparation

Federal reference method (FRM) and Federal equivalent method (FEM) monitors will be used for the collection of PM10 concentrations for comparison to the NAAQS. In the District network there are four models of the FRM sampler (the Rupprecht & Patashnick (R&P) Model 2000, Model FRM 2000, Model Partisol-Plus 2025; the BGI Model PQ200) and one model of the FEM monitor (R&P TEOM Model 1400a) employed. The R&P Models 2000, FRM-2000, and the BGI PQ200 are single-day samplers that meet the FRM designation. The R&P Model 2025 Sampler is a sequential multiple-day sampler that meets the FRM designation. The R&P TEOM Model 1400a is a continuous PM10 monitor that meets FEM designation. Each sampler shall be installed with adherence to procedures, guidance, and requirements detailed in 40 CFR Parts 50[1], 53, and 58[2], U.S. EPA QA Guidance Documents 2:10, 2.11, and 2:12[3], the sampler manufacturers operation manual, the District's Field SOPs, and this QAPP.

11.2.1 PM10 Monitor Set-up

Sample set-up of the FRM samplers in the District network takes place any day after the previous sample has been recovered. For multiple day samplers, 15 sample days and one field blank may be set up when daily or one-in-three-day sampling is required. At collocated sites, the second monitor will be set up generally to run at a sample frequency of one-in-six days; however, sample set-up will take place on the same day as the primary sampler. Detailed sample set-up procedures are available from the District PM10 sample methods standard operating procedure, Appendix E.

Set-up of the FEM monitors in the District network is conducted on a monthly basis at a minimum. The sample filter is installed on the sintered glass tube in the weighing unit. One sample filter will usually last one month, except during storm periods when a filter can become fully loaded during a single event. FEM monitor sites are visited every business day to verify monitor operation and change sample filters if necessary. The data from the FEM monitors is resolved into hourly and 24-hour PM10 concentrations. Monitor set-up and operation procedures are available in the District's PM10 monitoring methods standard operating procedure, Appendix E.

11.2.2 Sample Recovery

Sample recovery of any individual filter from the FRM sampler in the District network takes place after the end of the sample period for that filter. For one-in-three or one-in-six day sampling on single day samplers, this operation will normally be performed during the days after a sample is taken and before the next is to run. The next sample is generally set-up at the same time the exposed sample is being removed. For daily or one-in-three day sampling on multiple day samplers, filter samples are collected during or immediately after the final sample run. The next samples are set-up on this same day. At collocated sites the sample from the second monitor will be recovered on the same day as the primary sampler. Sample recovery procedures are detailed in the District's PM10 sampling methods standard operating procedure, Appendix E.

Sites where multiple day samplers are employed operating on a daily sampling frequency will require a minimum of two site visits per month for exposed sample recovery and unexposed sample set-up for the next sampling days. Sites that utilize multiple day samplers with the one-in-three day sampling frequency will require one site visit per month. For sites that utilize single day samplers with one-in-three or one-in-six day sampling frequency, a recovery and set-up visit will be required for every sample taken.

11.3 Support Facilities for Sampling Methods

Table 11.0.1 lists the supplies that are available to PM10 field operators. Support facilities for PM10 sampling include offices, trailers, and vehicles.

Table 11.0.1 Support Facility Supplies

Item	Minimum Quantity	Notes
Fuses	2	*Of the type specified in the sampler manual*
Sampler Operations Manual	1 per model	
PM10 Sampling SOP	1	
Flow rate verification filter	2	*Contained in sampling cassette*
Non-Permeable Membrane	2	*Contained in sampling cassette*
Filter Cassettes	2	*For use with flow rate check filter or non-permeable membr ane*
Filter Magazines	1 site	*For multiple day samplers only*
Cleaning Wipes	1 Box	*Dust resistant*
Data Download Cable	1	*Laptop computer or personal digital assistant*

Since there are other items that the field operator may need during a site visit that are not expected to be at each site, the operator is expected to bring these items with him/her. Table 11.0.2 details those items each operator is expected to bring with them.

Table 11.0.2 Site Dependent Equipment and Consumables

Item	Minimum Quantity	Notes
Tools	1 box	*screw drivers, wrenches, etc...*
PM10 Size-selective Inlet	1	*Clean inlet to be swapped for dirty inlet*
FRM Filter Cassettes, Magazines	1 for each sampler, plus field blanks	*Loaded with pre-weighed filter(s)*
Transport Container	2	*1 for pre-weighed, 1 for sampled filter(s)*

11.4 Sampling/Measurement System Corrective Action

Corrective action measures in the PM10 Air Quality Monitoring Network will be taken to ensure the data quality objectives are attained. There is the potential for many types of sampling and measurement system corrective actions. Table 11.0.3 is an attempt to detail the potential problems and corrective actions needed for a well-run PM10 network.

Table 11.0.3 Field Corrective Action

Item	Problem	Action	Notification
Filter Inspection (Unexposed)	Pinhole(s) or torn media	1) If additional filters have been brought, use one of them. Void filter with pinhole or tear. 2) Use new field blank filter as sample filter. 3) Obtain a new filter from lab.	1) Document on field data sheet. 2) Document on field data sheet. 3) Notify Field Manager
Filter Inspection (Exposed)	Torn or otherwise suspect particulate by-passing 46.2 mm filter.	1) Inspect area downstream of where filter rests in sampler and determine whether particulate has been by-passing filter. 2) Inspect in-line filter before sample pump and determine whether excessive loading has occurred. Replace as necessary.	1) Document on field data sheet. 2) Document on field data sheet and in log book.
PM10 Size-selective Inlet	Heavily loaded with coarse particulate as indicated by material accumulation in the impactor	Clean inlet, downtube, or swap out dirty inlet for clean one	Document on field data sheet and in log book.
Sample Flow Rate Verification	Out of Specification ($\pm$ 4% of transfer standard and $\pm$10% of design flow rate.)	1) Remove flow rate device, re-connect and repeat flow rate check. 2) Perform leak test. 3) Re-calibrate flow rate.	1) Document on data sheet. 2) Document on data sheet. 3) Document on data sheet, notify Field Manager, and flag data since last calibration.
Leak Test	Leak outside acceptable tolerance	1) Remove leak check adaptor, re-connect and repeat leak test. 2) Inspect all seals and O-rings, replace as necessary and repeat leak test.	1) Document in log book. 2) Document in log book, notify Field Manager, and flag data since last successful leak test.
Sample Flow Rate	Consistently low flows documented during sample run	1) Check programming of sampler flow rate. 2) Check flow with a flow rate verification filter and determine if actual flow is low. 3) Inspect in-line filter downstream of 46.2 mm filter location, replace as necessary.	1) Document in log book. 2) Document in log book. 3) Document in log book.

Ambient Temperature Verification, and Filter Temperature Verification.	Out of Specification (± 2°C of standard)	1) Make certain thermocouples are immersed in same liquid at same point without touching sides or bottom of container. 2) Use ice bath or warm water bath to check a different temperature. If acceptable, repeat ambient temperature verification. 3) Connect new thermocouple. 4) Check ambient temperature with another NIST traceable thermometer.	1) Document on data sheet. 2) Document on data sheet. 3) Document on data sheet. Notify Field Manager. 4) Document on data sheet. Notify Field Manager.
Ambient Pressure Verification	Out of Specification (±10 mm Hg)	1) Make certain pressure sensors are each exposed to the ambient air and are not in direct sunlight. 2) Call local Airport or other source of ambient pressure data and compare that pressure to pressure data from monitors sensor. Pressure correction may be required. 3) Connect new pressure sensor.	1) Document on data sheet. 2) Document on data sheet. 3) Document on data sheet. Notify Field Manager.
Elapsed Sample Time	Out of Specification (1 min/mo)	Check Programming, Verify Power Outages	Notify Field Manager
Elapsed Sample Time	Sample did not run	1) Check Programming 2) Try programming sample run to start while operator is at site. Use a flow verification filter.	1) Document on data sheet. Notify Field Manager 2) Document in log book. Notify Field Manager.
Power	Power Interruptions	Check Line Voltage	Notify Field Manager
Power	LCD panel on, but sample not working.	Check circuit breaker, some samplers have battery back-up for data but will not work without AC power.	Document in log book
Data Downloading	Data will not transfer.	Document key information on sample data sheet. Make certain problem is resolved before data is written over in sampler microprocessor.	Notify Field Manager.

11.5 Sampling Equipment, Preservation, and Holding Time Requirements

This element details: the requirements to prevent sample contamination, the volume of air to be sampled, temperature preservation requirements, and the permissible holding times to ensure against degradation of sample integrity.

11.5.1 Sample Contamination Prevention

The PM10 network has rigid requirements for preventing sample contamination. Powder-free gloves are worn or clean hands are used while handling filter cassettes. Once the filter cassette is

taken outside of the gravimetric laboratory it must never be opened as damage may result to the 46.2 mm Teflon filter. Filter cassettes are to be stored in filter cassette storage containers as provided by the sampler manufacturer during transport to and from the laboratory. After exposure, filters must be transported and stored with the sample side up to prevent sample losses. They are to be transported carefully to prevent any unnecessary jarring that could cause sample loss in the storage container. Once samples have been weighed, and prior to and again after they have been to the field for sampling, they are to be stored with the particulate side up, individually, in petri slides in the laboratory.

11.5.2 Sample Volume

The volume of air to be sampled is specified in 40 CFR Part 50. Sample flow rate of air is 16.67 liters per minute (LPM). The total sample of air collected will be approximately 24 cubic meters for a 24 hour sample. Samples are expected to be collected over 24 hours; however, in some cases a shorter sample period may be necessary, not to be less than 23 hours. Since capture of the fine particulate is predicated upon a design flow rate of 16.67 LPM, deviations of greater than 10% from the design flow rate will enable a shut-off mechanism for the sampler. If a sample period is less than 23 hours or greater than 25 hours, the sample will be flagged.

11.5.3 Temperature Preservation Requirements

The temperature requirements of the PM10 network are explicitly detailed in 40 CFR Part 50, Appendix M and J[1]. During transport from the gravimetric laboratory to the sample location, there are no specific requirements for temperature control; however, the filters will be located in their protective container and in the transport container. Excessive heat must be avoided (e.g., do not leave in direct sunlight or a closed-up car during summer). The filter temperature requirements are detailed in Table 11.0.4.

Table 11.0.4 Filter Temperature Requirements

Item	Temperature Requirement	Reference
Filter temperature control during post-sampling conditioning	Condition at a point from 15 to 30°C with control at ±3°C	40 CFR Part 50, Appendix J, M, Element 7.4.10

References

The following documents were utilized in the development of this Element:

1. U.S. EPA (1997a) National Ambient Air Quality Standards for Particulate Matter - Final Rule. 40 CFR Part 50. July 18,1997.

2. U.S. EPA (1997b) Revised Requirements for Designation of Reference and Equivalent Methods for PM10 and Ambient Air Quality Surveillance for Particulate Matter-Final Rule. 40 CFR Parts 53 and 58., July 18, 1997.

3. U.S. EPA Quality Assurance Guidance Document 2.10: Monitoring PM10 in Ambient Air Using a Dichotomous Sampler; September 1997.

4. U.S. EPA Quality Assurance Guidance Document 2.11: Monitoring PM10 in Ambient Air Using a High Volume Sampler; September 1997

12.0 Sampling Custody

Due to the potential use of the PM10 data for comparison to the NAAQS and the requirement for care in handling the sample collection filters, sample custody procedures will be followed. Figures 12.1, 12.2, and 12.3 represent chain of custody forms that will be used to track the stages of filter handling throughout the data collection operation. Definitions of parameters on the forms are explained in Table 12-1. Although entries on these forms will be made by hand, the information will be entered into the sampling tracking system, where an electronic record will be kept (see Element 19). This Element addresses sample custody procedures at the following stages:

- Pre-sampling
- Post-sampling
- Filter receipt
- Filter archive

Please note that some of the sample summary information for samples collected from the R&P Partisol Sequential Sampler is collected from the sampler electronically and sent to the District lab via e-mail or on diskette, therefore, this information is not recorded on the Field Form for the sequential sampler.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

PARTISOL PM-10 24-HOUR SAMPLE REPORT AND CHAIN-OF-CUSTODY

Filter ID: _____

Site Name: _____ Cassette ID: _____

Site ID: _____ Run Date: _____

Sampler ID: _____ Transport to Field: _____ / _____
Initial Date

PRE-SAMPLE INFORMATION

Operator: _____ Filter Install Date: _____

Install Time: _____

Stat (upper left): _____ Mode (upper right): _____

Start Date: _____ Amb Temp: _____

Sample Start: _____ Filt Temp: _____

Stop Date: _____ Amb Press: _____

Sample Stop: _____

POST-SAMPLE INFORMATION

Operator: _____ Filter Remove Date: _____

Remove Time: _____

Stat (upper left): _____ Rec (upper right): _____

		Min	Avg	Max
Set Start:				
Act Start:	Amb Temp:			
Act Stop:	Filt Temp:			
Elapse Time:	Press:			
Max Temp Diff:	Avg Flow: _____ CV%: _____			
Max Temp Date/Time: _____ / _____	Total Vol: _____			

Oprtr Comments: _____

Transport from Field: _____ / _____
Initial Date

LABORATORY INFORMATION

	Weight	Duplicate	Date	Analyst
Initial:				
Final:				

Comments: _____

Figure 12.1 Example of Single-Filter Partisol Field Form and Chain of Custody Record

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

BGI PQ200 PM-10 24-HOUR SAMPLE REPORT AND CHAIN-OF-CUSTODY

Site Name: Mono Lake Shore / Simis Ranch (circle one) **Site ID:** 901 / 782 (circle one)

Transport to Field: _____ \ _____
Initial Date

Pre-Sample Information

Operator: _____ Filter Install Date: _____
Filter ID: _____ Start Date: _____ Start Time: _____
Sampler ID: _____ Stop Date: _____ Stop Time: _____

Post-Sample Information

Operator: _____ Filter Remove Date: _____
Sampler Flags: _____
Elapsed Time: _____ Total Vol (m^3): _____

			Max	Min	Avg
Actual Start Date: _____	Start Time: _____	Amb Temp ('C):			
Actual Stop Date: _____	Stop Time: _____	Bar Press (mm Hg):			

Avg Flow (LPM): _____ CV%: _____
Oprtr Comments: _____

Transport from Field: _____ \ _____
Initial Date

Laboratory Information

	Weight	Duplicate	Date	Analyst
Initial:				
Final:				

Comments: _____

Figure 12.2 Example of Single-Filter BGI Field Form and Chain of Custody Record

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

PM10 SEQUENTIALS CUSTODY REPORT

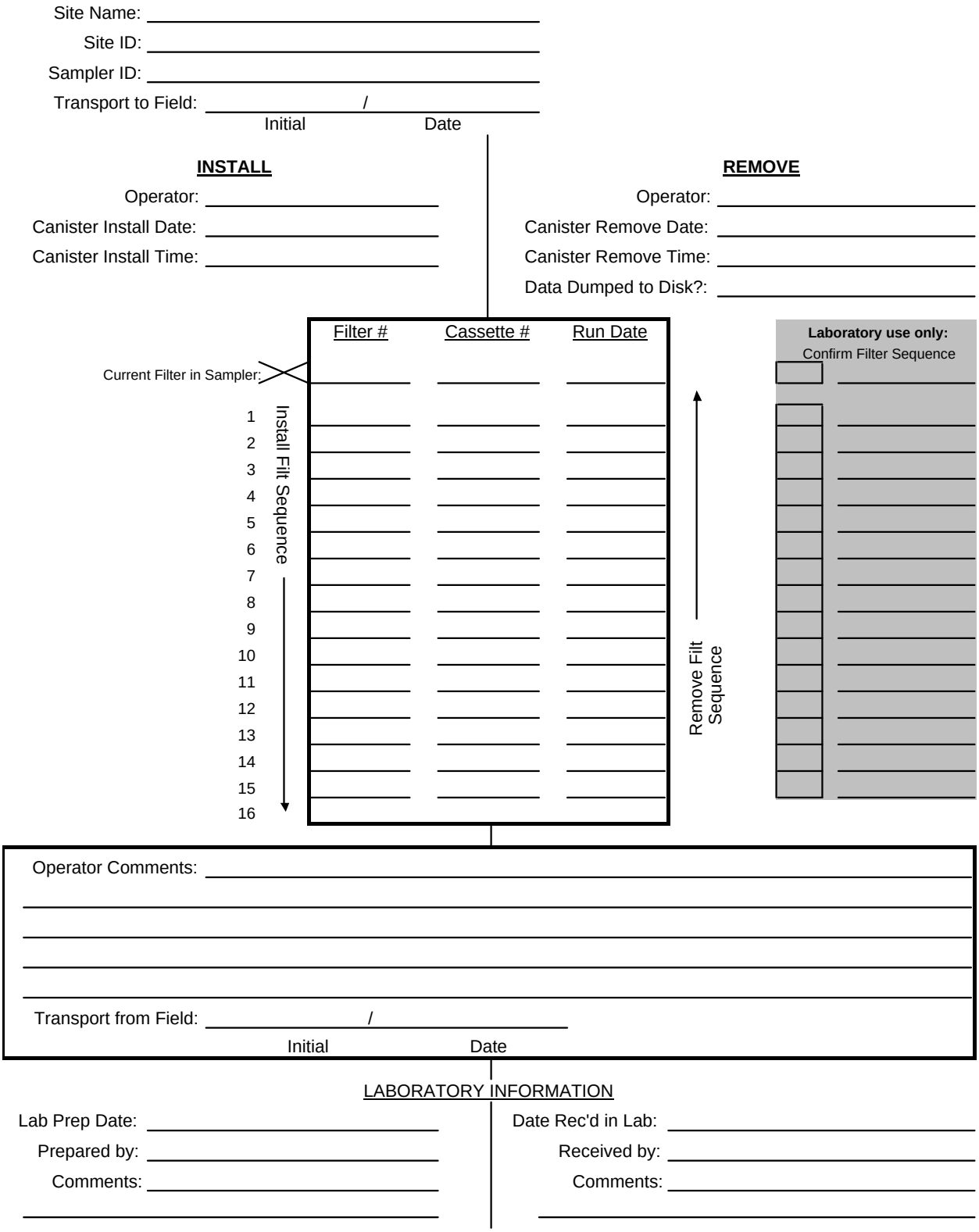


Figure 12.3 Example of Sequential-Filter Partisol Field Form and Chain of Custody Record

Filter Archiving Tracking Form

Filter ID	Analysis Date	Archive Date	Box ID/Box #	Archived By:	Comments

Figure 12.4 Filter Archive Form

Table 12-1 Parameter List

Parameter	Frequency	Comment
Identification		
Site ID	Every sample	Site identification number of where the sample was collected.
Site Name	Every sample	Name of the site where the sample was collected.
Filter ID	Every Sample	Unique filter ID of filter given by the weighing laboratory.
Cass ID #	Every sample	The filter cassette in which the filter was installed.
Sample Date	Every sample	The date on which the atmosphere was sampled through the filter.
Sampler Model/ID No.	Every sample	Sampler model number or District property number unique to the sampler.
Sample Summary		
Elapsed Time	Every sample	The amount of time the filter was sampling the air, in hours, minutes.
Start Date/Time	Every sample	The date and time (PST) at which sampling began for this filter.
Volume	Every sample	The sample volume in cubic meters for this particular filter
Avg. Flow Rate	Every sample	The average flow rate during this sample run, in liters per minute
Flow CV	Every sample	The coefficient of variation for the flow rate, in percent, during this run.
Local Condition Codes	Every sample	Codes that indicate activities in the vicinity of the sampler that may impact the sample.
Amb. Temp., °C	Every sample	The maximum, minimum, and average ambient temperature measured by the sampler during the run.
Amb. Pres., mm Hg	Every sample	The maximum, minimum, and average ambient pressure measured by the sampler during the run.

Sampler Status Codes	Every sample	Codes that indicate parameters measured during the sample run that are out of specification.
Operator Comments	Every sample	Notes made by the operator concerning issues that may affect the filter or sampler.
Chain of Custody		
Load in Sampler	Every sample	Date, time, and initials of the technician loading the filter in the sampler. Mode indicated on sampler.
Remove from Sampler	Every sample	Date, time, and initials of the technician removing the filter from the sampler after the run.
Sent to Lab	Every sample	Date, time, initials of technician taking filter from the site and transporting it to the lab.
Received at Lab	Every sample	Date, time, initials of technician taking filter from the transport container and placing it in the laboratory for conditioning
LABORATORY DATA		
Postweigh by	Every sample	Filter must be weighed as soon as possible after sampling.
Tare Weight	Every sample	The mass, duplicate mass if used for QC check, date, and initials of analyst performing initial weighing of filter prior to sampling.
Gross Weight	Every sample	The mass, duplicate mass if used for QC check, date, and initials of analyst performing final weighing of filter after sampling.
Laboratory Comments	As needed	Comments regarding the filter condition, anomalies, anything that occurred during the final weighing procedure that could affect sample integrity.

12.1 Sample Custody Procedure

One of the most important values in the sample custody procedure is the unique filter identification number, illustrated in Figure 12.4. The filter ID is an alpha-numeric value. The initial alpha value identifies the type of filter as being a PM10 (P) filter. The next seven digits represent a unique number. The filter ID is preprinted on the filter outer ring by the manufacturer, thus, simplifying filter tracking and identification.

P 1234567

Filter Identification Numbering Convention
Figure 12.4

12.1.1 Pre-Sampling Custody

The District's laboratory SOPs (Appendix B) define how the filters will be enumerated, conditioned, weighed, placed into the protective shipping container, sealed with tape, and distributed to the site operators. Filters must be stored onsite in their shipping containers prior to sampling to prevent contamination. In preparation for sampling:

- Select the appropriate *24-Hour Sample Report - Field Data Sheet* for the filter(s) to be installed in the sampler.
- Remove the filter(s) from the protective container per SOPs. If possible, briefly examine filter to determine filter integrity has been maintained. Install the filter cassette or magazine in the sampler.
- Record "Load in Sampler" information on the *Chain of Custody* portion of the *Field Data Sheet*.

12.1.2 Post Sampling Custody

The field sampling SOPs (Appendix E) specify the techniques for properly collecting and handling the sample filters. Upon visiting the site:

- Select the appropriate *24-Hour Sample Report - Field Data Sheet*.
- Remove filter cassette from the sampler. Briefly examine it to determine appropriate filter integrity flag and place it into the protective container per SOPs.
- Record the *Sample Summary* information from the sampler onto the *Field Data Sheet.*
- Record "Remove from Sampler" information on the *Chain of Custody* portion of the *Field Data Sheet*.
- Place the protective container(s) into the transport container in preparation for shipment.
- Record "Prepared for Shipment" information on the *Chain of Custody* portion of the *Field Data Sheet*.

Shipping Information

The site operator will deliver the sample(s) to the laboratory, transporting it in his/her vehicle. Shipping requirements include the following:

- Complete the "Sent to Lab" information in the *Chain of Custody* portion of the *Field Data Sheet*.
- Photocopy the *24-Hour Sample Report - Field Data Sheet* and retain the copy onsite.
- Place the original records in a plastic zip lock bag and include them in the transport containers to be taken to the laboratory.
- Seal all transport containers per SOPs.
- Site operator will transport the container to the laboratory, contacting the laboratory technician upon arrival.

12.1.3 Filter Receipt

Samples are transported to the laboratory by the site operator and delivered directly to the gravimetric laboratory with the associated field data sheet(s). The operator will notify the laboratory technician that the samples have arrived.

12.1.4 Filter Archive

Once the gravimetric laboratory receives the filters, information from the field data sheets will be used to log the samples in from the field. The laboratory technician will remove the filters from the transport container, place them in the laboratory for equilibration, and prepare them for post-sampling weighing activities. These activities are included in the analytical SOPs (Element 13). The laboratory technicians will take the filters out of the protective containers and the cassettes and examine them for integrity, which will be marked on the field data sheets. The samples will be stored within the conditioned environment of the gravimetric laboratory.

Upon completion of post-sampling weighing activities, the *Filter Archiving Form* (Figure 12.4) will be used by the laboratory technician(s) to archive the filter. Each filter will be packaged according to the SOPs and stored in a box uniquely identified by Site ID and box number. Samples will be archived in temperature-controlled storage for five years past the date of collection. Prior to disposal, U.S. EPA Region IX will be notified of the District's intent to dispose of the filters.

13.0 Analytical Methods Requirements

13.1 Purpose/Background

This method provides for gravimetric analysis of filters used in the District's PM10 network. The net weight gain of a sample is calculated by subtracting the initial weight from the final weight. Once calculated, the net weight gain can be used with the total flow passed through a filter to calculate the concentration for comparison to the daily and annual NAAQS. Since the method is non-destructive, and due to possible interest in sample composition, the filters will be archived after final gravimetric analysis has occurred.

13.2 Preparation of Samples

Upon delivery of approved 46.2 mm Teflon filters for use in the GBUAPCD network, the receipt is documented and the filters stored in the gravimetric laboratory. Storing filters in the laboratory makes it easier to maximize the amount of time available for conditioning. Upon receipt, cases of filters will be labeled with the date of receipt, opened one at a time and used completely before opening another case. All filters in a lot will be used before a case containing another lot is opened. When more than one case is available to open the "First In - First Out" rule will apply. This means that the first case of filters received is the first case that will be used.

Filters will be taken out of the case when there is enough room for more samples in the pre-sampling weighing section of the filter conditioning chamber. Filters will be visually inspected according to the FRM criteria to determine compliance. See Appendix B for inspection procedure for new shipments of filters. Filters will then be stored in the filter conditioning chamber within the laboratory. The minimum conditioning period is 24 hours. Filters will not be left out for excessive periods of conditioning to minimize possible contamination.

13.3 Analysis Method

13.3.1 Analytical Equipment and Method

The analytical instruments used for gravimetric analysis in the FRM or equivalent PM10 sampler method (gravimetric analysis) include the microbalance for low volume samples and the analytical balance for high-volume samples. The District uses a *Sartorius M5P* microbalance, which has a readability* of 1 µg and a repeatability* of 1µg (* equipment performance terms used by balance vendors to characterize their equipment for purchase comparison purposes; see also Appendix B). A Sartorius A200 analytical balance is used for weighing high-volume sampler filters. This balance has a readability of 0.0001 grams and a repeatability* of 0.0003 grams.

Both balances are calibrated annually by a technician from *Sartorius.*

The gravimetric analysis method (Appendix B) consists of information needed to establish and verify the continued acceptability of the set of primary and secondary mass reference standards, and a new lot of filters, and to establish stable conditions in the weighing room. The three main

subparts cover pre-sampling filter weighing (tare weight), post-sampling documentation and inspection, and post-sampling filter weighing (gross weight). The details of the gravimetric analysis method can be found in the GBUAPCD microbalance standard operating procedure (Appendix B).

13.3.2 Conditioning and Weighing Room

The primary support facility for the PM10 network is the filter conditioning and weighing room/gravimetric laboratory. Additional facility space is dedicated for long term archiving of the filters in a freezer. The gravimetric laboratory is used for both pre-sampling weighing and post-sampling weighing of each PM10 filter sample. Specific requirements for environmental control of the conditioning/weighing room laboratory are detailed in 40 CFR Part 50 Appendices J and M.[1]

13.3.3 Environmental Control

The District's gravimetric laboratory is an environmentally-controlled room with temperature and humidity control. Temperature is controlled at a setpoint of 22°C, within the required range of 15 to 30°C. Humidity is controlled at 35%, within the required 20 - 45% relative humidity range. Temperature and relative humidity are measured and recorded continuously during equilibration. The balance is located on a vibration free table and is protected from or located out of the path of any sources of drafts. Filters are conditioned before both the pre- and post-sampling weighings. Filters must be conditioned for at least 24 hours to allow their weights to stabilize before being weighed.

13.4 Internal QC and Corrective Action for Measurement System

A QC notebook or database (with disk backups) is maintained which contains QC data, including the microbalance calibration and maintenance information, routine internal QC checks of mass reference standards and laboratory and field filter blanks, and external QA audits. These data will duplicate data recorded on laboratory data forms but will consolidate them so that long-term trends can be identified. QC charts for the microbalance are calculated from the QC database. These charts enable the analyst to determine any excess drift that could signal an instrument malfunction.

At the beginning of each weighing day, after the analyst has completed zeroing and calibrating the microbalance and measuring the working standard, three laboratory filter blanks established for the current filter lot are weighed. Filter blanks from the most recently completed field blank study are also weighed. After approximately every tenth filter weighing, the analyst will reweigh one working standard. The microbalance is rezeroed as necessary between each weighing. The working standard and blank measurements are recorded in the laboratory QC notebook or database. If the working standard measurements differ from the certified values or the pre-sampling values by more than 3 µg, the working standard measurements will be repeated. If the blank measurements differ from the pre-sampling values by more than 15 µg, the blank measurements will be repeated. If the two measurements still disagree, the Laboratory Manager

will be contacted, who may direct the analyst to (1) reweigh some or all of the previously weighed filters, (2) recertify the working standard against the laboratory primary standard, (3) conduct minor, non-invasive diagnostic and troubleshooting, and/or (4) arrange to have the original vendor or an independent, authorized service technician troubleshoot or repair the microbalance.

Corrective action measures in the PM10 FRM system will be taken to ensure good quality data. Tables 13-1 (organized by laboratory support equipment) and 13-2 (organized by laboratory support activity) list potential problems and corrective actions needed to support a well-run PM10 network. Filter weighing will be delayed until corrective actions are satisfactorily implemented.

Table 13-1 Potential Problems/Corrective Action for Laboratory Support Equipment

System	Item	Problem	Action	Notification
Gravimetric Lab	Humidity	Out of Specification	Check HVAC system	Lab Manager
Gravimetric Lab	Temperature	Out of Specification	Check HVAC system	Lab Manager
Balance	Internal Calibration	Unstable	Redo and check working standards	Lab Manager
Balance	Zero	Unstable	Redo and check for drafts, sealed draft guard	Lab Manager
Balance	Working Standards	Out of Specification	Check balance with Primary standards	Lab Manager
Balance	Filter Weighing	Unstable	Check Lab Blank Filters	Document in Log Book

Table 13-2 Filter Preparation and Analysis Checks

Activity	Method and frequency	Requirements	Action if the requirements are not met
Microbalance Use		Resolution of 1µg, repeatability of 1µg	Obtain proper microbalance
Control of balance environment		Climate-controlled, draft-free room or chamber	Modify the environment
Use of Mass reference standards	Working standards checked every 3 to 6 months against laboratory primary standards	Standards up to 200 mg, individual standard's tolerance less than 25 µg, handle with smooth, nonmetallic forceps	Obtain proper standards or forceps
Filter Handling	Observe handling procedure	Use powder-free gloves or clean hands and smooth forceps. Replace Po210 antistatic strips every 6 months	Discard mishandled filter or old antistatic strip
Filter integrity check	Visually inspect each filter	No pinholes, separation, chaff, loose material, discoloration, or filter non-uniformity	Discard defective filter

Filter Identification	Write filter number on filter handling container, and on laboratory data form in permanent ink	Make sure the numbers are written legibly	Replace label or correct form
Pre-sampling filter equilibration	Determine the correct equilibration conditions and period (at least 24 hours) for each new lot of filters. Observe and record the equilibration chamber relative humidity and temperature; enter to lab data form.	Check for stability of laboratory blank filter weights. Weight changes must be <15 µg before and after equilibration. Mean relative humidity between 20 and 45 percent, with a variability of not more than ±5 percent standard deviation over 24 hours. Mean temperature will be held between 15 and 30 °C, with a variability of not more than ±3 °C standard deviation over 24 hours.	Revise equilibration conditions and period. Repeat equilibration
Initial filter weighing	Observe all weighing procedures. Perform all QC checks	Neutralize electrostatic charge on filters. Wait long enough so that the balance indicates a stable reading.	Repeat weighing
Internal QC	After every tenth filter, reweigh one of the two working standards. Weigh three laboratory filter blanks. Reweigh at least one duplicate filter with each sample batch (duplicate weighing).	The working standard measurements must agree to within 3 µg of the certified values. The blank and duplicate measurements must agree to within 15 µg.	Flag values for validation activities.
Post-sampling inspection, documentation, and verification	Examine the filter and field data sheet for correct and complete entries. If sample was shipped in a cooled container, verify that low temperature was maintained.	No damage to filter. Field data sheet complete. Sampler worked OK.	Notify Lab Manager. Void sample.
Post-sampling filter equilibration	Equilibrate filters for at least 24 hours. Must be within ± 5% RH of pre-sampling weighing conditions.	Mean relative humidity between 15 and 45 percent, with a variability of not more than ±5 percent standard deviation over 24 hours. Mean temperature will be held between 15 and 30 °C, with a variability of not more than ±3 °C standard deviation over 24 hours.	Repeat equilibration
Post-sampling filter weighing	Observe all weighing procedures. Perform all QC checks.	Neutralize electrostatic charge on filters. Wait 20 seconds after balance indicates a stable reading before recording data.	Repeat weighing

13.5 Filter Sample Contamination Prevention, Preservation, and Holding Time Requirements

This element details the requirements needed to prevent and protect the filter sample from contamination, the volume of air to be sampled, temperature preservation requirements, and the permissible holding times to ensure against degradation of sample integrity.

13.5.1 Sample Contamination Prevention

The analytical support component of the PM10 network has rigid requirements for preventing sample contamination. Filters are equilibrated/conditioned and stored in the same room where they are weighed. Filters are only contacted with the use of smooth nonserrated forceps. Upon determination of its pre-sampling weight, the filter is placed in its cassette and then placed in a protective petri dish. The petri dish is labeled with a uniquely identifying number. The filter is never removed from the filter cassette outside of the weigh room as damage may result to the 46.2 mm Teflon filter.

13.5.2 Sample Volume

The volume of air to be sampled is specified in 40 CFR Part 50. Sample flow rate of air is 16.67 LPM. Total sample of air collected will be 24 cubic meters based upon a 24 hour sample.

13.5.3 Temperature Preservation Requirements

The temperature requirements of the PM10 network are detailed in 40 CFR Part 50. In the weighing room laboratory, the filters must be conditioned for a minimum of 24 hours prior to pre-weighing; although, a longer period of conditioning may be required. The weighing room laboratory temperature must be maintained between 15 and 30°C, with no more than a +/- 3°C standard deviation change over the 24-hour period prior to weighing the filters. During transport from the weighing room to the sample location, there are no specific requirements for temperature control; however, the filters will be located in their protective container and excessive heat avoided. The temperature requirements are detailed in Table 13-3.

Table 13-3 Temperature Requirements

Item	Temperature Requirement	Reference
Weighing Room	15 - 30°C	40 CFR Part 50, Appendices J and M, Section 7.4.1
Filter Conditioning, Pre- and Post-exposure	+/- 3°C standard deviation for 24 hours prior to weighing	40 CFR Part 50, Appendices J and M, Section 7.4.2

13.5.4 Sample Holding Times

The sample holding times for the PM10 sample are not specific in either 40 CFR Part 50[1] or the U.S. EPA QA Guidance Documents 2.10 or 2.11[2]. The general principle of returning the filters as soon as possible after collection for equilibration and final weighing is adhered to by the District.

References

The following documents were utilized in the development of this element:

1. U.S. EPA (1997a) National Ambient Air Quality Standards for Particulate Matter - Final Rule. 40 CFR Part 50. July 18,1997.

2. U.S. EPA Quality Assurance Guidance Document 2.10: Monitoring PM10 in Ambient Air Using a Dichotomous Sampler. September 1997.

3. U.S. EPA Quality Assurance Guidance Document 2.11: Monitoring PM10 in Ambient Air Using a High Volume Sampler. September 1997.

14.0 Quality Control Requirements

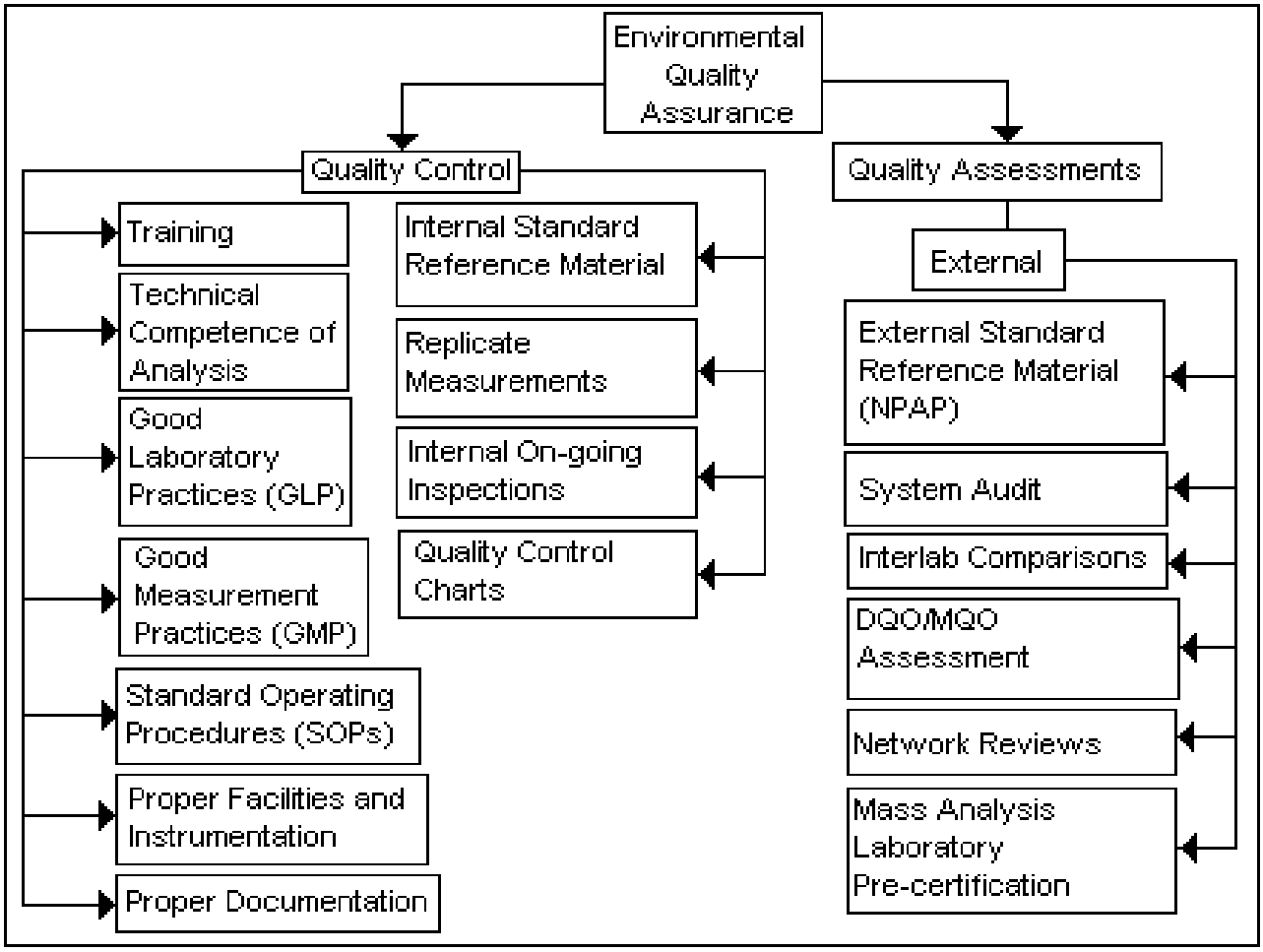


Figure 14.1 Quality control and quality assessment activities

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. One function is the control of the measurement process through broad quality assurance activities, such as establishing policies and procedures, developing data quality objectives, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. The other function is the control of the measurement process through the implementation of specific quality control procedures, such as audits, calibrations, checks, replicates, routine self-assessments, etc. In general, the greater the control of a given monitoring system, the better will be the resulting quality of the monitoring data.

Quality control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the District. In the case of the Ambient Air Quality Monitoring Network, QC activities are used to ensure that measurement uncertainty, as discussed in Element 7, is maintained within acceptance criteria for the attainment of the DQO. Figure 14.1 represents a number of QC activities

that help to evaluate and control data quality for the PM10 program. Many of the activities in this figure are implemented by the District and are discussed in the appropriate sections of this QAPP. The other activities in this figure are implemented by the California ARB and/or the U.S. EPA.

14.1 QC Procedures

Day-to-day quality control is implemented through the use of various check samples or instruments that are used for comparison. The measurement quality objectives tables (work in progress) in Element 7 contain a complete listing of these QC samples as well as other requirements for the PM10 Program. The procedures for implementing the QC samples are included in the field and analytical methods (Elements 11 and 13, respectively). As Figure 14.2 illustrates, various types of QC samples have been inserted at phases of the data operation to assess and control measurement uncertainties. Tables 14-1 and 14-2 contains a summary of all the field and laboratory QC samples. The following information provides some additional descriptions of these QC activities, how they will be used in the evaluation process, and what corrective actions will be taken when they do not meet acceptance criteria.

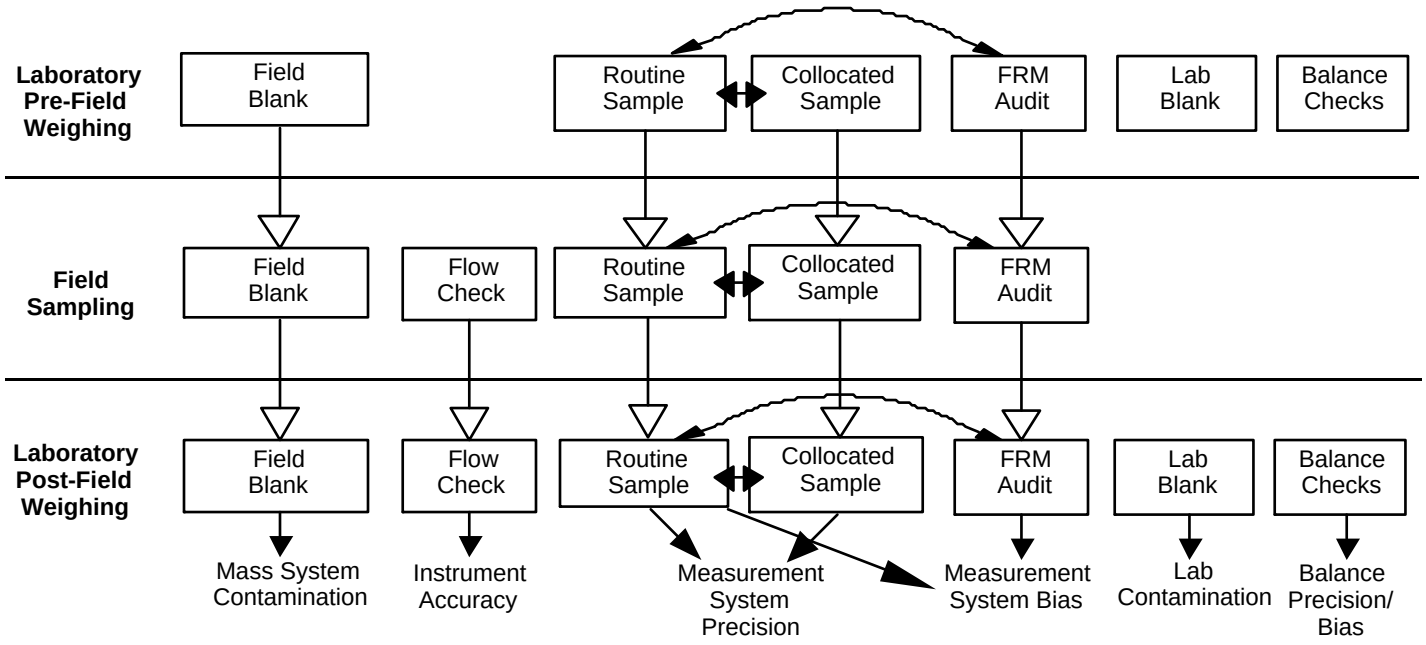


Figure 14-2 PM10 Quality Control Sampling Scheme

Table 14-1 Field QC Checks

Requirement	Frequency	Acceptance Criteria	CFR Reference	QA Guidance Document Reference	Information Provided
Calibration Standards					
Flow Rate Transfer Std.	1/yr	±2% of NIST-traceable Std.;	Part 50, App. J, M Sec 7.1.4;	2.10, Sec. 2.2	Certification of Traceability
Field Thermometer	1/yr	± 0.1°C resolution ± 0.5°C accuracy;	not described;	2.10, Sec 3.4.1, 3.5.1	Certification of Traceability
Field Barometer	1/yr	± 1 mm Hg resolution ± 5 mm Hg accuracy	not described	2.10, Sec. 3.4.1, 3.5.1	Certification of Traceability
Calibration/Verification					
Flow Rate (FR) mult-point verification	2/yr or if single-point verification failure	± 7% of transfer standard and ±10% of design FR	not described not described And Sec. 9.2.6	2.10, Table 2-1 not described	Calibration drift and memory effects
Calibration FR single-point verification	1/4 weeks				Calibration drift and
External Leak Check	monthly	<80 mL/min	Part 50, App.L, Sec 7.4	2.12, Secs. 6.6, 8.3	memory effects
Internal Leak Check	monthly	<80 mL/min	"	2.12, Secs. 6.6, 8.3	
Temperature Calibration	monthly	± 2°C of standard	Part 50, App.L, Sec 9.3	2.12, Sec. 6.4	Sampler function
Temp multi-point verification	If multi-point failure on installation, then 1/yr	± 2°C of standard	Part 50, App.L, Sec 9.3 " "	2.12, Sec. 6.4 and 8.2 " 2.12, Sec. 6.5	Sampler function Calibration drift and memory effects
One- point temp Verification	1/4 weeks on installation, then 1/yr	± 4°C of standard	" Part 50, App.L, Sec 7.4	2.12, Sec. 8.2 not described	Calibration drift and memory effects
Pressure Calibration	1/yr	±10 mm Hg			Calibration drift and memory effects
Pressure Verification	monthly	±10 mm Hg			Calibration drift and memory effects
Clock/timer Verification	monthly	1 min/mo			Verification to assure proper function
Blanks					
Field Blanks	10% of monitors sampling frequency	±30 µg	not described	QA G.D. 2.12, Sec. 7.7	Measurement system contamination
Precision Checks					
Collocated samples	every 6 days	CV ≤ 20%	Part 58, App.A, Sec 3.3, 5.3	QA G.D. 2.10, 2.11 Sec. 8.0	Measurement system precision
Audits (*external assessments*)					
Flow rate audit	1/yr	± 7% of audit standard and ±10% of design FR,	Part 58, App A, Sec 3.4.1	QA G.D. 2.10, 2.11 Sec 7.0, 8.0	External verification bias/accuracy
Temperature Audit	1/yr	± 2°C,	not described	QA G.D. 2.10, 2.11	Calibration drift and memory effects,
Pressure Audit	1/yr	±10 mm Hg	not described	Sec 1.0	same as above

Table 14-2 Laboratory QC

Requirement	Frequency	Acceptance Criteria	CFR Reference	QA Guidance Document Reference	Information Provided
Blanks					
Lot Blanks	3 filters per lot	±15 µg difference	Part 50, App. L, Sec 8.3	2.12 Sec. 7	Filter stabilization/equilibrium
Lab Blanks	3 per batch	±15 µg difference	"	2.12 Sec. 7.7	Laboratory contamination
Calibration/Verification					
	1/yr	Manufacturers spec.	Part 50, App. L, Sec 8.1,	2.12 sec 7.2, QAPP Sec. 13/16,	Verification of equipment operation
Balance Calibration	1/yr	± 2°C	Not defined,	QAPP Sec. 13/16	Verification of equipment operation
Lab Temp. Calibration					
Lab Humidity Calibration	1/yr	±2%	"		Verification of equipment operation
Accuracy					
Balance Audit	1/year	Not defined	Not defined	2.12 Sec 10.2	Laboratory technician operation
Balance Check	beginning, end of weighing session	Not defined	Part 50, App. L, Sec 8.1	2.12 Sec. 7.9	Balance accuracy/stability
Calibration standards					
Working Mass Stds.	3-6 mo.	tolerance ≤ 25 µg	Not defined	2.12 Sec 4.3 and 7.3	Standards verification
Primary Mass Stds.	1/yr	tolerance ≤ 25 µg	"	"	Primary standards verification
Precision					
Duplicate filter weighings	1 for every 10 filters	±20 µg difference	Not defined	2.10, 2.11 Sec 4.5 QAPP Sec. 13/16	Weighing repeatability/filter stability

14.1.1 Calibrations

Calibration is the comparison of a measurement standard or instrument with another standard or instrument to report, or eliminate by adjustment, any variation (deviation) in the accuracy of the item being compared[1]. The purpose of calibration is to minimize bias.

For PM10, calibration activities follow a two step process:

1. Certifying the calibration standard and/or transfer standard against an authoritative standard, and
2. Comparing the calibration standard and or transfer standard against the routine sampling/analytical instruments.

Calibration requirements for the critical field and laboratory equipment are found in Tables 14-1 and 14-2 respectively; the details of the calibration methods are included in the calibration Element (Element 16) and in the field and laboratory methods Elements (11 and 13, respectively).

14.1.2 Blanks

Blank samples are used to determine contamination arising from principally four sources: the environment from which the sample was collected/analyzed, the reagents used in the analysis, the apparatus used, and the operator/analyst performing the data operation. Three types of blanks will be implemented in the PM10 Program:

Lot Blanks - a shipment of 46.2mm filters will be periodically procured by the District for the PM10 lab. Each shipment must be tested to determine the length of time it takes the filters to stabilize. Upon arrival of each shipment, three lot blanks will be randomly selected from the shipment and be subjected to the conditioning/pre-sampling weighing procedures. The blanks will be weighed daily for a minimum of five days to determine the length of time it takes to maintain a stable weight reading.

Field Blanks - provide an estimate of total measurement system contamination. By comparing information from laboratory blanks against the field blanks, one can assess contamination from field activities. Details of the use of the field blanks can be found in field SOPs (Appendix E).

Lab Blanks - provide an estimate of contamination occurring at the weighing facility. Details of the use of the lab blanks can be found in lab SOPs (Appendix B).

Lab Blank Evaluation

Three (3) lab blanks will be weighed in each weighing session day. The following statistics will be used for data evaluation purposes:

Difference for a Single Check *(d)* - The difference, *d*, for each check is calculated using Equation 1, where X represents the weight of the filter measured from its previous

weighing and *Y* represents the weight of the filter measured from the current weighing session.

$$d = Y - X$$

Equation 1

Mean Difference for Batch (d_z) - The mean difference d_z for lab blanks within a weighing session batch is calculated using Equation 2 where d_1 through d_n represent individual
differences (calculated from Equation 1) and *n* represents the number of blanks in the batch.

$$d_z = \frac{d_1 + d_2 + d_3 .... d_n}{n}$$

Equation 2

Corrective Action- The acceptance criteria for lab blanks is 15 µg difference as determined by Equation 1. However, the mean difference based upon the number of blanks in each batch will be used for comparison against the acceptance criteria. If the mean difference of the laboratory blanks is greater than 15µg, then the laboratory balance will be checked for proper operation and all the lab blanks in the weighing session will be re-weighed. Prior to re-weighing, the laboratory balance will be checked for proper operation. If the blank mean is still out of the acceptance criteria, all samples within the weighing session will be flagged with the appropriate flag, and efforts will be made to determine the source of contamination. If the mean difference of the laboratory blanks is greater than 20µg and 2 or more of the blanks were greater than 20µg, the laboratory weighing will stop until the issue is satisfactorily resolved. The laboratory analyst will alert the Laboratory Manager of the problem. The problem and solution will be reported and appropriately filed under response and corrective action reports.

Lab blanks can be control charted (see Element 14.2). The batch difference calculation (Equation 2) can be used for control charting purposes.

Field Blank Evaluation

Field blanks will be weighed in the same weighing session as associated routine samples from the site. The following statistics will be generated for data evaluation purposes:

Difference for a Single Check *(d)* - The difference, *d*, for each check is calculated using Equation 1, where *X* represents the original weight of the filter and *Y* represents the filter weight after transport to and from the monitoring site including exposure in the sampler.

$$d = Y - X$$

Equation 1

Corrective Action- The acceptance criteria for field blanks is 30 µg difference as determined by Equation 1. If the field blank value is out of the acceptance criteria, efforts will be made to determine the source of contamination. In theory, field blanks should contain more contamination than laboratory blanks. Therefore, if the field blanks are outside of the criteria while the lab blanks are acceptable, weighing can continue on the next batch of samples while field contamination sources are investigated. The laboratory analyst will alert the Laboratory Manager. The problem and solution will be reported and appropriately filed under response and corrective action reports.

Field blanks can be control charted for each monitoring site (see Element 14.2). The difference calculation (Equation 1) can be used for control charting purposes.

14.1.3 Precision Checks

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the data quality objectives for precision, the District must ensure the entire measurement process is within statistical control. Two types of precision measurements will be made in the PM10 Program.

- Collocated monitoring
- Filter duplicates

Collocated Monitoring

In order to evaluate total measurement precision, collocated monitoring will be implemented, as referenced in 40 CFR. Therefore, every method designation will have collocated monitors (1 for 1 to 5 site networks, 2 for 6 to 20 site networks, 3 for networks of more than 20).

These monitors are located at sites that collect the highest 25% of measured concentrations in a given network or sub-network.

Evaluation of Collocated Data- Collocated measurement pairs are selected for use in the precision calculations only when both measurements are above 20 µg/m^3. However, all collocated data will be reported to AIRS.

The following equations will be used to evaluate collocated data. These equations are included in *40 CFR Part 58 Appendix A.* The equation numbers in 40 CFR will also be utilized in this QAPP.

Percent Difference for a Single Check (d_i) - The percentage difference, d_i, for each check is calculated by using Equation 19, where X_i represents the concentration produced from the primary sampler and Y_i represents the concentration reported for the duplicate sampler.

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

Equation 19

Coefficient of Variation (CV) for a Single Check (CV_i) - The coefficient of variation, CV_i, for each check is calculated by dividing the absolute value of the percentage difference, d_i, by the square root of two as shown in Equation 20.

$$CV_i = \frac{|d_i|}{\sqrt{2}}$$

Equation 20

Precision of a Single Sampler - Quarterly Basis ($CV_{j,q}$) - For particulate sampler *j*, the individual coefficients of variation ($CV_{j,q}$) during the quarter are pooled using Equation 21, where $n_{j,q}$ is the number of pairs of measurements from collocated samplers during the quarter.

$$CV_{j,q} = \sqrt{\frac{\sum_{i=1}^{n_j} CV_i^2}{n_{j,q}}}$$

Equation 21

The 90 percent confidence limits for the single sampler's CV are calculated using Equations 22 and 23, where $c^2_{0.05,df}$ and $c^2_{0.95,df}$ are the 0.05 and 0.95 quantiles of the chi-square (c^2) distribution with $n_{j,q}$ degrees of freedom.

$$\text{Lower Confidence Limit} = CV_{j,q}\sqrt{\frac{n_{j,q}}{\chi^2_{0.95,\,n_{j,q}}}}$$

Equation 22

$$\text{Upper Confidence Limit} = CV_{j,q}\sqrt{\frac{n_{j,q}}{\chi^2_{0.05,\,n_{j,q}}}}$$

Equation 23

Precision of a Single Sampler - Annual Basis - For particulate sampler *j*, the individual coefficients of variation, CV_i, produced during the calendar year are pooled using Equation 21, where n_j is the number of checks made during the calendar year. The 90 percent confidence limits for the single sampler's CV are calculated using Equations 22 and 23, where $c^2_{0.05,df}$ and $c^2_{0.95,df}$ are the 0.05 and 0.95 quantiles of the chi-square (c^2) distribution with n_j degrees of freedom.

Corrective Action: Single Monitor - The precision data quality objective of 20% coefficient of variation (CV) is based upon the evaluation of three years of collocated precision data. The goal is to ensure that precision is maintained at this level. Therefore, precision estimates for a single pair of collocated instruments, or even for a quarter, may be greater than 20% while the three year average is less than or equal to 20%. Therefore, single collocated pairs with values >20% will be flagged and investigated. If the value remains between 20-30% the field technician will be alerted to the problem. If the CV is greater than 30% after investigation, all the primary sampler data will be investigated from the last precision check and corrective action initiated as necessary. Paired CVs and percent differences will be control charted to determine trends if determined to be necessary (Element 14.2). The laboratory technician will alert the Laboratory Manager of the problem. The problem and solution will be reported and appropriately filed under response and corrective action reports.

Corrective Action: Quarter - Usually, corrective action will be initiated and imprecision rectified before a quarter's worth of data fail to meet the 20% CV criterion. However in the case where the quarter's CV is greater than 30%, the routine data for that monitor for that quarter will be flagged. The problem and solution will be reported and appropriately filed under response and corrective action reports.

Duplicate Laboratory Measurements

During laboratory pre-weighing and post-weighing sessions, a routine filter from the sampling batch will be selected for a second weighing. Equations 1 and 2 will be used to

calculate this information. The difference between the two filter weights must be less than 20µg. If this criterion is not met, the pair of values will be flagged and investigated. Failure may be due to transcription errors, microbalance malfunction, or samples not having reached equilibrium. Other QC checks (balance standards and lab blanks) will eliminate microbalance malfunction. If the duplicate does not meet the criterion, a second routine sample will be selected and reweighed as a second duplicate check. If this second check fails the acceptance criteria and the possibilities of balance malfunction and transcription errors have been eliminated, all samples in the batch will be equilibrated for another 24 hours and reweighed. Corrective actions will continue until duplicate weights for the batch meet acceptance criteria.

14.1.4 Accuracy or Bias Checks

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value. Four accuracy checks are implemented in the PM10 program:

- Collocated monitors
- Flow rate audits
- Balance checks
- FRM performance evaluations

Collocated Monitors

Although the collocated monitors are primarily used for evaluating and controlling precision, they can be used to determine accuracy or bias. By using Equation 19 to determine percent difference, one can track trends or bias between the two instruments without knowing which instrument is producing the "true" value. Use of the FRM performance evaluation information (discussed below) in conjunction with collocation data should help improve the quality of data.

Corrective Action - The percent difference of the paired values will be control charted to determine trends, if deemed necessary. If it appears that there is a statistically significant bias (> 10% at the 90% confidence level) between the pairs, corrective action will be initiated. The process will include eliminating uncertainties that may be occurring at filter handling, transport and laboratory stages, in order to determine that the bias is truly at the instrument. Corrective actions at the instrument will include multi-point temperature, pressure, and flow rate checks as well as complete maintenance activities. Additional corrective action could include a request for vendor servicing or a request for Region IX to implement an FRM performance evaluation.

Flow Rate Audits

The District will conduct flow rate audits quarterly. The ARB will conduct audits of District stations annually. Details of the implementation aspects of the audits are included in Element 11. An audit is conducted by measuring the monitor's normal operating flow rate using a certified flow rate transfer standard and comparing it with the monitor flow rate. The flow rate standard used for auditing will not be the same flow rate standard used to calibrate the monitor. However, both the calibration standard and the audit standard

may be referenced to the same primary flow rate or volume standard. The ARB and the District will report the audit (actual or volumetric) flow rate and the corresponding flow rate indicated or assumed by the sampler. The procedures used to calculate measurement uncertainty are described below.

Accuracy of a Single Sampler - Single Check (Quarterly) Basis (d_i) - The percentage difference (d_i) for a single flow rate audit *i* is calculated using Equation 13, where X_i represents the audit standard flow rate (known) and Y_i represents the indicated flow rate.

$$d_i = \frac{Y_i - X_i}{X_i} * 100$$

Equation 13

Bias of a Single Sampler - Annual Basis (D_j) - For an individual particulate sampler *j*, the average (D_j) of the individual percentage differences (d_i) during the calendar year is calculated using Equation 14, where n_j is the number of individual percentage differences produced for sampler *j* during the calendar year.

$$D_j = \frac{1}{n_j} * \sum_{i=1}^{n_j} d_i$$

Equation 14

Bias for Each U.S. EPA Federal Reference and Equivalent Method Designation Employed by the District - Quarterly Basis ($D_{k,q}$) - For method designation *k* used by the reporting organization, quarter *q*'s single sampler percentage differences (d_i) are averaged using Equation 16, where $n_{k,q}$ is the number of individual percentage differences produced for method designation *k* in quarter. *q.*

$$D_{k,q} = \frac{1}{n_{k,q}} * \sum_{i=1}^{n_{k,q}} d_i$$

Equation 16

Corrective Action - The single sampler accuracy performance goal is ±7% of the audit transfer standard and ±10% of design flow rate. If the audit violates the acceptance criteria, the sample operator will check the sampling instrument for internal and external leaks, ensure that temperature and pressure are within acceptable ranges, and verify the flow rate. Another audit will be scheduled. If the audit is still unacceptable, a multi-point calibration followed by a one-point verification is required. Routine data, back to an acceptable audit or the most recent calibration, will be flagged and reviewed to determine validity (see Element 23). In addition, one would expect that the monthly flow rate calibration verification checks (see Element 16) would indicate a drift towards unacceptable accuracy. If a review of the flow rate calibration verification check data does not show a problem, there is a potential that one or both of the flow rate standards need to be recertified.

Balance Checks

Balance checks are frequent checks of the balance working standards (100 and 200 mg standards) against the balance to ensure that the balance is within acceptance criteria throughout the pre- and post-sampling weighing sessions. The District will use ASTM class 1 weights for its primary and secondary (working) standards. Both working standards will be measured at the beginning and end of the sample. Balance check samples can be controlled charted (see Table 14-3) when needed.

Balance Check Evaluation- The following equation will be used to evaluate the balance checks:

Difference for a Single Check *(d_y)* - The difference, d_y, for each check is calculated using Equation 3, where *X* represents the certified mass weight and *Y* represents the reported weight,

$$d_y = Y - X$$

Equation 3

Corrective Action - The difference among the reported weight and the certified weight must be within ± 3µg. Since this is the first check before any pre- or post-sampling weighings, if this acceptance criterion is not met, corrective action will be initiated.

Corrective action may be as simple as allowing the balance to perform internal calibrations or to sufficiently warm-up, which may require checking the balance weights a number of times. If the acceptance criterion is still not met, the laboratory technician will be required to verify the working standards by comparison with the primary standards. Finally, if it is established that the balance does not meet acceptance criteria for both the working and primary standards, and other troubleshooting techniques fail, the *Sartorius* service technician (see Element 15) will be called to perform corrective action.

If the balance check fails acceptance criteria during a weighing session, the 10 filters weighed prior to the failure will be reweighed. If the balance check continues to fail, troubleshooting, as discussed above, will be initiated. The values of the 10 samples weighed prior to the failure will be recorded and flagged, but will be remain with the unweighed samples in the batch to be reweighed when the balance meets the acceptance criteria. Any balance check outside the acceptance criterion will be flagged.

14.2 Control Charts

Control charts will not be used extensively by the District, however, the data used to produce them will be available and charts will be generated when and if the need arises. The control charts can be used as an "early warning system" to evaluate trends in precision and bias.

Table 14-3 Control Charts

QC Check	Plotting technique
Flow rate calibration verification check	single values plotted
Lab/Field Blanks	mean value of each batch
Flow rate audit	single values plotted
Balance check	mean value of each batch
Collocated monitoring pairs	Percent difference each pair charted by site, coefficient of variation each pair, coefficient of variation of all sites per quarter.

References

1. Taylor, J.K. 1987 Quality Assurance of Chemical Measurements. Lewis Publishers, Chelsea, Michigan. 328pp.

2. U.S. EPA (1997b) Revised Requirements for Designation of Reference and Equivalent Methods for PM2.5 and Ambient Air Quality Surveillance for Particulate Matter-Final Rule. 40 CFR Parts 53 and 58. *Federal Register*, **62**(138):38763-38854. July 18, 1997.

3. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Part II: Quality Assurance Guidance Document 2.10: Monitoring PM10 in Ambient Air Using a High Volume Sampler, September 1997.

4. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Part II: Quality Assurance Guidance Document 2.11: Monitoring PM10 in Ambient Air Using a Dichotomous Sampler, September 1997.

15.0 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

15.1 Purpose/Background

The purpose of this element in the District QAPP is to discuss the procedures used to verify that all instruments and equipment are maintained in sound operating condition and are capable of operating at acceptable performance levels. All instrument inspection and maintenance activities are documented in the District's laboratory and field operations SOPs (Appendices B and E, respectively).

15.2 Testing

All PM10 samplers used in the District's PM10 Ambient Air Quality Monitoring Network are designated federal reference methods (FRM) or federal equivalent methods (FEM) that have been certified as such by U.S. EPA. Therefore, they are assumed to be of sufficient quality for the data collection operation. Testing of such equipment is accomplished by U.S. EPA through the procedures described in 40 CFR Part 50[1]. Prior to field installation, District staff will assemble and run the samplers in the field, following, in general the Acceptance Test procedure in Appendix E. The District field personnel will perform external and internal leak checks and temperature, pressure and flow rate verification checks. If any of these checks are out of specification (see Table 14-1), the District will troubleshoot the problem and contact the vendor for corrective action, if necessary. Once installed at the site, the District field personnel will run the tests mentioned above. If the sampling instrument meets the acceptance criteria, it will be assumed to be operating properly. These tests will be documented and filed as indicated in Element 9.

15.3 Inspection

Inspection of various pieces of equipment and components is provided here. Inspections are subdivided into two Elements: one pertaining to gravimetric laboratory issues and one associated with field activities.

15.3.1 Inspection in Gravimetric Laboratory

There are several items that need routine inspection in the gravimetric laboratory. Table 15-1 details the items to inspect and how to appropriately document the inspection.

Table 15-1 Inspections in the Gravimetric Laboratory

Item	Inspection Frequency	Inspection Parameter	Action if Item Fails Inspection	Documentation Requirement
Laboratory Temperature	Daily	15 - 30^{O} C	1) Check HVAC System	1) Document in laboratory log book 2) Notify Lab Manager
Laboratory Humidity	Daily	20 - 45 %RH	1) Check HVAC System	1) Document in laboratory log book 2) Notify Lab Manager
Dust, damp mop laboratory	Monthly	Visually inspect	Clean Laboratory	Document in Laboratory log book

15.3.2
Field Items

There are several items to inspect in the field before and after a PM10 sample has been taken. Table 15-2 details the inspections performed in the field before and after samples are taken.

Table 15-2 Inspection of Field Items

Item	Inspection Frequency	Inspection Parameter	Action if Item Fails Inspection	Documentation Requirement
Sample downtube	Weekly at Owens Lake, Monthly elsewhere	Visible particulate	Clean with a clean, lint-free cloth and/or compressed air	Document in log book
PM10 inlet, impactor	Weekly at Owens Lake, Monthly elsewhere	Visible particulate	Clean with a clean, lint-free cloth and/or compressed air	Document in log book
Rain collector	Every site visit	>1/3 full	Empty	Document in log book
O-rings	Every site visit	Any damage	Replace	Document in log book
Filter Cassettes	After each sample run	Visible particulate	Check downtube	Document in log book
Cassette Seals	Each sample	Clean and smooth	Clean with a clean, lint-free cloth, or replace as needed	Document when replaced
In-line filter	Every 6 months	Loaded particulate	Replace	Document in log book
Battery	Every 6 months	Decrease in voltage	Replace	Document in log book

15.4 Maintenance

There are many items that require attention and regular maintenance in the PM10 network. This Element describes those items according to whether they are gravimetric laboratory items or field items.

15.4.1
Laboratory Maintenance Items

The successful execution of a preventative maintenance program for the gravimetric laboratory promotes the success of the entire PM10 program. In the District's PM10 network, gravimetric laboratory preventative maintenance is handled by District personnel and contractors**.** The laboratory technician handles all preventative maintenance associated with the heating, ventilation, and air conditioning system (HVAC). Preventative maintenance for the microbalance is performed by a *Sartorius* service technician contracted by the District. Preventative maintenance for the microbalance is scheduled to occur at initial set-up and every 12 months thereafter. In the event that there is a problem with the microbalance that cannot be resolved by District staff, the *Sartorius* service technician can be contacted.

The following table details the gravimetric laboratory maintenance items, replacement frequency, and specifies the party responsible for performing the maintenance.

Table 15-3 Preventive Maintenance in Gravimetric Laboratories

Item	Maintenance Frequency	Responsible Party
Multi-point Microbalance	Each weighing session Yearly	*District Laboratory Technician* *Sartorius Service Technician*
Polonium strip replacement	6 Months	*Laboratory Technician*
Comparison of NIST Standards to laboratory working and primary standards	Yearly	*Laboratory Technician*
Cleaning gravimetric laboratory	Monthly	*Laboratory Technician*
HVAC air filter inspection, replacement	Monthly 6 Months, or as needed	*Laboratory Technician*
Clean sticky floor mat (just inside gravimetric laboratory)	Weekly	*Laboratory Technician*
HVAC system preventive maintenance	6 Months, or as needed	*Laboratory Technician*
Computer Back-up	Monthly	*Laboratory Technician*
Computer Virus Check	Weekly	*Laboratory Technician*
Computer system preventive maintenance (clean out old files, compress hard drive, inspect)	Yearly	*Laboratory Technician*

15.4.2
Maintenance Items

There are many items associated with appropriate preventative maintenance of the equipment in a successful field program. Table 15-4 details the appropriate maintenance checks of the PM10 samplers and their frequency.

Table 15-4 Preventive Maintenance of Field Items

Item	Maintenance Frequency	Location Maintenance Performed
Clean PM10 Inlet	Weekly at Owens Lake, monthly elsewhere	At Site
Inspect Filter Cassettes	Each run	At Site and Lab
Replace In-line filter	6 Months	At Site
Inspect Air Screens (under sampler's rain hood)	Monthly	At Site
Clean filter holding area, internal and external	Weekly	At Site
Sample Pump Rebuild	Every 10,000 hours of operation	At Field Office

References

The following documents were utilized in the development of this Element:

1. U.S. EPA (1997a) National Ambient Air Quality Standards for Particulate Matter - Final Rule. 40 CFR Part 50. *Federal Register,* **62**(138):38651-38760. July 18,1997.

16.0 Instrument Calibration and Frequency

16.1 Instrumentation Requiring Calibration

16.1.1 Mass Analysis by Gravimetry-Laboratory Microbalance

The laboratory support for the District includes calibration of the *Sartorius M5P* microbalance and the Sartorius A200 analytical balance. As indicated in Element 13, the balances are calibrated (and mass standard check weights recertified) once per year under a service agreement. The service technician performs routine maintenance and makes any balance response adjustments that each calibration shows to be necessary. During the visit by the service technician, both the in-house primary and secondary (working) standards are checked against the service technician's standards to ensure acceptability. All of these actions are documented in the service technician's report, a copy of which is provided to the laboratory manager, which after review, is appropriately filed. The laboratory mass standards are also sent to the manufacturer annually for recertification. The mass standard recertification documents are reviewed by the laboratory manager and filed appropriately.

16.1.2 Flow Rate - Standards Laboratory

The District Laboratory support sends out the flow rate transfer standards to the manufacturer(s) for the comparison of the flow rate transfer standard to a NIST-traceable primary flow rate standard. The District's own primary flow rate standard is sent out once every three years to the manufacturer for recertification. The field personnel use a Chinook Engineering Streamline Flowrate Transfer Standard (FTS) for flow rate verifications of all of the District's PM10 samplers and also for calibrations of the Rupprecht & Patashnick Sequential Samplers flow rates. Both of these devices have the advantage of providing volumetric flow rate values directly, without requiring conversion from mass flow measurements or water vapor corrections. In addition, the BIOS graphite piston flowmeter is used in the District Laboratory as a primary standard, where the absence of wind and relatively low humidity will have less negative effect on flowmeter performance.

Upon initial receipt of any new, repaired, or replaced PM10 sampler, field support staff will perform a flow rate calibration verification on the sampler to determine whether its initial performance is acceptable. Once sampler flow rates are accepted, the field personnel perform the calibration and verifications at the frequency specified in Element 14. The Laboratory directly performs or arranges to have another party perform the tests needed to recertify the District's standards.

16.1.3 Sampler Temperature, Pressure, Time Sensors-District Laboratory

The District Laboratory arranges support for the field calibration of temperature and pressure sensors by preparing and lab testing the temperature transfer standards. Field temperature transfer standards are compared against an ASTM mercury-in-glass thermometer bearing an NIST certification.

A stationary mercury barometer in the Laboratory is used as a primary standard to calibrate the electronic aneroid barometers that go into the field as transfer standards.

The District Laboratory verifies the time with the NIST@ Time clock which picks up the radio signal from Boulder, Colorado, against which other lab and field devices, including the volumetric flow meter and FRM samplers, are compared.

16.1.4 Field

As indicated in 16.1.3, the following calibrations are performed in the field:

- calibration of the MFM in FRM samplers against the flow rate transfer standard
- calibration of sampler temperature and pressure sensors against the temperature transfer standard and pressure transfer standard

The field equipment and calibration instruments will follow the calibration and recertification schedule as listed in Table 16-1.

Table 16-1 Field Equipment Calibration/Certification Schedule

Instrument	Frequency
R&P, BGI FRM Single-Filter Sampler	Annual or if verification check fails
Mass Flow Meter	"
Ambient Temperature Sensor	"
Filter Temperature Sensor	"
Ambient Pressure Sensor	"
R&P Sequential Sampler	Annual or if verification check fails
mass flow meter	"
Ambient Temperature Sensor	"
Filter Temperature Sensor	"
Ambient Pressure Sensor	"
Calibration Standard FTS orifice	Annual
Calibration Standard Temperature Sensor	Annual
Calibration Standard Pressure Sensor	Annual
Temperature Verification Standard	Annual
Pressure Verification Standard	Annual
Clock/Timer Verification Standard	Annual

16.2 Calibration Methods

16.2.1 Laboratory- Gravimetric (Mass) Calibration

The calibration and QC (verification) checks of the microbalance are addressed in Elements 13.3 and 16.1.1 and Appendix B of this QAPP. For the following three reasons, the multipoint calibration for this method will be zero, 100 and 200 mg: 1) the required sample collection filters weigh between 100 and 200 mg, 2) the anticipated range of sample loadings for the 24 hour sample period is rarely going to be more than 200 µg, and 3) the lowest, commercially available check weights that are certified according to nationally accepted standards are only in the single milligram range. Since the critical weight is not the absolute unloaded or loaded filter weight, but the difference between the two, the lack of microgram standard check weights is not considered cause for concern about data quality, as long as proper weighing procedure precautions are taken for controlling contamination, or other sources of mass variation in the procedure (see SOP in the Appendix B).

16.2.2 Laboratory (and Field) -Flow Calibration.

Monthly Maintenance QC Checksheets will be submitted to the Air Monitoring managers with the monthly data to ensure QA/QC checks are being performed per scheduled frequencies listed in Tables 6-4 and 7-4 in Elements 6 and 7, respectively.

Method Summary: After equilibrating the calibration device to the ambient conditions of the sampler, install a filter cassette containing an unused 46.2 mm filter in the sampler. After removing the inlet from the sampler, connect the flow calibration device on the sampler down tube. If the sampler has not been calibrated before, or if the previous calibration was not acceptable, perform a leak check according to the manufacturer's operational instruction manual, which is incorporated into the SOP in Appendix E.

Otherwise, place the sampler in calibration mode and perform a three-point calibration/verification or a one-point flow rate verification. The field staff will only perform a leak check after calibration or if verification is outside of the acceptance criteria.

Following the calibration or verification, turn off the sampler pump, remove the filter cassette from the filter cassette holder, remove the flow rate calibration device, (and flow adaptor device if applicable), and replace the sampler inlet. If the flow rate is determined to be outside of the required target flow rate range, attempt to determine possible causes by minor diagnostic and trouble shooting techniques (e.g., leak checks, etc.), including those listed in the manufacturer's operating instruction manual. Do **not** attempt extensive field repairs or flow rate adjustments.

16.2.3 Sampler Temperature Calibration Procedure.

Both the ambient air and filter temperature sensors will be calibrated once per year. The ambient air sensor is located inside the shielded fixture on the outside of the PM10 sampler and is easy to unfasten and remove for comparison to a transfer standard for temperature. The three-point verification/calibration will be conducted at the field site.

The filter temperature sensor is located in the (open) space just below the filter cassette. It is threaded through the walls of the filter cassette holding assembly section of the sampler and removal of plastic or metal fittings is required to remove the sensor and its associated wiring. It is difficult to calibrate this sensor in the field and, therefore, single-point side-by-side ambient temperature comparisons with the temperature transfer standard will the made.

Several steps to follow in calibrating the ambient air temperature sensor are given in the SOP in Appendix E and in the following summary. Refer to the operator's instruction manual for sampler-specific procedures and instructions.

Remove the ambient temperature sensor from the radiation shield. Prepare a convenient container (an insulated vacuum wide mouth thermos bottle) for the hot temperature water bath, ambient temperature water bath and the ice slurry bath. Wrap the sensor(s) and a thermometer together with rubber band, ensure that all the probes are at the same level. Prepare the ambient or ice slurry solution according to the SOP in Appendix E. Immerse the sensor(s) and the attached thermometer in the ambient temperature bath. Wait at least 5 minutes for the ambient thermal mass and the sensor/thermometer to equilibrate. Wait at least 15 minutes for equilibration with
the ice slurry before taking comparative readings.

For each thermal mass, in the order: Cold, Ambient, Hot, make a series of five measurements per temperature bath, taken about one minute apart. If the measurements indicate equilibrium, average the five readings and record the result as the sensor temperature relative to the thermometer.

A similar process will be used to verify the calibration of continuously-reading temperature sensors used in the gravimetric laboratory.

16.2.4 Sampler Pressure Calibration Procedure. Summarized here and detailed version attached as SOP in Appendix E.

General: According to ASTM Standard D 3631 (ASTM 1977), a barometer can be calibrated by comparing it with a secondary standard traceable to a NIST primary standard.

Precautionary Note: Protect all barometers from violent mechanical shock and sudden changes in pressure. A barometer subjected to either of these events must be recalibrated. Maintain the vertical and horizontal temperature gradients across the instruments at less than 0.1°C/m. Locate the instrument so as to avoid direct sunlight, drafts, and vibration.

A Fortin mercury type of barometer is used in the Laboratory to calibrate and verify the aneroid barometer used in the field to verify the internal barometric sensors of the PM10 samplers. Details are provided in 16.4.1, below, and in Appendix E.

16.2.5 Sampler and Standard Volumetric Flow Rate Sensors with Built-in Clocks

Time can be verified over phone lines from NIST (in Boulder, Colorado, directly or through the NIST calibration service in Gaithersberg, MD) or from the NIST radio-linked clocks in Bishop or Keeler. See Appendix B for details (or in NIST standardization handbooks and catalogues).

16.2.6 Procedure for Verifying Relative Humidity Control/Monitoring data for the Gravimetric Laboratory Only

A thermometer bearing an NIST-traceable certification is used by laboratory personnel to verify the temperature and a Psychrodyne powered wet bulb/dry bulb psychrometer is used to verify the relative humidity recorded by the Dickson weekly chart recorder and the Vaisala HMP35C sensor used to continuously monitor environmental conditions within the gravimetric laboratory. For details of this procedure, see Appendix B.

16.3 Calibration Standard Materials and Apparatus

Table 16-2 presents a summary of the specific standard materials and apparatus used in calibrating measurement systems for parameters necessary to generate the PM10 data required in 40 CFR Part 58 and EPA Quality Assurance Guidance Documents 2.10 and 2.11.

Table 16-2 Standard Materials and/or Apparatus for PM2.5 Calibration

Parameter M-Material A=Apparatus	**Std. Material**	**Std. Apparatus**	**Mfr. Name**	**Model #**	**Variable Control Settings**
Mass M	Standard Check weight	NA	*Troemner*	Class 1	NA
Temperature					
M+A	Hg	Thermometer	*Brooklyn*	PM	*
M+A	H20	Thermal mass (Thermos)	*TBD*	TBD	NA
M+A	NA	Thermistor	*TBD*	TBD	*
Pressure					
M+A	Hg	Fortin			*
A	NA	Aneroid	*TBD*		*

Flow Rate					
A	NA	Piston Meter	*BIOS*		*
A		Mass Flow Meter	*TBD*		NA
A		Adapter	*R&P, BGI*		NA
A		Orifice Flow Meter	*Chinook Engrg.*		
Relative Humidity			*Environmental*		
A	NA	Sling Psychrometer	*Tectronics Corp.*	Psychro-Dyne	

*- See manufacturer's operating manual an/or instruction sheet

16.4 Calibration Standards

Flow Rate

The flow rate standard apparatus used for flow-rate calibration (field- NIST-traceable, MFM and orifice flow meter; Laboratory-NIST-traceable graphite piston flow meter and time monitor) has its own certification and is NIST-traceable. A calibration relationship for the flow-rate standard, such as an equation, curve, or family of curves, is established by the manufacturer (and verified if needed) to be accurate within 2% over the expected range of ambient temperatures and pressures at which the standard will be used. The District flow rate standard will be recalibrated every year in the case of the orifice flow meter.

The actual frequency with which this recertification process must be completed depends on the type of flow rate standard - some are more stable than others. The Laboratory will maintain a database from which control charts (a running plot of the difference or % difference between the flow-rate standard and the NIST-traceable primary flow-rate or volume standard) for all comparisons can be produced. The minimum recertification frequency is once per year. Field staff who conduct field calibrations will track changes from recertification to recertification to assure that performance is not compromised.

Temperature

The operations manuals associated with the District's samplers identify types of temperature standards recommended for calibration and provide a detailed calibration procedure for each type that is specifically designed for the particular sampler.

The U.S. EPA Quality Assurance Handbook, Volume IV (EPA 1995), Section 4.3.5.1, provides information on calibration equipment and methods for assessing response characteristics of temperature sensors.

The temperature standard used for temperature calibration will have its own certification and be traceable to a NIST primary standard. A calibration relationship to the temperature standard (an equation or a curve) will be established that is accurate to within 2% over the expected range of ambient temperatures at which the temperature standard is to be used. The temperature standard must be reverified and recertified at least annually. The District will use an ASTM- or NIST-traceable mercury in glass thermometer, for laboratory calibration.

Great Basin Unified APCD Standards

The temperature sensor standards chosen by the lab and field staff and managers are based on standard materials contained in a standardized apparatus; each has been standardized (compared in a strictly controlled procedure) against temperature standards the manufacturers obtained from NIST.

The District Laboratory standard is a NIST-traceable glass mercury thermometer from the *Brooklyn Thermometer Company*@, with a certificate summarizing the company's NIST traceability protocol and documenting the technician's signature, comparison date, identification of the NIST standard used, and the mean and standard deviation of the comparison results.

The District field temperature standards are thermocouples with digital readout modules. Each probe is calibrated with an NIST-traceable thermometer before being used in the field.

Pressure

The Fortin mercurial type of barometer works on fundamental principles of length and mass and is therefore more accurate but more difficult to read and correct than other types. By comparison, the precision aneroid barometer is an evacuated capsule with a flexible bellows coupled through mechanical, electrical, or optical linkage to an indicator. It is potentially less accurate than the Fortin type but can be transported with less risk to the reliability of its measurements and presents no danger from mercury spills. The Fortin type of barometer is best employed as a higher quality laboratory standard used to adjust and certify an aneroid barometer in the laboratory.

16.4.1 Standards Lab

The GBUAPCD pressure standard is a Fortin-type mercury barometer.

16.4.2 Field

The field working standard is an aneroid barometer with digital readout.

16.5 Calibration Frequency

See Table 14-1 for a summary of field QC checks that includes frequency and acceptance criteria and references for calibration and verification tests of single and sequential sampler flow rate, temperature, pressure, and time. See Table 14-2 for a similar summary of laboratory QC, including frequency of primary and working mass standards and conditioning/weighing room temperature and relative humidity.

The field sampler flow rate, temperature and pressure sensor verification checks include 1-point checks at least monthly and multipoint checks (verification without adjustment unless needed as determined independently and calibration performed by the vendor's authorized service representative) at least annually.

All of these events, as well as sampler and calibration equipment maintenance, will be documented in field data records and notebooks and annotated with the flags noted in Appendix L of 40 CFR Part 50, the manufacturer's operating instruction manual, and any documents indicated in Element 22.7.2 of this document. Laboratory and field activities associated with equipment used by the respective technical staff will be kept in record notebooks as well. The records will normally be controlled by the managers, and located in the labs or field sites when in use or at the manager's offices when being reviewed or used for data validation.

References

1. ASTM. 1977. Standard test methods for measuring surface atmospheric pressure. American Society for Testing and Materials. Philadelphia, PA. Standard D 3631-84.

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3. . EPA (1997a) National Ambient Air Quality Standards for Particulate Matter - Final Rule. 40 CFR Part 50. *Federal Register,* **62**(138):38651-38760. July 18,1997.

4. EPA. 1997b. Ambient air monitoring reference and equivalent methods. U.S. Environmental Protection Agency. 40 CFR Part 53, as amended July 18, 1997.

5. EPA. 1997. Reference method for the determination of fine particulate matter as $PM_{2.5}$ in the atmosphere. U.S. Environmental Protection Agency. 40 CFR Part 58, Appendix L, as amended July 18, 1997.

6. EPA. 1995. Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements. U.S. Environmental Protection Agency. Document No. EPA/600/R-94/038d. Revised March.

7. NIST. 1976. Liquid-in-glass thermometry. National Institute of Standards and Technology. NBS Monograph 150. January.

8. NIST. 1986. Thermometer calibration: a model for state calibration laboratories. National Institute of Standards and Technology. NBS Monograph 174. January.

9. NIST. 1988. Liquid-in-glass thermometer calibration service. National Institute of Standards and Technology. Special publication 250-23. September.

10. NIST. 1989. The calibration of thermocouples and thermocouple materials. National Institute of Standards and Technology. Special publication 250-35. April.

17.0 Inspection/Acceptance for Supplies and Consumables

17.1 Purpose

The purpose of this element is to establish and document a system for inspecting and accepting all supplies and consumables that may directly or indirectly affect the quality of the PM10 Program. The District PM10 monitoring network relies on various supplies and consumables that are critical to its operation. Having documented inspection and acceptance criteria helps ensure the consistency of the supplies. This Element details the supplies/consumables, their acceptance criteria, and the required documentation for tracking this process.

17.2 Critical Supplies and Consumables

There are many components to the District's PM10 monitoring network. This Element attempts to describe the needed supplies for this network and includes items for the gravimetric laboratory and the field. Table 17.0.1 details the various components:

Table 17.0.1 Critical Supplies and Consumables

Area	Item	Description	Vendor	Model Number
Sampler	Rain Collector	Glass	R & P BGI	*To be determined* *To be determined*
Sampler	V-seals	The V-seals that seal in the filter cassette when it is placed in the sampler.	*To be determined*	
Sampler	In-line Filter	Downstream of sample collection and upstream of sample pump.	R & P BGI	*To be determined* *To be determined*
Sampler	Battery	Internal Sampler Battery.	R & P Andersen	*To be determined* *To be determined*
Sampler	Fuses	In sampler	R & P Andersen	*To be determined* *To be determined*
Sampler	Floppy Disks	3.5" Pre-formatted	Purchase local	
Filter	Filters	46.2 mm teflon	Whatman	7592-004
Filter	Petri-dish	47 mm with securing ring.	Gelman	7231
Filter	Filter Cassettes (single)	As per CFR design	R & P BGI	*N/A* *N/A*
Filter	Filter Cassette Holder, Protective Containers	For securing cassette(s)	R & P BGI	*N/A*
Filter	Sequential Sampler Cassette Magazine	For use with R&P Samplers	R & P	*N/A*
Filter	Filter Handling Containers	For transport to and from the field	*To be determined*	*N/A*
Gravimetric Laboratory	Staticide	Anti-static solution	Cole-Parmer	E-33672-00
Gravimetric Laboratory	Static Control Strips	Polonium 500μC_i	Nuclear Products	110653
Gravimetric Laboratory	Air Filters	High Efficiency	Purchase Local	

All	Powder Free Antistatic Gloves	Vinyl, Class M4.5	Fisher Scientific	Small 11-393-85A Medium 11-393-85A Large 11-393-85A X-Large 11-393-85A
All	Low-lint wipes	4.5" x 8.5" Cleaning Wipes	Kimwipes	34155

17.3 Acceptance Criteria

Acceptance criteria must be consistent with overall project technical and quality criteria. Some of the acceptance criteria are specifically detailed in 40 CFR Part 50. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

Table 17.0.2 details the acceptance test and limits for procurement of supplies and consumables to be utilized in the District's PM10 network:

Table 17.0.2 Acceptance Criteria for Supplies and Consumables

Equipment	Acceptance Criteria	Action if Requirements not met
Rain Collector	Not broken	Call Vendor, will likely not return
O-Rings, V-seals	Of the correct size	Return
In-line Filter	Of the correct size	Return
Battery	Correct size and voltage	Return
Fuses	Correct size and specification	Return
Floppy Disks	Undamaged and pre-formatted	Return
Filters, 46.2 mm Teflon	Tested and Accepted by the U.S. EPA with documentation of acceptance in package. Should meet visual inspection and pre-weight (110-160mg) criteria	Call David Lutz, U.S. EPA (919) 541-5476
Petri-dish	Clean and appropriately sized for 46.2 mm filters	Return
Filter Cassettes (single)	Of the correct type and make	Return
Filter Cassette Holder, Protective Containers	Of the correct size so that filter cassettes will not move around that could potentially lead to dislodging particulate	Return
Sequential Sampler Cassette Holder	Of the correct type for use with the sequential sampler model	Return
Filter Handling Containers	Clean	Clean
Anti-Static Solution	Of the correct type	Return
Static Control Strips	Manufactured within past 3 months and between 400 and 500μC_i of Polonium	Call vendor
Air Filters	Of the size and quality specified	Return
Powder Free Antistatic Gloves	Of the size and quality specified	Return
Cleaning Wipes	Of the quality specified	Return

17.4 Tracking and Quality Verification of Supplies and Consumables

Tracking and quality verification of supplies and consumables have two main components. The first is the need of the end user of the supply or consumable to have an item of the required quality. The second need is for the purchasing department to accurately track goods received so that payment or credit of invoices can be approved. In order to address these two issues, the following procedures outline the proper tracking and documentation activities to follow:

1. Receiving personnel will perform a rudimentary inspection of the packages as they are received from the courier or shipping company. Note any obvious problems with a receiving shipment such as crushed box or wet cardboard.

2. The package will be opened, inspected and contents compared against the packing slip.

3. Supply/consumable will be compared to the acceptance criteria in Table 17.0.2.

4. If there is a problem with the equipment/supply, note it on the packing list, notify the supervisor of the receiving area and immediately call the vendor.

5. If the equipment/supplies appear to be complete and in good condition, sign and date the packing list and send to accounts payable so that payment can be made in a timely manner.

6. Notify appropriate personnel that equipment/supplies are available. For items such as the 46.2 mm Teflon filters, it is critical to notify the laboratory manager of the gravimetric laboratory so sufficient time for de-gassing of the filters can be allowed.

7. Stock equipment/supplies in appropriate pre-determined area.

8. For supplies, consumables, and equipment used throughout the PM10 program, document when these items are changed out. If available, include all relevant information such as: model number, lot number, and serial number.

18.0 Data Acquisition Requirements

This Element addresses data not obtained by direct measurement from the PM10 Ambient Air Quality Monitoring 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. Use of information that fails to meet the necessary Data Quality Objectives (DQOs) for the PM10 Ambient Air Quality Monitoring Program can lead to erroneous trend reports and regulatory decision errors. The policies and procedures described in this element apply both to data acquired through the District monitoring program and to information previously acquired and/or acquired from outside sources.

18.1 Acquisition of Non-Direct Measurement Data

The PM10 Ambient Air Quality Monitoring Program relies on data that are generated through field and laboratory operations, however, other significant data are obtained from sources outside the District or from historical records. This Element lists these data and addresses quality issues related to the PM10 Ambient Air Quality Monitoring Program.

Chemical and Physical Properties Data

Chemical and physical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources. The following sources may be used in the PM10 Ambient Air Quality Monitoring Program without prior approval:

- National Institute of Standards and Technology (NIST)
- ISO, IUPAC, ANSI, and other widely-recognized national and international standards organizations
- U.S. EPA
- The current edition of certain standard handbooks may be used without prior approval. Two that are relevant to the fine particulate monitoring program are CRC Press' *Handbook of Chemistry and Physics*, and *Lange's Handbook.*

Geographic Location

Another type of data that will commonly be used in conjunction with the PM10 Ambient Air Quality Monitoring Program is geographic information. For the current sites, the District will locate these sites using the global positioning systems (GPS).

Historical Monitoring Information of the District

The District has operated a network of ambient air monitoring stations since the 1970's. Historical monitoring data and summary information derived from that data may be used in conjunction with current monitoring results to calculate and report trends in pollutant concentrations. In calculating historical trends, it is important to verify that historical data are fully comparable to current monitoring data. If different methodologies were used to gather the historical data, the biases and other inaccuracies must be described in trends reports based on

that data. Direct comparisons of PM10 with historical TSP or PM10 data will not be reported or used to estimate trends. Dichotomous sampler data (fine portion) may be used to establish trends in PM2.5 concentration; however, evidence must be presented to demonstrate that results of the two methods are comparable.

External Monitoring Data Bases

Users should review available QA/QC information to assure that the external data from other organizations or entities are comparable with District measurements and that the original data generator had an acceptable QA program in place. It is the policy of the District that no data obtained from any other organization or agency shall be used in creating published reports or regulatory actions unless the data were collected under a QA program that meets the requirements of 40 CFR Part 58, and has been approved by the ARB's Quality Assurance Section Manager or the US EPA. Such data that have received approval may be entered into AIRS.

Data from the U.S. EPA AIRS data base may be used in published reports with appropriate caution. Care must be taken in reviewing/using any data that contain flags or data qualifiers. If data are flagged, such data shall not be utilized unless it is clear that the data still meet critical QA/QC requirements. It is impossible to assure that a data base such as AIRS is completely free from errors including outliers and biases, so caution and skepticism is called for in comparing District data with data from other reporting agencies as reported in AIRS.

Meteorological Data From Other Sources

Meteorological data are gathered from other sources such as the U.S. Weather Service sites to provide information required when developing monitoring sites, computing corrections needed to convert from standard conditions to local conditions, and to support analysis and modeling efforts. These data are not reported to AIRS and are clearly identified when used in assessment and modeling efforts.

19.0 Data Management

19.1 Background and Overview

This Element describes the data management operations pertaining to PM10 measurements for the SLAMS stations operated by the Great Basin Unified APCD (District). This Element includes an overview of the mathematical operations and analyses performed on raw ("as-collected") PM10 data. These operations include data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval.

Data processing activities for PM10 data are summarized in Figure 19.0.1. Data processing steps are integrated, to the extent possible, into the existing data processing system used for the District's SLAMS network. All sampling data will be entered into a data management system (DMS) either through manual entry, electronic transfer from the field, or both. The DMS data are stored on a database running on a PC-compatible platform. All PM10 mass results are electronically transferred from the microbalance to a dedicated gravimetric laboratory computer, where the final concentrations are calculated. The data from the laboratory are provided to the data management group on diskette and in hardcopy form. The hardcopy data are then manually entered into the database by the data management group as a final QC check. This process is shown in Figure 19.0.1.

Each Ambient Air Monitoring Station operated by the District utilizes a Campbell Scientific Incorporated data logger. These data loggers provide data collection for continuous analyzers at each station. There are currently no facilities to remotely acquire the PM10 sampler data, however, the District is examining the possibility of upgrading these stations in the future so that sampler status, flow rate, temperatures, etc. can be monitored remotely.

Filter tracking and chain of custody information are entered into the PM10 DMS at two main stages as shown in Figure 19.0.1. The systems analysts are able to obtain reports on status of samples using the DMS. All users must be authorized by the Senior Research & Systems Analyst of the data processing group., and receive permission necessary to log on to the DMS. Once permission is received, all data processing privileges are available to the authorized user.

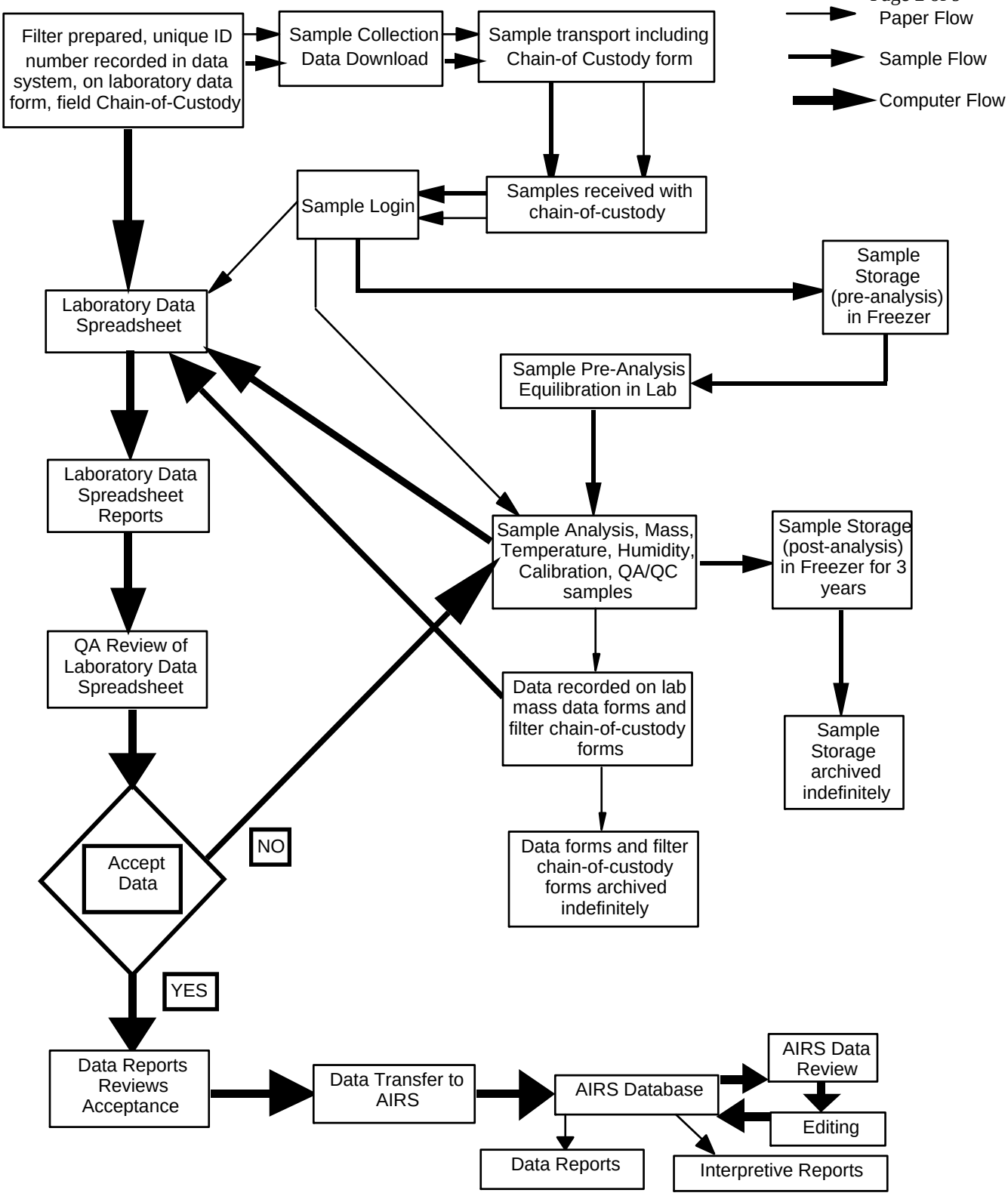

Figure 19.0.1 Draft PM10 data flow diagram

19.2 Data Recording

Data entry, validation, and verification functions are all part of the overall data management process. Data from gravimetric lab forms shown in Figure 19.0.1 are entered by laboratory personnel. Procedures for filling out the laboratory sheets and subsequent data entry are provided in SOPs listed in Appendix B.

19.3 Data Validation

Data validation involves checking that data processing operations have been carried out correctly and monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once problems are identified, the data can be corrected or invalidated, and corrective actions can be taken for field or laboratory operations. Numerical data stored in the DMS are never internally overwritten by condition flags. Flags denoting error conditions or QA status are saved as separate fields in the database, so that it is possible to recover the original data.

The following validation functions are part of the District's data management process and are used to ensure the quality of data entry and data processing operations:

- **Range Checks** - almost all monitored parameters have simple range checks programmed in. For example, valid times must be between 00:00 and 23:59, etc. The laboratory technician entering the data is notified by the data reviewer when an entry is out of range.
- **Completeness Checks** - When the data are processed certain completeness criteria must be met. For example, each filter must have a start time, an end time, an average flow rate, dates weighed, and operator and technician names. These entries are verified by the laboratory technician and by the data reviewer.
- **Internal Consistency and Other Reasonableness Checks -** Several other internal consistency checks are part of the data management process. For example, the end time of a filter sampling period must be greater than the start time. Computed filter volume (integrated flow rate over the monitoring period) must be approximately equal to the exposure time multiplied by the nominal flow. Additional consistency and other checks will be implemented as the result of problems encountered during data screening.
- **Data Retention** - Raw data sheets are retained on file in the District's main office for a minimum of five years, and are readily available for audits and data verification activities. After five years, hardcopy records and computer backup media are cataloged and boxed for storage. Physical samples such as filters are also cataloged and boxed for storage.
- **Statistical Data Checks** - Errors found during statistical screening will be traced back to original data entry files and to the raw data sheets, if necessary. These checks shall be run on a monthly schedule and prior to any data submission to AIRS. Data validation is the process by which raw data are screened and assessed before they can be included in the main database.
- **Sample Batch Data Validation**- which is discussed in Element 23, associates flags that are generated by QC values outside of acceptance criteria, with a sample batch. Batches containing more than one flag may be rerun and/or invalidated.

Table 19.0.1 summarizes the validation checks applicable to the PM10 data.

Table 19.0.1 Validation Check Summaries

Type of Data Check	Electronic Transmission and Storage	Manual Checks	Automated Checks
Data Parity and Transmission Protocol Checks	X	X	
Date and Time Consistency	X	X	X
Completeness of Required Fields	X	X	X
Range Checking		X	
Statistical Outlier Checking		X	
Manual Inspection of Charts and Reports		X	
Sample Batch Data Validation		X	

One key operational criterion for PM10 sampling is precision. As defined in 40 CFR Part 58, Appendix A, precision is based on differences between collocated sampler results. The District will inspect the results of collocated sampling during each quarterly data review activity. These data will be evaluated as early in the process as possible, so that potential operational problems can be addressed. The objective of the District will be to optimize the performance of its PM10 monitoring equipment. Initially, the results of collocated operations will be control charted (see Element 14). From these charts, control limits can be established to flag potential problems. Multiple collocation results must be accumulated to assess data quality with confidence. However, even limited data can be used for system maintenance and corrective action.

19.4 Data Transformation

Calculations for transforming raw data from measured units to final concentrations are relatively straightforward, and many are carried out in the sampler data processing unit before being recorded. The following relations in Table 19.0.2 pertain to PM10 monitoring:

Table 19.0.2 Raw Data Calculations

Parameter	Units	Type of Conversion	Equation
Filter Volume (V_a) *	m^3	Calculated from average Flow Rate (Q_{ave}) in L/min, and total elapsed time (t) in min. multiplied by the unit conversion (m^3/L)	$V_a = Q_{ave} * t * 10^3$
Mass on Filter (M_{10})	µg	Calculated from filter post-weight (M_f) in mg and filter pre-weight (M_i) in mg, multiplied by the unit conversion (µg/mg)	$M_{10} = (M_f - M_i) * 10^3$
PM_{10} Concentration (C_{PM10})	$\mu g/m^3$	Calculated from laboratory data and sampler volume	$PM10 = \frac{M_{10}}{V_a}$

* Many FRM instruments will provide this value from the data logger.

19.5 Data Transmittal

Data transmittal is the transfer of data from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file or electronic transfer of data over a telephone or computer network. Table 19.0.3 summarizes the District's data transfer operations.

Table 19.0.3 Data Transfer Operations

Description of Data Transfer	Originator	Recipient	QA Measures Applied
Electronically Transmit Weighing Data from balance into Laboratory Spreadsheet and write information on laboratory data forms	Laboratory Technician (handwritten data form)	Data Processing Personnel	Entered from hardcopy printouts of spreadsheets into District database
Electronic data transfer	(between computers or over network)	Data Processing Personnel	Parity Checking; transmission protocols
Filter Receiving and Chain-of-Custody	Field Technician	Laboratory Technician	Filter numbers are verified manually
AIRS data summaries	Systems Analyst	AIRS (U.S. EPA)	Sr. Systems Analyst

The District will report all PM10 ambient air quality data and information specified by the AIRS Users Guide (Volume II, Air Quality Data Coding, and Volume III, Air Quality Data Storage) or its replacement, coded in the AIRS-AQS format. Such air quality data and information will be fully screened and validated and will be submitted directly to the AIRS-AQS via electronic transmission in accordance with the quarterly schedule. The specific quarterly reporting periods and due dates are shown in the Table 19.0.4.

Table 19.0.4 Data Reporting Schedule

Reporting Period	Due Date
January 1-March 31	June 30
April 1-June 30	September 30
July 1-September 30	December 31
October 1-December 31	March 31

19.6 Data Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. The PM10 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. Examples of data summaries include:

- average PM10 concentration for a station or set of stations for a specific time period
- accuracy and precision statistics based on accumulated FRM/FEM data
- data completeness reports based on numbers of valid samples collected during a specified period

The Audit Trail is another important concept associated with data transformations and reductions. An audit trail is a data structure that provides documentation for changes made to a data set during processing. Typical reasons for data changes that would be recorded include:

- corrections of data input due to human error
- application of revised calibration factors

- addition of new or supplementary data
- flagging of data as invalid or suspect
- logging of the date and times when automated data validation programs are run

The DMS audit trail is implemented in the District data management process. Audit trail records will include the following fields:

- operator's identity
- date and time of the change
- table and field names for the changed data item
- reason for the change
- full identifying information for the item changed (date, time, site location, parameter, etc.)
- value of the item before and after the change

The audit trail is produced manually and documents changes, therefore, there is the ability to reverse changes after they have been made incorporated into the system.

Audit trail information is moved to backup media after the data are reported to AIRS. All backups and hardcopy manually completed forms will be retained so that any audit trail information can be retrieved for at least five years.

19.7 Data Analysis

The District is currently implementing the data summary and analysis requirements contained in 40 CFR Part 58, Appendix A. It is anticipated that as the PM10 Monitoring Program continues, additional data analysis procedures may be developed. The following specific summary statistics will be tracked and reported for the PM10 network:

- Single sampler accuracy (based on collocated FRM data, flow rate performance audits, and FRM performance evaluations)
- Single sampler precision (based on collocated data)
- Network-wide precision (based on collocated FRM data, flow rate performance audits, and FRM performance evaluations)
- Data completeness

Equations used for these reports are given in the Table 19.0.5.

Table 19.0.5 Report Equations

Criterion	Equation	Reference
Automated Sampler Precision: Flow - Single Check (d_i) X_i is reference flow; Y_i is measured flow (Equation also used for Single Sampler Accuracy)	$d_i = \frac{Y_i - X_i}{X_i} * 100$	40 CFR 58 Appendix A, Section 5.1.1.1

Single Sampler Precision (d_i) - X_i and Y_i are concentrations from the primary and duplicate samplers, respectively.	$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} * 100$	5.3.1.2
Completeness	$\text{Completeness} = \frac{N_{valid}}{N_{invalid}} * 100$	--

19.8 Data Flagging -Sample Qualifiers

A sample qualifier or a result qualifier consists of two to four alphanumeric characters which act as an indicator of the fact and the reason that the data value (a) did not produce a numeric result, (b) produced a numeric result but it is qualified in some respect relating to the type or validity of the result, or (c) produced a numeric result but for administrative reasons is not to be reported outside the laboratory. Qualifiers will be used both in the field and in the laboratory to signify data that may be suspect due to contamination, special events, or failure of QC limits. Some flags will be generated by the sampling instrument (see Table 6.0.2). Appendix C contains a complete list of the data qualifiers for the field and laboratory activities. Qualifiers will be placed on field and bench sheets with additional explanations in free form notes areas. When sample batch information is entered into DMS and validated, (see Element 23) flags will be applied as necessary. Table 19.0.6 lists the sample batch flags that will be used in the DMS.

Table 19.0.6 Sample Batch Quality Control Flags

Requirement	Acceptance Criteria	Flag
Blanks		
Field Blanks	>±30 µg difference	FB
Lab Blanks	>±15 µg difference	LB
Precision Checks		
Laboratory Duplicate	±15 µg	REP
Accuracy		
Balance Check	≤ 3 µg	BC

During the sample validation process, the flags will be used to decide on validating or invalidating individual samples or batches of data. Element 23 discusses this process.

There are several other flags associated with laboratory operations. See Appendix C for a complete list of data qualifiers/flags.

19.9 Data Tracking

The DMS and other District software and hardcopy forms contain the information necessary to track and account for the whereabouts of filters and the status of data processing operations for specific data. The following data are used to track filter location and status:

- Laboratory

- Filter receipt (by lot)
- Filter pre-sampling weighing (individual filter number first enters the system)
- Filter packaged for the laboratory (filter numbers in each package are recorded)
- Laboratory
- Filter Chain-of-Custody (package is opened and filter numbers are logged in)
- Filter post-sampling weighing
- Filter archival

Tracking reports may be generated by any personnel with access to the District computer systems. The following information is available:

- Location of any filter (by filter number)
- List of all filters sent to a specified site that have not been returned
- List of all filters that have not been returned and are more than 30 days past initial weighing date
- List of all filters in the filter archive
- List of all filters that have been received but have not been post-weighed

The laboratory technician is responsible for tracking filter status at least once per week and following up on anomalies such as excessive holding time in the laboratory before reweighing.

19.10 Data and Filter Storage and Retrieval

Data and filter archive policies for the PM10 data are shown in Table 19.0.7.

Table 19.0.7 Data and Filter Archive Policies

Data Type	Medium	Location	Retention Time	Final Disposition
Weighing records; chain of custody forms	Hardcopy	Laboratory	3 years	Archived
Laboratory Notebooks	Hardcopy	Laboratory	3 years	Archived
Field Notebooks	Hardcopy	Data Processing	3 years	Archived
PM10 MP Data Base (excluding Audit Trail records)	Electronic (on-line)	District Main Office	indefinite (may be moved to backup media after 5 years)	Backup media retained indefinitely
PM10 MP Audit Trail records	Hardcopy	Data Processing	3 years	Archived
Filters	Filters	Laboratory Freezer	3 years	Archived

The PM10 data reside on at least two PC-compatible computers in the District's main office.

Security of data in the PM10 database is ensured by the following controls:

- Password protection on the database
- Regular password changes (quarterly for continuing personnel; passwords for personnel leaving will be canceled immediately)
- Independent password protection on all dial-in lines
- Storage of media including backup tapes in locked, restricted access areas

20.0 Assessments and Response Actions

An assessment, for this QAPP, is defined as an evaluation process used to measure the performance or effectiveness of the quality system, the establishment of the monitoring network and sites and various measurement phases of the data operation.

The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and reporting phases is important to data users, who can then consider the impact of these control efforts on the data quality (see Element 21). Both qualitative and quantitative assessments of the effectiveness of these control efforts will identify those areas most likely to impact the data quality and to what extent. Periodic assessments of SLAMS data quality are required to be reported to U.S. EPA. On the other hand, the selection and extent of the QA and QC activities used by a monitoring agency depend on a number of local factors such as the field and laboratory conditions, the objectives for monitoring, the level of the data quality needed, the expertise of assigned personnel, the cost of control procedures, pollutant concentration levels, etc.

In order to ensure the adequate performance of the quality system, the California ARB and the Great Basin Unified Air Pollution Control District (District) will perform the following assessments:

- Network Reviews
- Systems Audits
- Field and Laboratory Performance Audits
- Data Quality Assessments

20.1 Assessment Activities and Project Planning

20.1.1 Network Reviews

Conformance with network requirements of the Ambient Air Monitoring Network set forth in 40 CFR Part 58 Appendices D and E is determined through annual network reviews of the ambient air quality monitoring system. The network review is used to determine how well a particular air monitoring network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. A PM10 Network review will be accomplished every year. Since the U.S. EPA Regions are also required to perform these reviews, the District will coordinate its activity with the ARB and EPA Region IX in order to conduct the reviews at the same time, if possible.

The following criteria will be considered during the review:

- date of last review
- areas where attainment status is being reviewed

- results of special studies, e.g. saturation sampling, point source oriented ambient monitoring, etc
- proposed network modifications since the last network review

In addition, pollutant-specific priorities may be considered (e.g., newly designated nonattainment areas, potential "problem areas", etc.).

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

- network files (including updated site information and site photographs)
- AIRS reports (AMP220, 225, 380, 390, 450)
- air quality summaries for the past five years for the monitors in the network
- emissions trends reports for dense population areas
- emission information, such as emission density maps for the region in which the monitor is located and emission maps showing the major sources of emissions
- National Weather Service summaries for monitoring network area

Upon receiving the information, it will be checked to ensure it is the most current available. Discrepancies will be noted on the checklist and resolved during the review. Files and/or photographs that need to be updated will also be identified. The following categories will emphasized during network reviews:

Number of Monitors - For SLAMS, the number of monitors required for PM10 depending upon the measurement objectives is discussed in 40 CFR Part 58 with additional details in the *Guidance for Network Design and Optimum Exposure for PM2.5 and PM10* . Element 10 of this QAPP discusses the PM10 Network. Adequacy of the network will be determined by using the following information:

- maps of historical monitoring data
- maps of emission densities
- dispersion modeling
- special studies/saturation sampling
- best professional judgment
- SIP requirements
- revised monitoring strategies (e.g., lead strategy, reengineering air monitoring network)

For NAMS, areas to be monitored must be selected based on urbanized population and pollutant concentration levels. To determine whether the number of NAMS are adequate, the number of NAMS operating will be compared to the number of NAMS specified in 40 CFR Part 58, Appendix D. The number of NAMS operating can be determined from the AMP220 report in AIRS. The number of monitors required, based on concentration levels and population, can be determined from the AMP450 report and the latest census population data. The District currently operates no NAMS sites.

Location of Monitors - For SLAMS, the location of monitors is not specified in the regulations, but is determined by the EPA Regional Office, State, and/or Local agencies on a case-by-case basis to meet the monitoring objectives specified in 40 CFR Part 58, Appendix D. Adequacy of

the location of monitors can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information will be helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions and/or historical monitoring data versus monitoring locations will also be used.

During the network review, the stated objective for each monitoring location or site (see Element 10) will be assessed to confirm the suitability of the location and verify the spatial scale under which it is operating and, therefore, to determine whether these objectives can still be attained at the present location.

Conformance to 40 CFR Part 58 Appendix E - Probe Siting Requirements - Applicable siting criteria for SLAMS, and NAMS are specified in 40 CFR Part 58, Appendix E. The on-site visit will consist of the physical measurements and observations to determine compliance with the Appendix E requirements, such as height above ground level, distance from trees, paved or vegetative ground cover, etc. Since many of the Appendix E requirements will not change within one year, this check at each site will be performed as part of a site survey each time the site is visited.

Prior to the site visit, the reviewer will obtain and review the following:

- most recent hard copy of site description (including any photographs)
- data on the seasons with the greatest potential for high concentrations for specified pollutants
- predominant wind direction by season

A checklist similar to the checklist used by the U.S. EPA Regional offices during their scheduled network reviews will be used. This checklist can be found in the *SLAMS/NAMS/PAMS Network Review Guidance*, which is intended to assist the reviewers in determining conformance with Appendix E. In addition to the items on the checklist, the reviewer will also perform the following tasks:

- ensure that the sampling inlet(s) is(are) clean
- check equipment for missing parts, frayed cords, damage, etc
- record findings in field notebook and/or checklist
- take photographs/videotape in 8 directions (at 45° intervals from North, clockwise)
- document site conditions, with additional photographs/videotape

Other Discussion Topics - 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
- any 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
  - proposed regulations
  - funding

A report of the network review will be written within two months of the review (Element 21) and appropriately filed (Element 10).

20.1.3 System Audits

A system audit is a thorough and systematic onsite qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. The ARB's Quality Assurance Section (QAS) will conduct the system audit either as a team or as an individual auditor. The QAS will perform three system audit activities that can be accomplished separately or combined :

- Field - handling, sampling, shipping
- Laboratory - Pre-sampling weighing, shipping. receiving, post-sampling weighing, archiving, and associated QA/QC activities
- Data management - Information collection, flagging, data editing, security, upload

Key personnel to be interviewed during the audit are those individuals with responsibilities for: planning, field operations, laboratory operations, QA/QC, data management, and reporting. The audit activities are illustrated in Figure 20.0.1.

To ensure uniformity of the system audit, an audit checklist will be developed and used.

The audit team will discuss deficiencies with key personnel during the debriefing. They will be informed of any air quality data actions (AQDA) that will be issued for deficiencies that may require data invalidation

The QAS will send a copy of the final system audit report to U.S. EPA Region IX. Any corrective action taken will be included in the report.

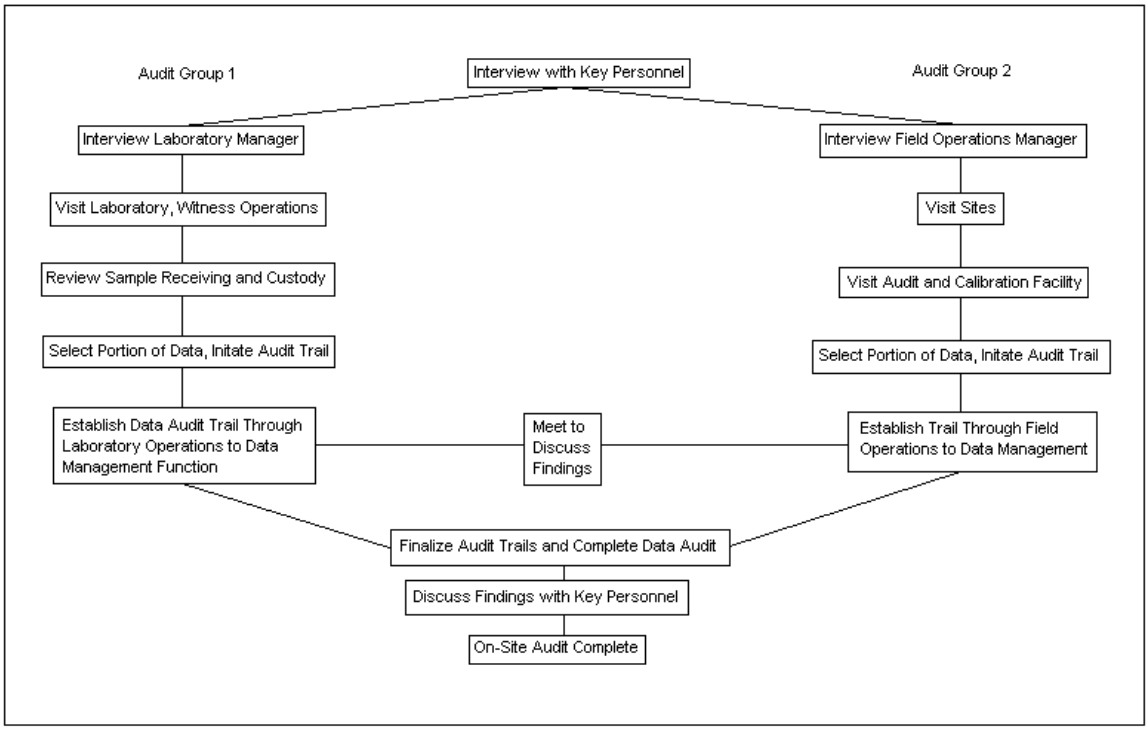

Figure 20.0.1 Audit Activities

Post-Audit Activities - The major post-audit activity is the preparation of the system audit report. The report will include:

- audit title and any other identifying information
- audit team leaders, audit team participants and audited participants
- background information about the project, purpose of the audit, dates of the audit, particular measurement phase or parameters that were audited, and a brief description of the audit process
- summary and conclusions of the audit and corrective action required
- attachments or appendices that include all audit evaluations and audit finding forms

To prepare the report, the audit team will meet and compare observations with collected documents and results of interviews and discussions with key personnel. Expected QA Project Plan implementation is compared with observed accomplishments and deficiencies and the audit findings are reviewed in detail. The system audit report will be submitted to the appropriate departments or agencies.

If the departments or agencies have written comments or questions concerning the audit report, the Audit Team will review and incorporate them as appropriate, and subsequently prepare and

resubmit a report in final form following receipt of the written comments. The report will include an agreed-upon schedule for corrective action implementation.

Follow-up and Corrective Action Requirements - The QAS and the audited organization may work together to solve required corrective actions. The audited organization has 30 days to respond to the follow-up and corrective action requirements in the system audit report. The QAS reviews the audited organization's responses to the follow-up and corrective action and works with the audited agency to resolve any discrepancies.

20.1.4 Field and Laboratory Performance Audits

Field and laboratory performance audits reveal how the data are handled, what judgments were made, and whether uncorrected mistakes were made. The audits can often identify the means to correct systematic data reduction errors. The audits will be performed every year and will also be part of the system audit. Thus, sufficient time and effort will be devoted to this activity so that the auditor or team has a clear understanding and complete documentation of data flow. Pertinent audit questions will appear on the system audit check sheets to ensure that the data collected at each stage maintains its integrity. The audits will serve as an effective framework for organizing the extensive amount of information gathered during the audit of laboratory, field monitoring, and support functions within the agency. The audits will have the same reporting/corrective action requirements as the system audit.

20.1.5 Data Quality Assessment

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the quality of data is adequate to support the decisions which are based on the DQOs. Data are appropriate if the level of uncertainty in a decision based on the data is acceptable.

The District's Air Quality Data Review Committee has the responsibility to assess the data quality and the suitability of the monitoring network. These functions are done on an annual basis as required under 40 CFR Part 58. Data are processed through data screening programs to determine whether they are suitable for use in attainment/nonattainment decisions. Data flagged during this procedure are subject to further evaluation using statistical techniques to determine possible causes of anomalies. Results of these analyses are forwarded to data collection staff for confirmation of the validity of the data. If the data are shown to be invalid, Air Quality Data Review Committee staff will remove the data from all relevant databases. All changes to the data are to be documented in air quality data action reports.

Measurement uncertainty will be estimated for both automated and manual methods. Terminology associated with measurement uncertainty is found within 40 CFR Part 58 Appendix A and includes: (a) Precision - a measurement of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, expressed generally in terms of the standard deviation; (b) Accuracy - the degree of agreement between an observed value and an accepted reference value, accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations. The individual results of these tests for each method or analyzer shall be reported to U.S. EPA.

Estimates of the data quality will be calculated on the basis of single monitors and aggregated to all monitors.

20.2 Documentation of Assessments

Table 20.0.1 summarizes each of the assessments discussed above.

Table 20.0.1 Assessment Summary

Assessment Activity	Frequency	Personnel Responsible	Schedule	Reporting/Resolution
Network Reviews App D App E	 1/ year 1/3 years	 GBUAPCD GBUAPCD	 6/2001 6/2001	GBUAPCD TO EPA & ARB
System Audits	1/3 years	Quality Assurance Section - ARB	2003	MLD Quality Assurance Section to GBUAPCD
Field and Laboratory Performance Audits	1/ year	Quality Assurance Section - ARB	annual	MLD Quality Assurance Section to GBUAPCD
Data Quality Assessment	1/year	GBUAPCD-Data Review Committee	6/2001	GBUAPCD to U.S. EPA Region IX & ARB

21.0 Reports to Management

This Element describes the quality-related reports and communications to management necessary to support SLAMS/NAMS PM10 network operations and the associated data acquisition, validation, assessment, and reporting activities. Unless otherwise indicated, data pertaining to PM10 will be included in reports containing monitoring data for other pollutants.

Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Quality assessments, including the evaluation of the technical systems, the measurement of performance, and the assessment of data, are conducted to help insure that measurement results meet program objectives and that necessary corrective actions are taken early, when they will be most effective.

Effective communication among personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following:

- adherence to scheduled delivery of data and reports,
- documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality
- analysis of the potential uncertainties in decisions based on the data

21.1 Frequency, Content, and Distribution of Reports

Required reports to management for PM10 monitoring and the SLAMS program in general are discussed in various Elements of 40 CFR Parts 50, 53, and 58. Guidance for management report format and content are provided in guidance developed by U.S. EPA's Quality Assurance Division (QAD) and the Office of Air Quality Planning and Standards (OAQPS). These reports are described in the following sub-elements.

21.1.1 Network Reviews

As required by 40 CFR Part 58 Appendix A, Section 4(a), revised July 18, 1997, the District's Air Quality Data Review Committee has assembled a list of all monitoring sites and their AIRS site identification codes and submitted the list to the U.S. EPA Region IX Office, with a copy to the Aerometric Information Retrieval System (AIRS)-Air Quality Subsystem (AQS). The AIRS-AQS is U.S. EPA's computerized system for storing and reporting of information relating to ambient air quality data. Whenever there is a change in this list of monitoring sites in a reporting organization, the District's Air Quality Data Review Committee will report this change to the U.S. EPA Region IX Office, to AIRS-AQS, and to ARB's MLD Quality Assurance Section and TSD Air Quality Data Review Section.

21.1.2 Quarterly Reports

Each quarter, the District will report to AIRS-AQS the results of all precision and accuracy tests carried out during the quarter. The quarterly reports will be submitted, consistent with the data reporting requirements specified for air quality data as set forth in 40 CFR Parts 58.26, 58.35, and 40 CFR Part 58, Appendix A, Section 4.

The data reporting requirements of 40 CFR Parts 58.28 and 58.35 apply to those stations designated SLAMS or NAMS. Required accuracy and precision data are to be reported on the same schedule as quarterly monitoring data submittals. The required reporting periods and due dates are listed in Table 21-1.

Table 21-1 Quarterly Reporting Schedule

Reporting Period	Due on or Before
January 1-March 31	June 30
April 1-June 30	September 30
July 1-September 30	December 31
October 1-December 31	March 31 (following year)

Air quality data submitted for each reporting period will be edited, validated, and entered into the AIRS-AQS using the procedures described in the *AIRS Users Guide, Volume II, Air Quality Data Coding.* The District's Technical Services Group and Data Processing Group will be responsible for preparing the data reports, which will be reviewed by the Air Monitoring Specialist and the Senior Systems Analyst before they are transmitted to U.S. EPA.

21.1.3 System Audit Reports

The ARB conducts System Audits of the District's monitoring system (Element 20) . These reports are issued by the ARB MLD Quality Assurance Section Manager and are reviewed by the ARB/MLD Quality Management and Operations Support Branch Chief and the MLD Chief. These reports will be filed (see Table 9-1) and made available to the U.S. EPA.

External system audits are to be conducted at least every three years by the U.S. EPA Regional Office as required by 40 CFR Part 58, Appendix A, Section 2.5. Further instructions are available from either the U.S. EPA Regional QA Coordinator or the System Audit QA Coordinator, Office of Air Quality Planning and Standards, Emissions Monitoring and Analysis Division (MD-14), United States Environmental Protection Agency, Research Triangle Park, NC 27711.

21.1.4 Air Quality Data Action Request

An Air Quality Data Action (AQDA) request is issued by the District or the ARB whenever a problem is found with the operation or a failure to comply with procedures is discovered, which could have an effect on data quality. The AQDA request is one of the most important ongoing reports to management because it documents primary QA activities and provides valuable records of QA activities that can be used in preparing other summary reports.

The AQDA request procedure is designed as a closed-loop system. The AQDA request form identifies the originator, who reported and identified the problem, states the problem, and may suggest a solution. The form also indicates the name of the person(s) who is assigned to correct the problem. The assignment of personnel to address the problem and the schedule for

completion will be determined by the appropriate supervisor. The AQDA request procedure closes the loop by requiring that the recipient state on the form how the problem was resolved and what disposition to take with the data (accept, correct, invalidate). Copies of the AQDA request will be distributed twice: first, when the problem has been identified and the action has been scheduled; and second, when the correction has been completed. The originator, the District's Air Monitoring Specialist, the field or laboratory supervisor, ARB branch chiefs, and the ARB QA Section Manager will be included in both distributions.

21.1.5 Calibration Summaries

Calibration summaries for laboratory instruments are updated after every new calibration or standardization as defined in the relevant SOP. Control charts can be generated from these data, should the need arise. Analysts are responsible for reviewing these data immediately after they are collected and for taking corrective actions whenever out-of-specification conditions are observed. Calibration reports are to be reviewed at least quarterly by the laboratory supervisor. The laboratory technician will provide quarterly summary information to the District QA Technician and to the Air Monitoring Specialist. Calibration data are also subject to inspection during audits, and laboratory personnel are responsible for maintaining a readily-accessible file of calibration summaries for each instrument.

21.2 Responsible Organizations

This Element outlines the responsibilities of individuals within the monitoring organization for preparing quality reports, evaluating their impact, and implementing follow-up actions. Changes made in one area or procedure may affect another part of the project. Only by defining clear-cut lines of communication and responsibility can all the affected elements of the monitoring network remain current with such changes. The documentation for all changes will be maintained and included in the reports to management. The following paragraphs describe key personnel involved with QA reporting.

Air Pollution Control Officer

The District Air Pollution Control Officer is ultimately responsible for the quality of the data and the technical operation of the particulate monitoring network. The responsibilities for overseeing the air quality data collection and reporting activities are delegated to the Deputy Air Pollution Control Officer, the Senior Project Manager, and the Director of Technical Services.

Deputy Air Pollution Control Officer, Senior Project Manager, Director of Technical Services

The Deputy Air Pollution Control Officer, Senior Project Manager, and Director of Technical Services are responsible for the data collected from all PM10 monitors in the District's monitoring network. These responsibilities include defining and implementing the document management and quality assurance systems for the PM10 monitoring network. The responsibility for the collection, validation, and submission of the data collected from all PM10 monitors is delegated by the Management Staff to the Air Monitoring Specialist and the Senior Systems Analyst. The responsibility for the submittal of all relevant reports is also delegated to the Air Monitoring Specialist and the Senior Systems Analyst.

Air Monitoring Specialist

The Air Monitoring Specialist oversees the day-to-day activities associated with the PM10 monitoring program, including the operation, maintenance, and repair of any PM10 monitors in the District. He submits all relevant reports to the Management Staff as necessary. The Air Monitoring Specialist is also responsible for the precision and accuracy of all data generated and collected by the District. This position serves as one part of the effort to assure that the data are in compliance with the criteria set by Federal and State Clean Air Acts. These responsibilities are carried out by conducting field performance and system audits, issuing recommendations for data adjustment on instruments, evaluating potential air monitoring sites, and issuing reports on audit results.

Quality Assurance Technician

The quality assurance technician is responsible for the District's internal audit program. These responsibilities include audits of all particulate monitors, meteorological sensors, etc., operated within the District. Audit reports are generated and provided to Senior Staff and the Air Monitoring Specialist as a "third-party" check on the operation of the monitoring equipment used throughout the District.

Instrument Technicians

Instrument technicians are responsible for the calibration, operation, and maintenance of the monitoring equipment and for the gathering of the data collected by that monitoring equipment. They are not normally responsible for authoring reports to management, however, they participate in the process by identifying the need for data adjustments and maintaining other quality-related information used to prepare District QA reports and ARB QA reports.

Laboratory Technicians

The District laboratory technician is responsible for authoring appropriate sections of quarterly QC reports to management. He generates spreadsheets and charts, identifies the need for data adjustments, and maintains other quality-related information used to prepare QA and QC reports. He also assembles and prepares the quarterly laboratory report for submission to the air monitoring specialist and the ARB.

Senior Systems Analyst/Data Analyst

The District senior systems analyst and data analyst carefully manage, archive, and distribute the ambient aerometric data collected on behalf of the District's air quality management programs. Specific activities include resolving discrepancies in data, providing for the orderly and efficient transfer of data from data suppliers to the District and the EPA AIRS database, and distributing the data to meet customer needs. Further specific duties include the development and implementation of enhancements to the data management systems and to the forms of data distribution. The analysts are also involved in the evaluation of siting issues, including annual network reviews for PM10 and other parameters.

22.0 Data Review, Validation and Verification Requirements

This element describes how the Great Basin Unified APCD will verify and validate the data collection operations associated with the PM10 ambient air monitoring network. Verification can be defined as confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Validation can be defined as confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Although there are a number of objectives of ambient air data, the major objective for the GBUAPCD PM10 network is for comparison to the NAAQS standard and therefore, this will be identified as the intended use. This element will describe the verification and validation activities that occur at a number of the important data collection phases. Earlier elements of this QAPP describe in detail how the activities in these data collection phases will be implemented to meet the data quality objectives of the program. Review and approval of this QAPP by the ARB and U.S. EPA Region IX provide initial agreement that the processes described in the QAPP, as implemented, will provide data of adequate quality. In order to verify and validate the phases of the data collection operation, the District will use various qualitative assessments (e.g., system audits, network reviews) to verify that the QAPP is being followed, and will rely on the various quality control samples, inserted at various phases of the data collection operation, to validate that the data will meet the DQOs described in Element 7.

22.1 Sampling Design

The monitoring network description for the District is contained in three documents that cover the sub-networks mentioned in Element ??. These documents are the Air Quality Management Plan for the Town of Mammoth Lakes, November 30, 1990; the Reasonable Further Progress Report for the Mono Basin PM-10 State Implementation Plan, September 2001; and the Owens Valley PM10 Planning Area Demonstration of Attainment State Implementation Plan, November 16, 1998 (Revision due 2003). All of these documents have been submitted to EPA IX and they describe the PM10 monitoring network designed by the District. These documents cover the number of sites required for each sub-network, their locations, and the frequency of data collection. The objective of the sampling design is to represent the population of interest at adequate levels of spatial and temporal resolution. Most of these requirements are described in the Code of Federal Regulations. However, it is the responsibility of the District to ensure that the intent of these regulations is properly administered and carried out.

22.1.1 Sampling Design Verification

Verification of the sampling design is accomplished through three processes:

Network Design Plan Confirmation - The Network Design Plan that discusses the deployment of the network must be submitted, reviewed and approved by U.S. EPA Region IX. This process verifies the initial sampling design.

Internal Network Reviews - At least once each year, the District's Air Quality Management Staff will perform a network review to determine whether the network objectives, as described in the Network Design Plan, are still being met, and that the sites are meeting the Federal siting criteria (see Element 20).

External Network Reviews - Every three years the U.S. EPA Region IX Office and/or the ARB Quality Assurance Section will conduct a network review to determine whether the network objectives, as described in the Network Design Plan, are still being met, and that the sites are meeting the Federal siting criteria.

22.1.2 Sampling Design Validation

The ambient air monitoring data collected from the sites will be used to validate the sampling design. This information will be included in the network review documentation and appropriately communicated to the U.S. EPA Region IX Office. In addition, the processes described in Element 10 will be used to confirm the network design.

22.2 Sample Collection Procedures

22.2.1 Sample Collection Verification

Sample collection procedures are described in detail in Element 11 and are developed to ensure proper sampling and handling to maintain sample integrity. The following processes will be used to verify the sampling collection activities:

System Audits - will be required as described in Element 20

System audits will be used to verify that the sample collection activity is being performed as described in this QAPP and the SOPs. Deviations from the sample collection activity will be noted in audit finding forms and corrected using the procedures described in Element 20.

22.2.2 Sample Collection Validation

The sample collection activity is just one phase of the measurement process. The use of QC samples that have been placed throughout the measurement process can help validate the activities at each phase. The review of QC data such as the collocated sampling data, field blanks, the FRM performance evaluation, and the sampling equipment verification checks that are described in Elements 14 and 16 can be used to validate the data collection activities. Any data that indicates unacceptable levels of bias or precision or a tendency to drift will be flagged and investigated.

22.3 Sample Handling

Elements 11, 12, and 17 detail the requirements for sample handling, including the types of sample containers and the preservation methods used to ensure that the samples are appropriate to the nature of the sample and the type of data generated from the sample. Due to the size of the filters and the nature of the collected particles, sample handling is one of the phases where inappropriate technique can have a significant effect on sample integrity and data quality.

22.3.1 Verification of Sample Handling

As mentioned above, system audits will be performed to ensure the specifications mentioned in the QAPP are being followed. The audits will include checks on the identity of the sample (e.g.,

proper labeling and chain-of-custody records), packaging in the field, and proper storage conditions (e.g., chain-of-custody and storage records) to ensure that the sample continues to be representative of its native environment as it moves through the data collection process.

22.3.2 Validation of Sample Handling

Similar to the validation of sampling activities, the review of data from collocated sampling, field blanks, and the FRM performance evaluations, that are described in Elements 14 and 16, can be used to validate the sample handling activities. Acceptable precision and bias in these samples would lead one to believe that the sample handling activities are adequate. Any data that indicates unacceptable levels of bias or precision or a tendency to drift will be flagged and investigated.

22.4 Analytical Procedures

Element 13 details the requirements for the analytical methods, which include the pre-sampling weighing activities that give each sample a unique identification, an initial weight, and preparation for the field. Also included are the post-sampling weighing activities, which provide the final and hence, the net weight, and the final concentration calculations. The methods include acceptance criteria (Elements 13 and 14) for important components of the procedures, along with suitable codes for characterizing each sample's deviation from prescribed procedure.

22.4.1 Verification of Analytical Procedures

As mentioned above, system audits will be performed to ensure the analytical method specifications mentioned in the QAPP are being followed. The audits will include checks on the identity of the sample. Deviations from the analytical procedures will be noted in audit finding forms and corrected using the procedures described in Element 20.

22.4.2 Validation of Analytical Procedures

Similar to the validation of sampling activities, the review of data from lab blanks, calibration checks, laboratory duplicates and other laboratory QC activities that are described in Elements 14 and 16 can be used to validate the analytical procedures. Acceptable precision and bias in these samples would indicate that the analytical procedures are adequate. Any data that indicates unacceptable levels of bias or precision or a tendency to drift will be flagged and investigated as described in Element 14.

22.5 Quality Control

Elements 14 and 16 of this QAPP specify the QC checks that are to be performed during sample collection, handling, and analysis. These include analyses of mass standards, filter blanks, spikes, and replicates, which provide indications of the quality of data being produced by specified components of the measurement process. For each specified QC check, the procedure, acceptance criteria, and corrective action are specified.

22.5.1 Verification of Quality Control Procedures

As mentioned above, system audits will be performed to ensure the quality control method specifications mentioned in the QAPP are being followed.

22.5.2 Validation of Quality Control Procedures

Validation activities of many of the other data collection phases mentioned in this sub-element use the quality control data to validate the proper and adequate implementation of that phase. Therefore, validation of QC procedures will require a review of the documentation of the corrective actions that were taken when QC samples failed to meet the acceptance criteria, and the potential effect of the corrective actions on the validity of the routine data. Element 14 describes the techniques used to document QC review/corrective action activities.

22.6 Calibration

Element 16, as well as the field (Element 11) and the analytical elements (Element 13) detail the calibration activities and requirements for the critical pieces of equipment for the PM10 monitoring network.

22.6.1 Verification of Calibration Procedures

As mentioned above, system audits will be conducted to ensure the calibration specifications and corrective actions mentioned in the QAPP are being followed. Deviations from the calibration procedures will be noted in audit finding forms and corrected using the procedures described in Element 20.

22.6.2 Validation of Calibration Procedures

Similar to the validation of sampling activities, the review of calibration data that are described in Elements 14 and 16, can be used to validate calibration procedures. Calibration data within the acceptance requirements indicate that the sample collection measurement devices are operating properly. Any data that indicates unacceptable levels of bias or precision or a tendency to drift will be flagged and investigated as described in Elements 14 or 16. Validation would include the review of the documentation to ensure corrective action was taken as prescribed in the QAPP.

22.7 Data Reduction and Processing

22.7.1 Verification of Data Reduction and Processing Procedures

As mentioned above, system audits will be conducted to ensure the data reduction and processing activities mentioned in the QAPP are being followed.

22.7.2 Validation of Data Reduction and Processing Procedures

As part of the audits of data quality, discussed in Element 20, a number of sample IDs chosen at random will be identified. All raw data files, including the following will be selected:

- Presampling weighing activity

- Presampling activities and environment
- Sampling activity and sampler data download
- Sampler calibration in effect during sampling period
- Postsampling handling, storage, and transport to lab
- Postsampling storage and weighing by lab
- Corrective action procedures
- Data reduction and entry

These raw data will be reviewed and final concentrations will be calculated by hand to determine whether the final values submitted to AIRS compare favorably with the hand calculations. The data will also be reviewed to ensure that associated flags or any other data qualifiers have been appropriately associated with the data and that appropriate corrective actions were taken.

23. Validation and Verification Methods

Many of the processes for verifying and validating the measurement phases of the PM10 data collection operation have been discussed in Element 22. If these processes, as written in this QAPP are followed and the monitoring sites are representative of the boundary conditions for which they were selected, then the PM10 Data Quality Objectives (DQOs) should be achieved. Exceptional field events may occur, however, and field and laboratory activities may adversely affect the integrity of the samples. Additionally, it is expected that some of the QC checks will fail to meet the acceptance criteria. Information on problems that affect the integrity of the data are identified in the form of data qualifiers or flags (Appendix C). It is important to determine how and whether these failures affect the routine data. The review of these routine data and their associated QC data will be verified and validated. It is assumed that if measurement uncertainty will be maintained within the precision and bias DQOs, then the program objectives will be met.

23.1 Process for Validating and Verifying Data

23.1.1 Verification of Samples

After a sample batch is processed in the laboratory, a thorough review of the data for completeness and data entry accuracy will be conducted. All raw data that are entered by hand on the data sheets will be entered into the spreadsheet as discussed in Element 19. The entered data are compared with the data forms to minimize transcription errors. The spreadsheet will then flag all data that fall outside the acceptance criteria. The flagged data will be reviewed and reassessed. Details of these activities are discussed in Element 19. The data qualifiers or flags are listed in Appendix C.

23.1.2 Validation

Validation of measurement data will be conducted on three levels: one at the measurement value level, a second at the batch level, and a third at the instrument level. Records of all invalid samples will be filed. Information will include a brief summary of the reason(s) for invalidating the sample along with the associated flags. A portion of this record will be available on the spreadsheet since all filters that are pre-weighed will be recorded whether or not the sample is valid. At least one flag will be associated with an invalid sample, that being the “INV” flag signifying invalidation. Additional flags will usually be associated with the INV flag that help explain the reason for this flag. Free form notes from the field operator or laboratory technician may also be included.

Validation of Measurement Values

Certain criteria based upon Title 40 CFR, U.S. EPA QA Guidance Documents 2.10, 2.11, and field operator and laboratory technician judgment have been developed that will be used to determine whether individual samples or samples from a particular instrument will be invalidated. In all cases the samples will be returned to the laboratory for further examination. When the laboratory technician reviews the field sheet and chain-of-custody forms he or she will look for flag values. Samples that are flagged for obvious contamination, filter damage, or field

accidents will immediately be examined. Upon concurrence of the laboratory technician and the laboratory supervisor, these samples will be invalidated.

Other flags listed in Appendix C may be used alone or in combination to invalidate samples. Since the possible flag combinations cannot be anticipated, the District will review these flags and determine whether single values or values from a site for a particular time period will be invalidated. The District will keep a record of the combination of flags that resulted in invalidating a sample or set of samples. These combinations will be reported to EPA Region IX and the ARB and will be used to ensure that the District evaluates and invalidates data consistently from one batch to the next. These combinations will be programmed into the validation system in order to assist the laboratory in evaluating data. As mentioned above, all data invalidation will be documented. Table 23-1 contains criteria that can be used to invalidate single samples based on single flags.

Table 23-1 Single Flag Invalidation Criteria for Single Samples

Requirement	Flag	Comment
Contamination	CNTM	Concurrence with lab technician and lab manager
Filter Damage	DMG	Concurrence with lab technician and lab manager
Event	See Table C-3	Exceptional, known field event expected to have affected sample Concurrence with lab technician and lab manager
Laboratory Accident	LABA	Concurrence with lab technician and lab manager
Field Accident	FLDA	Concurrence with lab technician and lab manager
Flow Rate Cutoff	FLOW	Termination of sample collection due to flow rate > 10% design flow rate for 60 seconds.

Due to the nature and holding times of the routine samples, it is critical that the District minimize the amount of data invalidated. Therefore, the District will validate data on single samples, sample batches, and groups of samples from one instrument. Based on the types of QC samples that are included and the field and laboratory conditions that are reported (field/lab flags), the ARB, in conjunction with the national PM10 Data Validation Workgroup, is developing a validation template that will be used to determine when routine data will be invalidated and when major corrective actions need to be instituted. Tables 23-2, 23-3, and 23-4 represent the validation template.

Table 23-2 lists those requirements that are critical and must be met. Table 23-3 lists the recommendations that should be met. In instances where acceptance criteria in Table 23-3 are not met, the District will investigate and take corrective action. Data that do not meet these criteria will not necessarily be invalidated. Table 23-4 lists those requirements that should also be met but are of a systemic nature. Data will not necessarily be invalidated if the criteria in Table 23-4 are not met.

Table 23-2 Parameter PM10-Critical Frequency and Acceptance Criteria Defined in CFR

Requirement	Frequency	Acceptance Criteria

Sampling Period	All data	1380 - 1500 minutes or if <1380 and exceedance of NAAQS
Sampling Instrument Flow Rate	every 24 hours of operation	≤10% of 16.67 lpm
Filter Visual Defect Check Filter Conditioning Environment Equilibration Temp. Range Temp. Control Humidity Range Humidity Control Pre/post sampling RH Balance	 All filters All filters “ “ “ “ “ “	 See QA Guidance Document 2.10, Sec. 4.2 24 hours minimum 24-hr mean 15-30°C ±3°C standard deviation over 24 hrs 24-hr mean 20-45% RH ±5% standard deviation over 24 hrs. ±5% RH located in filter conditioning environment

Table 23-3 Parameter PM10 - Operational Evaluation Indicators

Requirement	Frequency	Acceptance Criteria
Reporting Units	All data	µg/m^3
Detection Limit Lower DL Upper Conc. Limit	 All data All data	 2 µg/m^3 (estimated) 30000 µg/m^3 (estimated)
Filter Checks Lot Blanks Exposure Lot Blanks	 3 filters per lot 3 filters per lot	 < 15µg change between weighings < 15µg change between weighings
Lab QC Checks Field Filter Blank Lab Filter Blank Balance Check Duplicate Filter Weighing	 10% or 1 per weighing session 10% or 1 per weighing session beginning, every 10th sample, end 1 per weighing session	 ± 60µg change between weighings ± 15µg change between weighings ≤ 3µg ± 20µg change between weighings
Calibration/Verification Flow Rate (FR) multipoint calibration FR single-point Verification	 2/yr or if verification failure 1/4 weeks	 **± 4% of transfer standard** **± 7% of transfer standard and ±10% of design flow rate**

Table 23-4 Parameter PM10 - Systematic Issues

Requirement	Frequency	Acceptance Criteria
Data Completeness	**quarterly**	**75%**
Accuracy		
FRM Performance Evaluation	**25% of sites 4/yr**	**±10%**
Precision		
Collocated Samples	**Every 6 days for collo. sites**	**CV ≤ 25%**
Single Analyzer	**1/3 months**	**CV ≤ 10%**
Single Analyzer	**1/year**	**CV ≤ 10%**
Reporting Org.	**1/3 months**	**CV ≤ 25%**
Calibration & Check Standards		
Flow Rate Transfer Std.	**1/year**	**± 2% of NIST-traceable std.**

The samples will be evaluated and a report generated based on the results of validation. If the report indicates invalidation of data, those samples will be reanalyzed and reevaluated. All efforts will be made to take whatever corrective actions are necessary to correct the problem. If, after this secondary or Level II validation, the samples still remain outside the applicable criteria, the samples will be flagged as invalid (INV), depending on the specific acceptance criteria.

24. Reconciling Results with DQOs

--WORK IN PROGRESS--

Appendix A

Glossary

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

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

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

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

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

Audit of Data Quality (ADQ) — A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Authenticate — The act of establishing an item as genuine, valid, or authoritative.

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

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

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

Calibration drift — The deviation in instrument response from a reference value over a period of time before recalibration.

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

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

Check standard — A standard prepared independently of the calibration standards and analyzed exactly like the samples. Check standard results are used to estimate analytical precision and to indicate the presence of bias due to the calibration of the analytical system.

Collocated samples — Two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

Comparability — A measure of the confidence with which one data set or method can be compared to another.

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

Computer program — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as "software," or it may be stored permanently on computer chips, referred to as "firmware." Computer programs covered in a QAPP are those used for audit results, design analysis, data acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

Confidence Interval — The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Consensus standard — A standard established by a group representing a cross section of particular government agencies, industry or trade, or a part thereof.

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

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

Correlation coefficient — A number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables.

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

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

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

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

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

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

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

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data usability — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Deficiency — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

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

Detection Limit (DL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

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

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

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

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

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

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Environmental technology — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this

term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

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

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

Financial assistance — The process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally accompanied by specific examples of the observed condition.

Goodness-of-fit test — The application of the chi square distribution in comparing the frequency distribution of a statistic observed in a sample with the expected frequency distribution based on some theoretical model.

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

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

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

Identification error — The misidentification of an analyte. In this error type, the contaminant of concern is unidentified and the measured concentration is incorrectly assigned to another contaminant.

Independent assessment — An assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

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

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Laboratory split samples — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability.

Limit of quantitation — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

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

Management Systems Review (MSR) — The qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

Matrix spike — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

May — When used in a sentence, a term denoting permission but not a necessity.

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Mean squared error — A statistical term for variance added to the square of the bias.

Measurement and Testing Equipment (M&TE) — Tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

Memory effects error — The effect that a relatively high concentration sample has on the measurement of a lower concentration sample of the same analyte when the higher concentration sample precedes the lower concentration sample in the same analytical instrument.

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

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Mid-range check — A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

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

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

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

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

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

Peer review — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

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

Pollution prevention — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

Population — The totality of items or units of material under consideration or study.

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

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Project — An organized set of activities within a program.

Qualified data — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Qualified services — An indication that suppliers providing services have been evaluated and determined to meet the technical and quality requirements of the client as provided by approved procurement documents and demonstrated by the supplier to the client's satisfaction.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality Assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Program Description/Plan — See *quality management plan*.

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

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

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

Quality improvement — A management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

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

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

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

Readiness review — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Record (quality) — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — The act of determining whether or not the methodology measures all of the analyte contained in a sample.

Repeatability — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

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

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

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met.

Research (applied) — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Research (basic) — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Research development/demonstration — The systematic use of the knowledge and understanding gained from research and directed toward the production of useful materials, devices, systems, or methods, including prototypes and processes.

Round-robin study — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are compared and used to develop summary statistics such as interlaboratory precision and method bias or recovery efficiency.

Ruggedness study — The carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

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

Service — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, installation, and calibration.

Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of

alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

Significant condition — Any state, status, incident, or situation of an environmental process or condition, or environmental technology in which the work being performed will be adversely affected sufficiently to require corrective action to satisfy quality objectives or specifications and safety requirements.

Software life cycle — The period of time that starts when a software product is conceived and ends when the software product is no longer available for routine use. The software life cycle typically includes a requirement phase, a design phase, an implementation phase, a test phase, an installation and check-out phase, an operation and maintenance phase, and sometimes a retirement phase.

Span check — A standard used to establish that a measurement method is not deviating from its calibrated range.

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

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

Split samples — Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

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

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

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

Surveillance (quality) — Continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

STANDARD OPERATING PROCEDURE FOR MASS ANALYSIS OF FINE PARTICULATE COLLECTED ON TEFLON FILTERS

1.0 SCOPE

This document describes the methodology used by the laboratory staff to analyze the mass of particulate matter (PM10) samples collected on Teflon filters.

2.0 SUMMARY OF METHOD

Individual teflon filters (46.2 mm in diameter) are weighed on an electronic microbalance before and after field sampling. Particulate matter less than 10 μm in aerodynamic diameter is collected from ambient air over a 24-hour period on one of these filters. The net difference between pre- and post-sampling filter weights is used to calculate the ambient air mass concentration. After final weighing, filters are stored for subsequent analysis.

3.0 INTERFERENCES

3.1 The potential effect of body moisture or oils contacting the filters is minimized by using non-serrated forceps to handle the filters at all times. This measure also moderates interference due to static electricity.

3.2 Teflon filters accumulate a surface electrical charge which may affect filter weight. Static electricity is controlled by treating filters on a "Static Master" static charge neutralizer prior to weighing. Holding filters between two "Static Masters" is required for a minimum of twenty seconds before any filter can be weighed.

3.3 Moisture content can affect filter weight. Filters must be equilibrated for a minimum of 24 hours in a controlled environment prior to pre- and postweighing. During the equilibration period, relative humidity must be maintained at a mean value of 32.5-37.5% and air temperature at a mean of 21-23 degrees Celsius.

3.4 Airborne particulates can adversely affect an accurate mass measurement of the filter. Equilibrating filters should not be placed within airflow paths created by air conditioning ductwork, near computer printers or turbulence created by opening and closing doors. Dust contamination can be further minimized by cleaning the lab bench tops and weighing areas daily, installing "sticky" floor mats at the entrance to the balance room, and wearing clean lab coats over regular clothing.

4.0 APPARATUS

4.1 Sartorius M5P electronic microbalance with a minimum resolution of 0.001 mg (i.e., 1 microgram) and a precision of ± 0.001 mg, supplied with a balance pan. The microbalance must be positioned upon a marble balance support table.

4.2 Calibration weights, utilized as Mass Reference Standards, should be non-corroding, range in weight from 100 mg to 200 mg and be certified as traceable to National Institute of Standards and Testing (NIST) mass standards. Two sets are needed, one set as a working standard and one set as the primary standard. The weights should be Class 1 category with a tolerance of 0.01mg.

4.3 Radioactive (alpha-particle) Polonium-210 ("StaticMaster") antistatic strips for charge neutralization. At least 2 strips are needed per balance.

4.4 Non-serrated forceps.

4.5 Digital timer/stopwatch or analog clock.

4.6 Filter: Teflon membrane, 46.2 mm in diameter with a polymethylpentene support ring.

4.7 Filter support cassettes.

4.8 Filter equilibration racks.

4.9 Dickson relative humidity/temperature recorder.

4.10 Psychrometer (NIST certified) for calibration of relative humidity readings.

4.11 Humidity calbration kit with three salt solutions: LiCl, $MgCl_2$, NaCl for humidity checks at 11%, 33%, and 75%

4.11 Precision thermometer (NIST certified) for calibration of temperature readings.

4.12 Light box.

4.13 Antistatic, nitrate-free, phosphate-free, sulfate-free, lint-free 100% nylon gloves.

4.14 Plastic petri-slide filter containers.

4.15 Zip-lock plastic bags, 5"x8".

4.16 Disposable laboratory wipes.

4.17 Filter equilibration cabinet(s).

4.18 Metal shipping containers and fiberglass filter cassette magazine(s) (supplied with R & P FRM sequential samplers), metal shipping containers for individual filters (supplied by BGI and other manufacturers for single-filter samplers).

5.0 BALANCE CALIBRATION PROCEDURE

5.1 Prior to any filter weighing, the balance must be calibrated. First, check the balance level and adjust as needed. After connecting the balance to a line source, the liquid crystal display should read "stand-by". Press the on/off key to activate the balance. The balance performs an internal circuitry check which is complete when "CH2" appears in the liquid crystal display (LCD). The LCD then displays an "L", indicating that the internal load weights should be removed (The internal load weights are used only for weighing objects in excess of 1500 or 3000 mg). Press the bottom white key marked with the small white "t" to remove the load weights. The LCD should soon display "0.000" and a stabilization bubble (which appears as a small "o" in the upper right corner of the display). Open the weighing chamber door to allow equilibration to room temperature. To ensure maximum stability, the microbalance must remain on at all times; the display will register "stand-by" when not in use.

5.2 Internal Calibration: After chamber equilibration (usually one minute), close the cover. Once the stabilization bubble in the LCD (hereafter referred to as the "bubble") appears above the "mg", press the "CAL" key. The LCD should soon display "0.000" and the bubble and the "CAL" LED will be illuminated. Press the "CAL" key a second time and the LCD will display a "C" followed by "CC" and then followed by "0.000" and the bubble and "CAL" LED goes out. The balance is now ready for an external calibration check. However, should the display read "CE", an error has occurred and the calibration must be repeated as described above.

5.3 External Calibration Check: Open the chamber door. Place a 100 mg working reference standard calibration weight onto the balance pan with nonmetallic forceps. Close the chamber door and record the date, temperature and relative humidity in a quality control notebook assigned to the microbalance on which the weighing procedure is being performed. After the LCD displays a weight readout and the bubble, wait for 30-45 seconds then record the weight readout in the quality control logbook along with temperature and humidity data and initial. Remove the calibration weight and tare the balance by tapping the red "T" key to re-register a balance zero reading. Repeat this same procedure with a 200 mg calibration weight. The balance is now ready for weighing the filters. The weight readouts of calibration and filter masses must be documented on the quality control logsheets. External calibration will be performed daily for each day that filters are pre- and/or postweighed.

6.0 FILTER INSPECTION AND EQUILIBRATION

6.1 When the filters initially are brought into the laboratory for preconditioning and preweighing, they should be transferred from their sealed manufacturer's packaging to a filter-handling container such as a glass or plastic petri dish. The filters should be handled only with non-serrated forceps. Vinyl or 100% nylon gloves that are lint-free, ion-free, powder-free and antistatic may be worn by lab personnel when filters are being prepared for conditioning and weighing. These precautions reduce the risk of body moisture or oils coming into contact with the filters and affecting mass measurements. Before the filter is placed in a container, it has to be inspected for defects. This is done by examining a filter on a "light table" or over a dark surface (lab bench top). A filter must be discarded if any defects are found. Specific defects to look for are the following:

1. **Pinhole**--A small hole appearing (a) as a distinct and obvious bright point of light when examined over a light table or screen or (b) as a dark spot when viewed over a dark surface.

2. **Separation of ring--**Any separation or lack of seal between the filter and the filter border reinforcing the ring.

3. **Chaff or flashing**--Any extra material on the reinforcing, polymethylpentene ring or on the heat seal area that would prevent an airtight seal during sampling.

4. **Loose material--**Any extra loose material or dirt particles on the filter.

5. **Discoloration**--Any obvious discoloration tat might be evidence of contamination.

6. **Filter nonuniformity--**Any obvious visible nonuniformity in the appearance of the filter when viewed over a light table or a black surface that might indicate gradations in porosity or density across the face of the filter.

7. **Other--**A filter with any imperfection not described above, such as irregular surfaces or other results of poor workmanship.

6.2 After inspection, filters must be conditioned within an environmentally controlled room for at least 24 hours prior to performing presampling weighing (preweighing). Mean relative humidity must be held to 32.5-37.5% and the mean temperature must be held to 21-23 degrees Celsius. Once per quarter, the hygrothermograph recorder is checked against the laboratory humidity sensor. Once per month the laboratory humidity sensor (Vaisala HMP35C) is calibrated at three points using the salt solutions described above. The relative humidity

recording is checked against an NIST- certified psychrometer and the temperature recording is checked against an NIST- certified thermometer once per quarter.

6.3 From each new lot of filters received, take a random sample of 3 filters as "lot blanks" and expose each in a separate container within the controlled room environment. Weigh these "lot blanks" every 24 hours (as explained in Sections 7.6 and 7.7). The filters should be conditioned in an open-sided cabinet that will allow air circulation over the filters while reducing the chance that extraneous airborne material inside the conditioning room will settle onto the filters. If the weight change after 24 hours exceeds 15 micrograms, continue conditioning until the 24-hour weight variation is less than 15 micrograms for each of the 3 "lot blanks". This process should take less than a week. Inscribe information concerning the lot number, balance ID number, and dates of "lot blank" weighings on the Lot Blank Filter Conditioning Mass Data Form. Once the "lot blanks" have generated stable mass values, note the time taken from initial exposure of the filters to balance room conditions until achievement of stable mass. This period is designated as the minimum time needed to condition other filters from the same lot before they can be preweighed and used for routine sampling.

6.4 After the minimum conditioning period has been determined, select a number of filters that can be satisfactorily weighed with an acceptable level of precision within the normal working day (20-40 filters should be an adequate number). Condition the selected filters for at least the time required and set aside for preweighing.

7.0 PRESAMPLING FILTER WEIGHING

7.1 Record the relative humidity and temperature of the conditioning environment in the quality control logbook for the balance. Ensure that 1) the temperature and the relative humidity of the Balance Room have remained (and are currently) within the allowable limits (see Section 3.0) throughout the previous 24 hours and that 2) the selected filters have been conditioned for at least the minimum time needed to attain mass stability, as determined from the lot blanks.

7.2 Clean the microbalance's weighing chamber with a fine brush, if necessary. Clean the surfaces near the microbalance with antistatic solution or methyl alcohol-moistened disposable laboratory wipes. Clean the forceps used for handling the mass reference weights and the filters with the moistened wipes prior to each weighing session. Ensure that both forceps are thoroughly dry.

7.3 Perform an internal and external calibration of the microbalance (as described in Section 5.0) prior to beginning each daily weighing session. Once the weighing procedure begins however, you only need to tare (i.e., zero) the microbalance before weighing each consecutive filter.

7.4 Obtain the appropriate shipping container(s) designated for use with the sampler at the monitoring site for which filters are to be preweighed, and appropriate filter support cassettes and metal covers or filter cassette magazine, etc. For filters being sent to monitoring sites using R&P samplers use blue polypropylene cassettes with a beveled inner edge on the top ring; for filters being sent to monitoring sites using BGI samplers use white Delrin cassettes without the beveled top ring.

7.5 Boot up the computer, open EXCEL and the appropriate spreadsheet for the filters to be weighed. Enter the site, filter number and initial weight or final weight in the appropriate cells.

7.6 Take each conditioned filter, using forceps and gripping the filter only by the outer polymethylpentene support ring, and hold the filter (support ring side up) between the two static neutralizers. Hold the filter between the static neutralizers for a minimum of 20 seconds prior to weighing.

7.7 Place the filter onto the balance pan and close the cover. Each filter is assigned a **24-Hour Sample Report-Field Data Sheet** (24-Hour Sample Report) that includes the **chain of custody record** and will be used for recording information about the filter sample. After approximately 10 seconds, the bubble will appear over the "mg" on the balance display. Wait an additional 10 seconds after the bubble appears to ensure the balance has stabilized. Record the weight on the computer spreadsheet. Record this mass as a "preweight" value on the 24-Hour Sample Report. Date and initial the 24-Hour Sample Report and enter a date on the "Postweigh by" line that is 30 days from the preweighing date.

7.8 After the weight is entered in the spreadsheet and recorded on the sample report form, you are ready to begin weighing the next filter. If there is a need to re-weigh a filter, however, enter the data on a separate row in the spreadsheet for the reweigh data.

7.9 After the filter is weighed secured it in an appropriate (see Section 7.4) filter support cassette, with the filter's support ring facing up.

7.9.1 BGI Samplers: Fasten the protective metal covers onto the cassette. Label the cassette with the filter ID number and place it in the metal filter-shipping cylinder used for transfer to the sampling site.

7.9.2 R & P Single Filter Samplers: Place filter cassette in an individual metal shipping container. The metal shipping container should be labelled with the filter ID number.

7.9.3 R & P Sequential Filter Samplers: Place filter cassette(s) in a fiberglass filter cassette magazine. Cap the ends of the magazine with the Cap Plugs

provided by the manufacturer. Place the loaded magazine into the metal shipping container.

7.9.4 Each filter comes with a unique preprinted number on the support ring. This number must be recorded on the 24-Hour Sample Report as the filter ID Number. Each filter cassette is uniquely numbered as well. The filter cassette ID number must also be recorded on the 24-Hour Sample Report.

7.10 After each filter is weighed, if the microbalance does not return to zero, the microbalance can be zeroed by pressing the red **TARE** key. After it is zeroed, the balance is ready for the next filter.

7.11 After repeating the above steps for 9 individual filters, a field blank should be weighed. Select any conditioned filter and weigh as described above, but select a filter number preceded by the designation **FB** and record this number on the 24-Hour Sample Report. Once this weighing has been completed, recheck the balance by weighing a standard mass. The microbalance is tared and either a 100 mg or a 200 mg mass working reference standard is weighed as a QC check. **NOTE**: Each working standard will be checked against the corresponding laboratory primary standard mass at least quarterly. If the standards disagree by more than 3 micrograms, the working standards must be checked by a certified outside contractor and replaced if necessary.

7.12 A duplicate filter must be selected from the previous 9 routine sample filters and weighed as a quality control check. Weigh the filter, as described above, record the weight on the 24-Hour Report as a duplicate mass, and enter it in the spreadsheet. If the duplicate mass varies more than 15 micrograms from the original mass measurement, tare the microbalance and re-weigh the filter. If the variation in mass remains more than 15 micrograms, flag the filter in question and consult with the laboratory supervisor.

7.13 Affix to each filter's 24-Hour Sample Report sheet a filter bar code label corresponding to the filter ID number, and record the site name. The site operator will add the AIRS site number and other relevant information needed to characterize a specific filter sampled at a specified site. When the preweighed filters are loaded into the sampler, the **chain of custody** portion of the 24-Hour Sample Report will be signed by the field operator and the date and time recorded.

7.14 Stack together all 24-Hour Sample Reports for filters in one filter-shipping cylinder or magazine going to one site, folded so that the site name is readable. Place these in a 5"x8" zip-lock bag and wrap this around the shipping cylinder or magazine, securing in place with a rubber band. In the case of the single-filter samplers, place each individual filter shipping container with the corresponding 24-Hour Sample Report into an 11"x 13" or larger zip-lock bag.

7.15 During the first preweighing session, and as needed during later weighing sessions (consult with the laboratory supervisor), designate five filters to be used as **lab blanks**. Assign a unique identification number LBxxxx to each of five filters and record this on the petri-slide label and in the laboratory QC notebook. Weigh as indicated in Sections 7.6 and 7.7, and additionally record, along with the date, the information in the QC notebook. Initial each weight entry. Replace the filters in their petri-slides and leave open in the cabinet where sample filters are conditioned.

8.0 POSTSAMPLING TRACKING, DOCUMENTATION & INSPECTION

8.1 Upon receipt of filter samples from the field, the laboratory technician will perform the following steps:

1. Remove the attached bag of 24-Hour Sample Reports and check the temperature recorders on the cylinders or in the transport container.
2. On each 24-Hour Sample Report, in the "received by lab" column on the **chain of custody record**, note date, time and temperature at the time of sample arrival in the lab.
3. Inspect the condition of the sample container and filter samples, especially for contamination by moisture during shipping.
4. Keep the 24-Hour Sample Reports with the shipping cylinder, magazine, or single filter shipping containers.
5. The shipping container will be placed in the lab until ready for conditioning.

8.2 The Laboratory Technician will verify acceptance of the filters for postweighing by examining the 24-Hour Sample Report (which includes the **chain of custody**). If field data are missing or not obtainable from the site operator or if a sampler malfunction is evident, "flag" the filter on its 24-Hour Sample Report Sheet and continue processing the next filter. A "flagged" filter is archived and stored in the lab until further consultation with a lab supervisor determines whether the filter is acceptable or declared invalid.

8.3 When ready to start conditioning of the filters move the shipping cylinder to the gravimetric laboratory. Remove each filter cassette from the shipping container and remove its protective metal covers (if applicable), but keep the filter in its filter support cassette for handling. Use a "light table" to check on the physical appearance of the filter sample area (especially for pinholes). If particulate matter is found on the inside of the metal covers or on the inside of the single-filter transport container after the filter has been removed, note that observation on the 24-Hour Sample Report and "flag" the filter. Consult the lab supervisor to determine whether the filter should be invalidated.

8.4 Remove the filter from the support cassette using the filter cassette separator. Match the filter with the appropriate 24-Hour Sample Report, and with a petri-slide labeled with a barcode number identical to the filter ID number. Antistatic, ion-free, lint-free 100% nylon or vinyl gloves may be worn during filter handling. Inspect the filter for any damage that may have occurred during sampling that was not revealed during the initial inspection. If any damage is found, "flag" the filter and record this on the 24-Hour Sample Report and hold the filter for further consultation by the lab supervisor. If the filter is found to be acceptable for mass analysis, transfer it into the petri-slide and place the cover on loosely.

8.5 After the filters have been inspected and processed as described above, log in each individual filter by transmitting the bar-code filter ID number on the 24-Hour Sample Report provided into the appropriate District spreadsheet. Write the ID number generated from the database onto the 24-Hour Sample Report, the petri-slide label and in a laboratory logbook. Place each filter (in its petri-slide, with the cover underneath or fitted loosely to allow free circulation of air over the filter) onto the filter equilibration rack and place in a well-ventilated cabinet in the gravimetric laboratory. Allow the filters to equilibrate for at least 24 hours. It should be noted that the relative humidity conditions for post-sampling filter mass weighing after conditioning should be within $\pm$ 5% of the pre-sampling conditioning environment.

9.0 POSTSAMPLING FILTER WEIGHING

9.1 After conditioning, remove the racks containing the post-sampling filters from the cabinets and retrieve the 24-Hour Sample Reports. Match up the filter ID numbers on the petri slides and on the 24-Hour Sample Reports and place them on the bench top near the microbalance. Place filters in an orderly fashion on the balance table adjacent to the microbalance.

9.2 Calibrate the microbalance as described in Sections 5.1, 5.2, and 5.3. After calibration, at the start of each weighing session re-weigh the three **lab blank** filters. These are filters that have been conditioned, weighed, then left continually exposed in the cabinets where sample filters are conditioned (see Section 7.15). Record the weight of the lab blanks, and the date, in the QC notebook and initial the record. The average weight change for these filters should not exceed 15 micrograms per day of exposure. If this limit is exceeded consult with the laboratory supervisor before weighing any sample filters. Long-term results can also be used to measure the mass stability of the Teflon filters over time.

9.3 Open the appropriate spreadsheet and find the rows containing the pre-weight information for the filters that have now been exposed. The post-

sampling or exposed filter data will be entered in the appropriate columns in the same spreadsheet as the initial or unexposed filter data were entered.

9.4 Begin weighing as described in Sections 7.6 and 7.7, except that when the mass read-out appears on the LCD screen record the value on the 24-Hour Sample Report in the "postweight" space. Then enter the data in the appropriate spreadsheet, and proceed with the next sample. After 9 individual filters have been weighed, which may include field blank filters, it may be necessary to weigh a **check standard** and then reweigh a sample filter. The filter number of the reweighed filter will be the same as the original filter, except for the inclusion of a notation of the duplicate weight in the comments column of the spreadsheet. Record the duplicate weight on the 24-Hour Sample Report. Also record the date of postweighing on the 24-Hour Sample Report.

9.5 If mass difference between the preweight and postweight of a "field blank" filter is greater than 60 micrograms, "flag" that filter and notify the site operator and the lab supervisor. If mass differences between the original and replicate mass read-outs from a postweighed duplicate are greater than 20 micrograms, flag that filter and notify the lab supervisor.

9.6 If, after postweighing, the filter will receive further analysis, return it to the conditioning container, close the container tightly and note on the conditioning container that additional analyses are required. Transfer the filter, along with any special comments on a copy of the 24-Hour Sample Report, to the lab responsible for performing additional analyses.

Appendix C

Data Qualifiers/ Flags

A sample qualifier or a result qualifier is an indicator of the fact and the reason that the subject analysis

(a) did not produce a numeric result,

(b) produced a numeric result but it is qualified in some respect relating to the type or validity of the result, or

(c) produced a numeric result but for administrative reasons is not to be reported outside the laboratory.

An alphanumeric code is used for invalid data. An alphabetic code represents a data flag indicating the data is qualified in some respect and may be invalidated.

Table C-1 Field Qualifiers

Code	Definition	Description
CNTM	Contamination	Contamination including observations of insects or other debris
DMG	Filter Damage	Filter appeared damaged
T	Elapsed Sample Time	Elapsed sample time out of specification
See Table C-3	Event	Exceptional event expected to have affected sample (dust, fire , spraying etc)
FA	Field Accident	There was an accident in the field that either destroyed the sample or rendered it unsuitable for analysis.
F	Flow Rate	Flow rate 5 min avg out of specification
Temp	Filter Temperature	Filter temperature differential, 30 minute interval out of specification
CalF	Failed Multi-point Calibration Verification	Failed the initial Multi point calibration verification
FCF	Failed Single Point Calibration Verification	Failed the initial single point calibration verification
Leak	Leak suspected	internal/external leak suspected
Sampler Dam.	Sampler Damaged	Sampler appears to be damaged which may have affected filter

Table C-2 Laboratory Qualifiers

Code	Definition	Description
LA	Laboratory Accident	There was an accident in the laboratory that either destroyed the sample or rendered it not suitable for analysis.
INV	Invalid	Indicates sample was invalidated for some reason.

Table C-3 List of Events for PM10 Mass Concentrations

Code	Description
A	High Winds
C	Volcanic eruptions
D	Sandblasting
E	Forest fire
F	Structural fire
G	High pollen count
H	Chemical spills and industrial accidents
J	Construction/demolition
K	Agricultural tilling
L	Highway construction
N	Sanding/salting of streets
O	Infrequent large gatherings
P	Roofing operations
Q	Prescribed burning
R	Clean up after a major disaster
S	Seismic activity

Table C-4 AIRS Data Validation Codes

W	Sample flow rate out of limits
X	Filter Temp. Differential 30-min. Interval out of specification
Y	Sample Period out of specification
T	Multiple Flags

GREAT BASIN UNIFIED
AIR POLLUTION CONTROL DISTRICT

AIR MONITORING QUALITY ASSURANCE

PM 10 QAPP

APPENDIX E-1

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

BGI, Inc.
PQ200 AIR SAMPLER

NOVEMBER 2002

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GREAT BASIN UNIFIED
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APPENDIX E-1

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

STATION OPERATOR'S PROCEDURES FOR BGI, Inc. PQ200 AIR SAMPLER

NOVEMBER 2002

AI.1.0 GENERAL INFORMATION

AI.1.0.1 Purpose

The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's (BGI) Operator's Manual by describing modifications in hardware or procedures which may have been implemented by the Great Basin Unfied APCD (District). These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 10 microns or smaller (PM10) when using the BGI, Inc. PQ200 Ambient Air Sampler.

AI.1.0.2 General Description and Theory of Operation

The BGI PQ200 was designated in the Federal Register as a FRM for collection of PM10. This sampling system performs all the functions required or recommended in the instrument specification portion of the FRM PM10 standard, including: a fixed flow rate of 16.67 liters per minute (LPM) using a specified PM10 inlet, tubing (downtube), filter holder, and filter cassette. The sampler uses a filter cassette which holds single filters in their individual cassettes.

The sampler draws ambient air through its PM10 inlet and a 46.2 millimeter (mm) diameter Teflon sample filter which traps the PM10 fraction. The sample filter is conditioned and weighed before and after sampling and the resulting difference is the collected PM10 mass. Electronic systems in the sampler are designed to monitor and maintain the flow rate as well as record the elapsed sampling time enabling the sampler to calculate the total sample volume. With this information, the analyzing laboratory will calculate the average PM10 concentration of the sampling period.

The BGI PQ200 air sampler monitors and regulates the flow rate using a critical orifice, a variable speed pump, and ambient temperature and pressure sensors, all controlled by the sampler's microprocessor and software.

For a more detailed explanation of the sampler's theory of operation, see Section 2: Introduction, of the Operator's Manual and see Figure AEI.1.0.1: Schematic of BGI, Inc. PQ200 Air Sampler.

Figure AI.1.0.1
Schematic of BGI, Inc. PQ200
Air Sampler
(to be provided)

AI.1.0.3 Safety

Installation, operation, maintenance, or calibration of the sampler should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit and due to typical rooftop installations, the risks of working outdoors at elevation during ambient weather conditions should also be considered. Also read Section 1: Cautions and Notices, in the Operator's Manual.

AI.1.1 INSTALLATION PROCEDURE

AI.1.1.1 Physical Inspection

Each BGI, Inc. PQ200 Air Sampler purchased should be supplied with the following supplies:

1 PM10 Inlet
1 inlet tube
1 stand kit
1 leak check adapter
1 filter bypass leak check disk
1 filter cassette
1 filter dust excluder ring
1 ambient temperature solar radiation shield
2 sets of filter cassettes and backing screens
2 sets of inlet O-rings
4 accessories required for the collection, storage, and transport of filter samples
1 DataTrans, docking station and power supply, and interconnect cable
1 copy of the Operator's Manual

Upon receipt of the sampler(s), inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

AI.1.1.2 Initial Sampler Installation

Follow directions found in Section 1 and 2 of the PQ200 Operator's Manual for installation instructions and consult with your area specialist/engineer or supervisor to assure that installation site complies with Federal and State siting criteria for FRM PM10.

AI.1.1.3 Initial Sampler Set-Up

Follow directions found in Sections 2, 3, and 4 of the PQ200 Operator's Manual.

AI.1.2 DATA RETRIEVAL

AI.1.2.1 Introduction

Field personnel will have the responsibility of ensuring PM10 sampling information for each filter run is properly retrieved. The sampling information from the BGI sampler can be obtained either manually or electronically.

The BGI sampler has a built-in serial communications port that can be used to interface with PC's, modems, and printers. The sampler's communications use N-8-1 protocol (8 stop bits, no parity, 1 stop bit). The sampler is capable of communications over a wide range of baud rates. There are two primary ways to download data from the sampler: Laptop PC or DataTrans.

To manually record sample data, field personnel will complete a District 24-Hour Field Sample Report (see Figure EI.1.0.3). The 24-Hr sample report will contain all information required by 40 CFR Part 50, Appendices J and M.

To electronically record sample data, field personnel can download data via an RS-232 data output connection through which digital data will exported to a laptop PC or DataTrans unit.

AI.1.2.2 Download Apparatus Using Laptop PC

1. Laptop PC with communications software or terminal program.

2. Serial cable with D-9 male plug with female pins on one end and a D-9 female plug with male pins on the other.

AI.1.2.3 Download Procedure Using Laptop PC

1. Connect the serial cable from the PC to the serial port on the sampler.

2. Open the communications software, configure to operate using the N-8-1 protocol and baud rate set on the BGI sampler. Enable the file capture portion of the software package(For Procomm click capture icon or type Alt F1).

3. Select the "Data Transfer" menu from the main menu of the BGI sampler. Select either "Summary", "Data Log", or "Pwr Fail Log" depending on the information that is desired to be transmitted. Typically only the summary information will be downloaded. Data Log (5-minute averages) should be downloaded if a problem was encountered during sampling.

4. After a selection is made, the BGi sampler system will send the data over the serial connection to the PC. The terminal window of the communications software should show the data being transmitted.

5. After transmission is completed, disable the file capture capability of the communications software to close the capture file. (For Procomm click capture icon or type "Alt F1"). Disconnect serial cable from sampler and PC.

AI.1.2.4 Download Apparatus Using DataTrans

1. DataTrans unit
2. 9-pin Male to 9-pin female extension cable
3. AC to DC wall transformer for 115 V.
4. Docking station adapter
5. winDataTrans software package

AI.1.2.5 Download Procedure Using DataTrans

1. The BGI sampler system must be properly configured in order to use the DataTrans. The baud rate of both the DataTrans and the BGI sampler system must be identical. The default setting is 19200 baud. See the Andersen Operator's Manual for instructions on setting sampler and DataTrans baud rate.

2. Connect the DataTrans to the serial port on the sampler. Each time the DataTrans is attached to an BGI sampler system a new data file is created.

3. Select the "Data Transfer" menu from the main menu of the BGI sampler. Select either "Summary", "Data Log", or "Pwr Fail Log" depending on the information that is desired to be transmitted.

4. After making a selection, the BGI sampler system will send data to the DataTrans. The green LED of the DataTrans will flash while it is receiving data. When the green LED has stopped flashing it is safe to disconnect the DataTrans. The DataTrans will store this data for later retrieval. If additional data files are transferred they will be appended to the same data file. If a separate data file is desired for each data file then detach and reattach the DataTrans.

AI.1.2.6 Data Upload from DataTrans to PC

1. To view data stored on the DataTrans, data will need to be uploaded to a desktop PC via the docking station and viewed with the winDataTrans software.

2. Locate an available COM port on the desktop PC. Attach the appropriate end of the 9-pin extension cable to the selected COM port. Attach the docking station adapter to the other end of the 9-pin extension cable. Connect the docking station to a 110-120 VAC outlet via the AC to DC wall transformer.

3. winDataTrans software will initiate communications with the DataTrans. After the software has initialized, users will see a preview screen and a directory pane. The preview pane provides a preview of this.

AI.1.3 DATA SUBMITTAL (FIELD TO LABORATORY)

AI.1.3.1 Introduction

Once field personnel have retrieved sampling information either manually or electronically, the sample run information must be forwarded to the laboratory. If the sampling information was recorded manually, a 24-Hr sample report will accompany the sampled filter(s) to the laboratory. If the sampling information was recorded electronically, the sampling information will be sent to the lab via file transfer protocol. An abbreviated 24-Hr sample report will still accompany the sampled filter(s) to document chain-of-custody and additional sampling information.

AI.1.3.2 Electronic Data Submittal to Laboratory

(*work in progress)*

AI.1.3.3 Sample Chain-of-Custody

The chain-of-custody process begins once the filter is pre-conditioned and inspected by laboratory personnel. After pre-conditioning is complete, filters will be preweighed, placed in cassette filter rings and prepared for shipping. Each filter's unique number will be written on the 24-Hr Sample Report. Laboratory personnel will annotate the preweight of the filter, date and initials on the 24-Hr Sample Report. The 24-Hr sample report and filter(s) will be shipped to the field. When the filter is loaded on the sampler, field personnel will document the date, time and initials of person loading the sampler. After sampling, field personnel will document date, time and initials of person removing the sample from the sampler. Field personnel will document date and time when the filter is prepared for transport. When the filter is transported to the laboratory, the date, time, and person transporting the filter will be documented on the 24-Hr Sample Report. When the filter arrives at the laboratory, the date, time, and person receiving the filter will be noted on the 24-Hr sample report. The filter will then be prepared for postconditioning. The date, time, and name of analyst will be documented once postconditioning begins.

AI.1.4 QUALITY CONTROL MAINTENANCE PROCEDURES

AI.1.4.1 General Information

Quality Control (QC) maintenance procedures (checks) are designed to help assure that valid data is produced as a result of proper sampler operation and maintenance in accordance with its federal designation and the manufacturer's operating manual. The maintenance frequency presented in these standard operating procedures should be considered the minimum required even though the actual frequency of performing some of these checks may vary from site to site due to different environmental factors. These may include the sampling schedule, particulate concentrations, or seasonal factors which may require an increase in maintenance frequency. In the event that these checks cannot be performed on schedule, the deferred maintenance should be performed as soon as practical. The QC procedures schedule is presented in Table AI.1.0.1.

When QC checks are performed, the date, results, and any comments should be recorded on the Monthly Quality Control Maintenance Check Sheet for the FRM PM10 Filter Sampler (QC checksheet) presented in Figure AI.1.0.4. This document will be forwarded to the supervisor on a monthly basis for subsequent review and filing. It is recommended that a copy be made by the operator and kept at the field site for later reference by the operator or a site visitor.

AI.1.4.2 Daily Checks

During the procedure of unloading the sample cassettes from the sampler, record the sample summary data onto the sample cassette's matching 24-Hr sample report. Also record run date on the QC checksheet.

Review the summary data for reasonableness and for compliance with Measurement Quality Objectives for FRM PM10 presented in Table AI.1.0.2. If questionable summary data is seen, download the five (5) minute data averages using the BGI DataTrans or personal computer (PC) and examine these averages for anomalies. Procedures for downloading these data are presented in Section EI.1.2 (Data Retrieval) of this SOP as well as Section 7: Data Logging, in the Operator's Manual. In the event that anomalies are present in the 5 minute averages, troubleshoot the sampler according to instructions in Section 12: Troubleshooting, of the Operator's Manual and notify your supervisor or area calibrator. Also, visually inspect the PM10 inlet's water collector jar and drain it if water is present.

Quality Control Procedure Schedule for
Federal Reference Method PM10 Sampling

	*Daily	Every Month	Every 6 Months	Every 12 Months
Record and Review Run Summary	X			
Inspect or Drain Inlet Water Jar	X			
Perform Leak Check		X		
Disassemble and Clean PM10 Inlet, Downtube		X		
Inspect O-rings and Gaskets		X		
Perform Single Point Flow Rate Check		X		
Clean Interior of Sampler		X		
Clean Air Intake Filter and Fan		X		
Perform Single Point Check of Ambient Temp and Press Sensors		X		
Verify Sampler Clock Time		X		
Transport Samples with Temp-logger		X		
Run a Field Blank		X		
Perform as-is Three Point Calibration Verification of Flow Rate, Pressure and Temperature Sensors				X
Verify As-is Condition of Sampler's Interior, Inlet				X
Perform Multipoint Calibration of Flow Rate, Pressure & Temperature Sensors				X
Calibrate or Re-certify Flowrate, Press and Temp QC Check Standards				X

*or each time sample cassettes are exchanged

Table AI.1.0.1
QC Procedures Schedule for FRM PM10 Sampling

Figure AI.1.0.4
District Monthly Quality Control Maintenance Check Sheet
FRM PM10 Filter Sampler (in development)

Measurement Quality Objectives for FRM PM10

Requirement	Frequency	Acceptance Criteria
Sampling Period:	all data	1380 to 1500 minutes or MC if <1380 and exceedance of NAAQS
Sampler:	every 24 hrs of operation	
Flow rate		≤10% of 16.67 LPM
Flow rate variability		≤4% CV
		measured ≤10% average for 5 min
Data Completeness:	quarterly	75%
Filter:	all filters	Visual defect check
Monthly QC Check:	monthly	
Flow rate		+/-7% of standard
Clock/timer		+/-10 min of corrected clock time
Multipoint Calibration:	annually or	
Flow rate	when failed monthly check,	+/-7% of transfer (xfer) standard
Leak check	following major repair,	<80 mL/min for 10 minutes
Temperature sensors	or after sampler transport	+/-2°C of xfer standard
Pressure sensors		+/-10 mm Hg of xfer standard
Monthly QC Standards:	annually	
Flow rate standard		+/-2% of NIST-traceable standard
Temperature standard		+/-0.1%C resolution
		+/-0.5%C accuracy
Pressure standard		+/-1 mm Hg resolution
		+/-5 mm Hg accuracy
Calib. Xfer Standards:		
Flow rate xfer standard	critical orifice annually	+/-2% of NIST-traceable standard
Temperature xfer standard	annually	+/-0.1°C resolution
		+/-0.5°C accuracy
Pressure xfer standard	annually	+/-1 mm Hg resolution
		+/-5 mm Hg accuracy

Table AI.1.0.2
Measurement Quality Objectives for FRM PM10

AI.1.4.3 Monthly Checks

Disassemble and clean the PM10 inlet and sampler downtube. Inspect o-rings for abrasions, breaks, tears, deformations or other damage. If necessary, replace o-rings and lubricate them with a light coating of halocarbon or silicone vacuum grease prior to reassembly. Using the same lubricant, also lightly lubricate any aluminum threads and take extra care that the fine threads are not cross-threaded during assembly. After reassembly, perform a leak check according to instructions in Section 3.2 of the Operator's Manual and record the results on the QC checksheet. If the results of the leak check meet the acceptance criteria found in Table EI.1.0.2, perform a single point flow check according to instructions presented in Section 3.1 of the Operator's Manual. If the results of the leak check do not meet the criteria, troubleshoot the sampler according to Section 12: Troubleshooting, of the Operator's Manual to determine the cause and if a cause cannot be found, notify your supervisor or area calibrator.

Perform the flow check using an actual flow rate or volume measuring device having an accuracy of at least +/-2 percent (%) of full scale (0-20 LPM vol-o-flow, mass flow meter, etc.) and which is calibrated or certified annually against a NIST-traceable standard. If the sampler's flow rate measurement is not within +/-7 percent of the standard's measurement, investigate the cause. If a cause for the flow discrepancy cannot be found, notify your supervisor. Record the date that these procedures were performed and results of the flow check onto the sampler's QC checksheet.

Clean the interior of the sampler chassis with a damp cloth. Remove the air intake filter and clean it with soap and water following instructions found in Section 2.5 of the Operator's Manual. Clean air intake fan blades with a damp cloth or brush if necessary.

Perform both a leak check and a flow check, as previously described in Every 25 Sampling Runs Checks, if it has been more than a month since these procedures were last performed. Perform a single point check of ambient pressure and temperature sensors using a temperature and pressure standard which is calibrated or certified annually against a NIST-traceable standard. If the sampler's measurements are not within the acceptance criteria (+/-4% for flow rate, <80 mL/min for leak check, $\pm$10 mm Hg for pressure, and $\pm$2°C for temperature) of the standard's measurements, examine the sampler for obvious causes as well as following instructions in Section 12: Troubleshooting, found in the Operator's Manual. If the cause of the discrepancy cannot be found, notify your supervisor or area calibrator.

Verify that the sampler's clock time is within ten (10) minutes of standard time as compared to a clock standard such as the telephone service time or other corrected clock. If there is a difference of more than 10 minutes, reset the sampler's clock to within one (1) minute of the standard according to instructions given in Section 7.1 of the Operator's Manual. Record the date that these procedures were performed and the results obtained onto the sampler's QC checksheet.

Field blanks will be implemented at 10% of sampling frequency. This procedure will be initiated by the laboratory and will consist of the laboratory sending or designating a sample cassette as a field blank. The operator will treat this sample cassette in the same manner as a regular sample cassette used for sampling with the sole exception that it will not be used to collect sample. The field blank sample cassette is to be loaded and unloaded from the sampler, transported, stored and shipped as usual, but the sampler will not be programmed for a sampling event using this sample cassette. In order for this field blank to be as meaningful as possible in checking for passive contamination, leave the field blank in the sampler for at least as long as a regular filter cassette stays in the sampler, both before and after the sampling event. Fill-in the appropriate sections of the field blank's 24-Hr sample report and ship blank cassettes alongside valid samples to the laboratory.

AI.1.4.6 Annual Checks

Every year, the area calibrator will inspect the sampler's interior and PM10 inlet for cleanliness and condition after an as-is three point calibration verification check has been performed. If any of the sampler's calibrated systems fail to meet the acceptance criteria presented in Table EI.1.0.2, the calibrator must perform a final multipoint (three (3) points) calibration of all systems. The operator may assist the area calibrator in performing all necessary repairs and maintenance prior to the calibrator performing a final multipoint calibration of flow rate and all temperature and pressure sensors. The area calibrator will also measure the temperature of the site's freezer (if so equipped) and record the results onto the sampler's calibration worksheet or report. The operator will record all maintenance performed and date of calibration onto the sampler's QC checksheet.

The operator will have their flow rate, temperature, and pressure QC verification check measurement standards re-certified or calibrated against a NIST-traceable standard. The date that these procedures are performed will be recorded onto the sampler's QC checksheet.

AI.1.5 SAMPLE FILTER HANDLING AND SHIPPING PROCEDURE

AI.1.5.1 Presampling Filter Handling Procedures

The laboratory will supply preweighed sample filters, installed in filter cassettes, to the field/site operator. These sample cassettes, along with their respective 24-Hour sample report, will be shipped inside a shipping container. This container should have external markings which designate that the container is assigned to the site operator as well as that it contains preweighed filters which are available for sampling. These markings are necessary to insure that the correct number of filters are delivered to the proper site since different sites will be operating under different sampling schedules. Also, additional markings will alert the operator that the shipment contains sample filters since not all shipments of insulated containers will contain sample filters.

Inside the shipping container, the sample cassettes will be further contained inside the BGI metal filter transport containers which are designed to hold a single cassette. Check the metal container(s) and confirm that each sample cassette has a cassette ID number written on its side and that this number corresponds to the cassette ID number written in a matching 24-Hr sample. If either a cassette or a 24-Hr sample report is received that does not have its matching cassette or 24-Hr sample report, notify the laboratory for further instructions.

Close the metal container leaving the sample cassette inside, attach the sample report forms and store the cylinder under office environmental conditions until ready for loading into the sampler. If the cylinder will be stored with previously received cylinders, store them in such a way that the first received is the first sampled. When ready for sampling, remove the sample cassette(s) from the cylinder and load the filters into the sampler according to instructions in Section 6: Sampling, and Section 10: PM10 Measurement Procedure, of the Operator's Manual. At this time, also fill-in appropriate sections of the sample cassette's matching 24-Hr sample report.

To minimize the possibility of contaminating the sample filter prior to the sampling event, load the sample filter(s) at a time as close as practical to the start of the sampling event. Also, if it appears probable that the surface of the sample filter may be touched during handling, then laboratory grade (non-dusted) latex gloves should be worn.

AI.1.5.3 Postsampling Filter Handling Procedures

Remove sample cassette(s) from the sampler according to instructions in Section 2.1 of the Operator's Manual. Install the filter cassette in the metal filter transport container

and place cassette shipping container. After filling-in 24-Hr sample report(s), review sample summary data for compliance with Measurement Quality Objectives presented in Table EI.1.0.2. If objectives are not met, investigate the cause and if a cause cannot be found and remedied, notify your supervisor or area calibrator. Note problem in comments section of the 24-Hr sample report as well as on the QC checksheet. After filling-in 24-Hr sample report(s), place report(s) inside a zip-lock plastic bag to avoid condensation. Store transport containers with sampled in the laboratory. Use a method of storage which assures that the oldest samples will be the first transported to the laboratory.

AI.1.5.4 Shipping and Transport Procedures

When traveling to a satellite PM10 site, the operator should bring a shipping container or cooler. The container will be used to transport the samples to the operator's office or the laboratory.

Upon arrival at the operator's office, the operator will fill-in the portion of each 24-Hr sample report's chain of custody section which asks for time, date, and initials. Next, put the 24-Hr sample reports into a ziplock bag and place the bag in the transport container with the for storage until ready for transport to the laboratory.

Shipments to the laboratory will be made on a monthly basis by the station operator. Schedule the delivery early enough in the week to avoid arrival on weekends or holidays.

To prepare the samples for transport, remove the cylinder containing the oldest (earliest sample date) sample cassettes and attached 24-Hr sample reports from the shipping container. Open each metal transport container and confirm that each sample cassette has a matching 24-Hr sample report having the same cassette ID number. Fill-in the portion of each 24-Hr sample report's chain of custody which asks for date, time and initials of the technician. If alright, close the container, attach the 24-Hr sample report(s) and place the container in an shipping for transport to the laboratory. Close the shipping container and secure the lid or opening to prevent opening during transport. Hand-carry the container to the analyzing laboratory.

AI.1.6 TROUBLESHOOTING

AI.1.6.1 General Information

If a problem is encountered as a result of the review of the sample summary data which may affect the validity of the sample, download and store the five (5) minute averages. Review the 5 minute averages for operational parameters which may exceed limits of measurement quality objectives defined in Table EI.1.0.2 of these procedures. Also refer to Section 3.4: Troubleshooting, of the Operator's Manual for a probable cause and remedy. Notify your supervisor if the problem cannot be resolved. If the perceived problem does not affect sample validity, refer to Section 3.4: Troubleshooting of the Operator's Manual and continue to monitor the problem or correct it. If the problem persists, contact your supervisor or the manufacturer.

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX AI.2

CALIBRATION PROCEDURES FOR BGI PQ200 AIR SAMPLER

NOVEMBER 2002

AI.2.0 BACKGROUND AND GENERAL INFORMATION

AI.2.0.1 Overview

The calibration of the fine particulate matter samplers whose mass has an aerometric diameter of less than 10 microns (PM10) must be performed on an annual basis. There are several parameters that must be calibrated with this new generation of fine particulate matter samplers. These parameters include flow or volume, temperature, pressure and time. The District has chosen three reference method samplers to monitor for PM10 at this time. These samplers are the BGI PQ200 Sampler, the Rupprecht and Patashnick Partisol-FRM Model 2000 PM10 single channel sampler, and the R & P Partisol Plus Model 2025 Sequential Sampler. Each sampler has a different principle of flow and, therefore, two calibrations are required for this SOP. The primary purpose of the calibration is to determine and/or verify that the volumetric flow of the PM10 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Refer to 40 CFR Part 50, Appendices J and M for further information.

AI.2.0.2 General Information

The calibration of the BGI sampler should be performed in the following steps:

1) temperature calibration
2) pressure calibration
3) leak test
4) volume calibration
5) verify calibration parameters

All calibration information and data will be recorded on the BGI PM10 Calibration Data Sheet (Figure AI.2.0.1).

California Air Resources Board
BGI PM10 Calibration Data

(In Development)

Figure AI.2.0.1
BGI PM2.5 Calibration Data Sheet

AI.2.1 CALIBRATIONS

AI.2.1.1 Calibration Transfer Standards and Equipment

The BGI calibration kit will be used as the calibration transfer standards. The calibration transfer standards and equipment will be as follows:

1. NIST-traceable critical orifice
2. Calibrated electronic thermometer, thermocouple type "K"
3. Calibrated electronic manometer
4. NIST-traceable pressure sensor
5. BGI flow adapter
6. Tubing: _ inch OD, thick walled, surgical rubber, 1 meter in length
   1/8 inch OD, surgical rubber, 3 pieces, 1 foot in length, plus a plastic 1/8 inch "tee"
7. Blank filter(s)
8. Three (3)Two-liter thick walled plastic insulated containers, water and ice
9. Cup heater
10. Calibration forms or laptop computer
11. NIST-traceable timer

EI.2.1.2 Certification of Transfer Standards

All transfer standards used for calibrations will be re-certified every 12 months by the manufacturer's or the District's standards laboratory.

EI.2.1.3 Temperature Sensor Calibration

The BGI Samplers employ epoxy coated bead thermocouples to measure temperature at several locations throughout the sampler. The locations are the outside ambient air and the filter holder assembly. A single-point side-by-side calibration will be performed with the filter temperature sensor. The ambient air thermocouple is used to determine the volumetric flow rate of the sampler. Therefore, it is essential that this temperature sensor be tested for accuracy. It will be the only temperature probe that will receive a full three-point calibration.

From the Main Menu of the BGI sampler, arrow down until the "Maintenance" item is highlighted. Next, select the "Calibrate" option.

AI.2.1.3.1 Ambient Sensor

To calibrate the ambient temperature sensor, remove the sensor from the louvered housing. Place the sensor and the calibration temperature sensor in the ice bath. Agitate the water until readings on both sensors are stable. Record the readings and repeat the agitation and recording three times.

Repeat this procedure for the ambient temperature bath and for the hot water bath.

AI.2.1.3.2 Filter Sensor

To calibrate the filter temperature sensor, place the calibration thermocouple near the filter temperature sensor. Allow the cal. device to equilibrate, and when the readings are stable record the calibration device temperature and the sampler filter temperature sensor measured temperature. Note these temperatures on the calibration sheet. Repeat this comparison a minimum of five times.

AI.2.1.5 Barometric Pressure Sensor Calibration

The barometric pressure sensor of the BGi sampler can be calibrated by comparison with the calibration barometer. Record the make, model, and calibration date of your calibration pressure sensor on the calibration data sheet. Compare the ambient readings of the two sensors throughout the calibration period, a minimum of five separate readings. Record the readings on the calibration sheet.

AI.2.1.6 Flow Rate Calibration

AI.2.1.6.1 Leak Check

Before calibrating the flow (volume) of the sampler it is important to ensure that the sampling train does not have a leak. The Andersen sampler was designed to perform automatic leak checks.

Remove the BGI PM10 inlet. Install the leak check adapter to the sampler inlet, and place the valve in the closed position. Insert 46.2mm Teflon filter(s) into the sample filter position of the monitor.

The leak check procedure is accessed from the Main Menu. Select Leak Check, then Enter to initiate the leak check procedure.

The sampler will pump the system pressure down to approximately 80 mm. When the vacuum reaches that point, a timer is initiated and the vacuum will be tested for 2 minutes.

Record the leak check vacuum and the leak check time on the calibration data sheet.

AI.2.1.6.2 Flow Rate Calibration

The flow rate of the BGI sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate calibration is to ensure that the sampler draws the correct volumetric air flow rate. Section 3.1 of the BGI Operator's Manual discusses the sampler flow calibration. The BGI sampler is flow rate calibrated by measuring the flowrate at 3 points using a NIST-traceable critical orifice.

In this calibration procedure, the flow rate is checked at 16.67 LPM. The flow rate for the second calibration point is 18.3 LPM, and the flow rate for the third point is 15.0 LPM. The following steps outline the calibration procedure:

1. The BGI flow rate is tested by placing the critical orifice on the inlet tube of the sampler and attaching the electronic manometer to the orifice with thick walled silicone rubber tubing. Place a filter in the filter holder and make sure the filter has been properly engaged by the manual sampling system. Choose the calibration selection from the Calibrate menu. Press Enter.

2. Record the orifice ID number, calibration date, calibration coefficient(s), initial readings from both the monitor and the orifice manometer, and the temperature an pressure on the calibration data sheet.

   The sampler should be run for at least 5 minutes to ensure stable readings.

3. The sampler calibration procedure will prompt you to repeat steps 1 through 2 for flow rates of 18.3 and 15.0 LPM.

After the three flow rates have been measured, calculate the calibration device flow rates and compare with the sampler flow rates.

The system will ask if you want to save the calibration. Select Yes to save the calibration if the flow rates on the sampler have differed from those of the calibration orifice by more than 4%, and press Enter.

AI.2.2 SAMPLER CALIBRATION VERIFICATION

AI.2.2.1 Temperature Verification

To verify the ambient temperature sensor, place the calibration thermocouple near the temperature sensor in the shade. Allow the calibration device to equilibrate, and when the readings are stable record the calibration device temperature and the sampler ambient temperature sensor measured temperature. Note these temperatures on the calibration sheet. Repeat this comparison a minimum of five times.

AI.2.2.2 Barometric Pressure Verification

From the Main Menu, select the Maintenance option. Next select the Monitor option. This screen will display the values for the Ambient, Meter, Filter, Inactive thermocouples, and Barometer.

Record the Make, Model, ID Number, Certification Date and Certification Factors for the pressure standard on the calibration data sheet, or laptop calibration program . Read and record three sets of pressure readings from the pressure transfer standard and from the particulate matter sampler in mm Hg. If the difference between the sampler barometer and the calibration barometer is greater than +/-10 mm Hg, the sampler barometer must be recalibrated.

AI.2.2.3 Flow Rate Verification

The flow rate of the BGI sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate verification is to ensure that the sampler draws the correct volumetric air flow rate. Section 3.1 of the BGI Operator's Manual discusses the sampler flow calibration. The BGI sampler is flow rate verified by measuring the flowrate at 16.67 LPM comparing it with the flow rate measured with a calibration critical orifice.

1. The BGI flow rate is tested by placing the critical orifice on the inlet tube of the sampler and attaching the electronic manometer to the orifice with thick walled silicone rubber tubing. Place a filter in the filter holder and make sure the filter has been properly engaged by the manual sampling system. Choose the calibration selection from the Calibrate menu. Press Enter.

2. Record the orifice ID number, calibration date, calibration coefficient(s), initial readings from both the monitor and the orifice manometer, and the temperature an pressure on the calibration data sheet.

   The sampler should be run for at least 5 minutes to ensure stable readings.

AI.2.2.4 Clock/Timer Verification

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler.

Observe the sampler time from the Main Menu, choose "View Run", then "Current Sample". Press "Enter" until you reach the last of 3 screens. The last screen will contain the current sampler time. Enter this value onto the calibration data sheet. At the same time, enter the value of your time keeping device. Identify your time keeping device on the calibration data sheet.

Include the make, model, ID number, date last certified, and bias of your clock.

If the sampler is greater than 10 minutes from true time, reset the system clock.

To reset the clock, from the Main Menu select "Configure", then Set Clock. Enter the correct time to +/- 1 minute from true. Enter the corrected time on your calibration data sheet.

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PM 10 QAPP

APPENDIX E-2

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

RUPPRECHT & PATASHNICK
PARTISOL-PLUS MODEL 2025 PM10 AIR SAMPLER

NOVEMBER 2002

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RUPPRECHT & PATASHNICK
PARTISOL-PLUS MODEL 2025 PM-2.5 AIR SAMPLER

FIGURES

AJ.1.0 GENERAL INFORMATION

AJ.1.0.1 Purpose

The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's Operator's Manual by describing modifications in hardware or procedures which may have been implemented by the Monitoring and Laboratory Division of the Air Resources Board. These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 10 microns or smaller (PM10) when using the Rupprecht & Patashnick (R&P) Partisol-Plus Model 2025 PM10 Air Sampler.

AJ.1.0.2 General Description and Theory of Operation

Read Section 1 of the R&P Operating Manual and see Figure AJ.1...: System Schematic.

AJ.1.0.3 Safety

Installation, operation, maintenance, or calibration of the sampler should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit and due to typical rooftop installations, the risks of working outdoors at elevation should also be considered.

AJ.1.1 INSTALLATION PROCEDURE

AJ.1.1.1 Physical Inspection

Each R&P Partisol-FRM Model 2000 PM10 Air Sampler by the District should be supplied with the following items:

1 Partisol-Plus enclosure with filter exchange mechanism
1 Inlet system for size-selective sampling
1 sample tube
1 Partisol-Plus stand
3 rain hoods and associated hardware
1 flow audit adapter
3 magazine transport container with cassettes and carriers
1 ambient temperature sensor and cable
3 filter cassette magazines
2 sets of inlet O-rings
1 analog input calibration cable
1 mating cable connector for four-pin user output connector
1 Operating software diskette
1 9-to-9 pin computer cable
2 Operating Manuals
1 Service Manual
1 Quick Start Guide

Upon receipt of the sampler(s), inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

AJ.1.1.2 Initial Sampler Installation

Follow directions found in Section 2 of the R&P Operating Manual for installation instructions and consult with your area specialist/engineer or supervisor to assure that installation site complies with Federal and State siting criteria for FRM PM10.

AJ.1.1.3 Initial Sampler Set-Up

Follow directions found in Sections 4, 5, and 6 of the R&P Operating Manual.

AJ.1.2 ROUTINE SERVICE CHECKS *(WORK IN PROGRESS)*

AJ.1.2.1 General Information
Figure E-2.1.2.1.1

AJ.1.2.2 Daily Checks

AJ.1.2.3 Weekly Checks

AJ.1.2.4 Biweekly Checks

AJ.1.2.5 Monthly Checks

AJ.1.2.6 Semiannual Checks

AJ.1.2.7 Annual Checks

To Be included in final draft.

Figure AJ.1.2.1.1
Monthly Quality Control Maintenance Check Sheet

AJ.1.3 MAINTENANCE PROCEDURES *(WORK IN PROGRESS)*

AJ.1.3.1 General Information

AJ.1.3.2 Sampler Maintenance

AJ.1.3.3 PM10 Inlet Maintenance

AJ.1.4 SAMPLE FILTER HANDLING PROCEDURES

AJ.1.4.1 General Information

Federal regulations stipulate specific time frames and environmental conditions for FRM PM10 sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated by the receiving laboratory. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample filters, filter cassettes, or anything else which may come in contact with the sample filters.

AJ.1.4.2 Presampling Filter Handling Procedures

Sample filters must be retained in their shipping containers prior to sampling to ensure that any possible contamination is prevented.

AJ.1.4.3 Postsampling Filter Handling Procedures

Sampled filters must be removed from the sampler and placed in their respective transport holders until they are transported to the laboratory.

The storage environment will have its temperature constantly monitored and recorded.

Sampled filters and their GBUAPCD 24-Hour Sample Report-Field Data Sheets (Figure AJ.1.4.3.1), will be transported in an insulated shipping container containing sufficient "Blue Ice" or other chilled medium to assure that sample filters arrive at the laboratory at a temperature no greater than 25°C or preferably 4°C. Other methods may also be employed if they comply with these requirements.

Transport containers will contain a min/max thermometer, temperature data logger, irreversible temperature indicators (3M, 5°C and 26°C) or other suitable means to determine whether temperature requirements of the sample filters have been exceeded during transit. This requirement also applies when sampled filters are being transported from remote or satellite sites to central or main locations.

Sampled filters will be transported to the laboratory biweekly.

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PARTISOL PM-10 24-HOUR SAMPLE REPORT AND CHAIN-OF-CUSTODY

Filter ID: _____

Site Name: _____ Cassette ID: _____

Site ID: _____ Run Date: _____

Sampler ID: _____ Transport to Field: _____ / _____
Initial Date

PRE-SAMPLE INFORMATION

Operator: _____ Filter Install Date: _____

Install Time: _____

Stat (upper left): _____ Mode (upper right): _____

Start Date: _____ Amb Temp: _____

Sample Start: _____ Filt Temp: _____

Stop Date: _____ Amb Press: _____

Sample Stop: _____

POST-SAMPLE INFORMATION

Operator: _____ Filter Remove Date: _____

Remove Time: _____

Stat (upper left): _____ Rec (upper right): _____

		Min	Avg	Max
Set Start:				
Act Start:	Amb Temp:			
Act Stop:	Filt Temp:			
Elapse Time:	Press:			
Max Temp Diff:	Avg Flow: _____ CV%: _____			
Max Temp Date/Time: _____ / _____	Total Vol: _____			

Oprtr Comments: _____

_____

_____

_____

_____

Transport from Field: _____ / _____
Initial Date

LABORATORY INFORMATION

	Weight	Duplicate	Date	Analyst
Initial:				
Final:				

Comments: _____

_____

_____

Figure AJ.1.4.3. GBUAPCD 24-Hour Sample Report-Field Data Sheet

AJ.1.4.4 Filter Blank Handling Procedures

Upon receipt and identification of filter blanks, treat these filters the same as filters to be sampled with the exception that they will not be used to collect samples. They are to be installed in the sampler for the same time period as a filter sample, stored in a transport container and returned to the laboratory with the sampled filters. Fill out the GBUAPCD 24-Hour Sample Report-Field Data Sheet (Figure E-2.1.4.3.1) with exception of run data and submit with rest of Sample Reports.

AJ.1.5 TROUBLESHOOTING

AJ.1.5.1 General Information

If review of the R&P Operating Manual does not result in correction of the problem, notify your area engineer, specialist, and/or repair facility technician.

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AIR MONITORING QUALITY ASSURANCE

APPENDIX E-2.2

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

CALIBRATION PROCEDURES FOR
R&P PARTISOL-PLUS MODEL 2025 PM10 AIR SAMPLER

TECHNICAL SERVICES GROUP

MARCH 2001

E-2.2.0 BACKGROUND AND GENERAL INFORMATION

E-2.2.0.1 Introduction

This SOP for the Rupprecht & Patashnick Partisol- Plus Model 2025 PM10 Air Sampler (R&P PM10 FRM) is written as a starting point only. The procedures listed are in reference to the R&P Operating Manual and are in the process of being tested or tried. This document is for preliminary purposes only and will likely change as the monitoring program continues.

E-2.2.0.2 Overview

The calibration of the particulate matter samplers whose mass has an aerometric diameter of less than 10 microns (PM10) must be performed on an annual basis. There are several parameters that must be calibrated with this new generation of fine particulate matter samplers. These parameters include flow or volume, temperature, pressure and time. The GBUAPCD has chosen three reference method samplers to monitor for PM10 at this time. These samplers are the BGI PQ200 Air Sampler, the R&P Partisol-Plus 2025 sequential sampler and the R&P Partisol FRM 2000 sampler. Each sampler has a different principle of flow and, therefore, two calibrations are required for this SOP. The following procedures concentrate on the R&P PM10 FRMs.

The calibration procedure in Section 12 of the R&P Operating Manual is fairly complete, accurate and easy to follow. The primary purpose of the calibration is to determine and/or verify that the volumetric flow of the PM10 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Refer to 40 CFR Part 50, Appendices J and M for further information.

E-2.2.0.3 Apparatus for R&P PM2.5 Sequential Sampler Calibration

1. NIST-traceable mass flow transfer standard
2. NIST-traceable temperature sensor
3. NIST-traceable pressure sensor
4. R&P inlet flow adaptor
5. tubing
6. blank filter
7. calibration forms or laptop computer
8. Leak check disk

E-2.2.0.4 General Information

The calibration of the R&P PM10 FRM sampler should be performed in the following steps:

1) temperature calibration
2) pressure calibration
3) leak test
4) flow calibration
5) verify calibration parameters

All calibration information and data will be recorded on the Partisol Flow Check Data Sheet (Figure E-2.2.0.4.1).

Great Basin Unified Air Pollution Control District								
Partisol								
FLOW CHECK								
Date:				Site Name:				
Start:		PST		Operator:				
Finish:		PST		Project:	SB270			
				Site Elevation:		ft		
Make:	R&P			Amb. Press.:		in. Hg		
Model:	2000 / 2025			Amb. Temp.:		deg. C		
Prop. Or Ser. No.:	/							
Type:	PM10 / PM2.5							
Last Cal. Date:								
	Audit Device			Temperature/ Pressure Verification				
Make:	Chinook Eng.				Sampler	Standard	(Raw)	
Model:	Streamline FTS			Filter Temp:				
S/N:	991009			Amb Temp:				
Range:	20	lpm		Amb Pressure:				
Calibration factors:								
m:	0.3931			Time / Date Verification				
b:	-0.4202			Sampler:			Adjust? :	
Cal date:	10/20/99			Standard:				
$Q_a=m[dPxT_a/P_a]^{1/2}+b$ w/ T in Kelvin, P in atm.								
Leak Check:	Initial Pres.		Final Pres.	P_i-P_f		Limit		
External						<5 psi / <25mm		
Internal						/ <140mm		
			Site		Nominal Flow Rates			2%
Audit	Audit Flow Rate		Flow Rate	Diff.	Lower Limit	Upper Limit		16.37-17.03
Point	manometer	(VLPM)	(VLPM)	(%)	(LPM)	(LPM)		
Total Fow Rate					15.0	18.4		4%
								16.03-17.37
Total Flow Rate					15.0	18.4		
Inspect "V" seals:								
Comments:								

Figure E-2.2.0.4.1
R&P PM2.5 Partisol-Plus Sequential Sampler Calibration Data Sheet

E-2.2.1 CALIBRATIONS

E-2.2.1.1 Temperature Sensor Calibration

The R&P PM10 Partisol-Plus sequential sampler has two temperature sensors: the ambient and the filter sensors. These two temperature sensors require one temperature data point each to calibrate. To calibrate, the following procedure requires an external calibrated thermometer or other calibrated temperature reading device.

E-2.2.1.1.1 Ambient Sensor

Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform an ambient temperature sensor calibration.

1. Press <Menu> to enter the service menu with the cursor point to "Calibration/Audit."
2. Press <F3:Senscal> to enter the sensor caliberation screen.
3. Determine the current temperature in ^{O}C at the ambient temperature sensor using the external thermometer.
4. Press <Edit> to enter the edit mode, and move the cursor to the "ACT" (actual) column in the row labeled "AmbT."
5. Enter the current temperature in ^{O}C and press <ENTER> to leave the edit mode.
6. Upon receiving the actual temperature, the system's microprocessor automatically computes the span for the ambient temperature sensor. Note this number for future reference.

E-2.2.1.1.2 Filter Sensor (Service Manual Section 3.2.4)

Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform a filter temperature sensor calibration.

1. Press <Menu> to enter the service menu. With the cursor pointing to "Calibration/Audit," press <F4:FiltCal> to enter the filter temperature calibration screen.
2. Determine the current temperature in ^{O}C at the location of the sample filter in the FRM using the external thermometer.
3. Press <Edit> to enter the edit mode, and move the cursor to the "ACT" (actual) column in the row labeled "FltT."
4. Enter the current temperature in ^{O}C and press <ENTER> to leave the edit mode.

5. Upon receiving the actual temperature, the system's microprocessor computes the span for the filter temperature sensor. Note this number for future reference.

E-2.2.1.2 Barometric Pressure Sensor Calibration (Service Manual Section 3.2.5)

Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform a barometric pressure sensor calibration.

1. Press <Menu> to enter the service menu. With the cursor pointing to "Calibration/Audit," press <F3:SensCal> to enter the sensor calibration screen.
2. Determine the current ambient barometric pressure in mm Hg.
3. Press <Edit> to enter the edit mode, and move the cursor to the "ACT" (actual) column in the row labeled "Pres."
4. Enter the current pressure in mm Hg and press <ENTER> to leave the edit mode.
5. Upon receiving the actual pressure, the system's microprocessor computes the span for the ambient pressure sensor. Note this number for future reference.

E-2.2.1.3 Flow Rate Calibration

E-2.2.1.3.1 Leak Check

Before calibrating the flow of the sampler it is important to ensure that the sampling train does not have a leak. The leak check should be performed as described in Sections 12.1, 12.1.5, and 12.1.7 of the R&P Operating Manual.

E-2.2.1.3.2 Flow Rate Calibration (Service Manual Section 3.2.8)

The flow rate of the R&P PM10 FRM sampler must be 16.67 LPM in order to correctly select particulate matter smaller than 10 microns in diameter. The purpose of the flow rate calibration is to ensure that the sampler draws the correct volumetric air flow rate. Section 11.6 of the R&P PM10 FRM Operating Manual discusses the sampler flow calibration. The R&P PM10 FRM sampler is flow rate calibrated by testing the flow rate at 3 points using a NIST-traceable Streamline FTS Flow Transfer Standard. Return the sampler to the "Main Screen." The device must be in the "Stop Operating Mode" to perform a barometric pressure sensor calibration.

1. Carefully remove the 1st stage inlet from the sampler.
2. Display the "Flow Calibration Screen" by pressing <F5: Setup>, <F2: Calib> and <F2:FlowCal> when in the Main Screen.
4. Five points will be determined and entered. The sampler will compute the proper value for flow span.

E-2.2.2 SAMPLER CALIBRATION VERIFICATION

E-2.2.2.1 Temperature Sensor Verification

The R&P PM10 Partisol-Plus sequential sampler has two temperature sensors: the ambient and the filter sensors. These two temperature sensors require one temperature data point each to calibrate and each sensor requires only one point to verify. To verify the calibration, the following procedure requires an external calibrated thermometer or other calibrated temperature sensor.

E-2.2.2.1.1 Ambient Temperature Sensor (Operator's Manual Section 12.1.1)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Determine the current temperature in ^{o}C at the ambient temperature sensor using the external thermometer.
5. Verify that the value for the temperature displayed as "Ambient Temp" in the Audit Screen is within +/-2 ^{o}C of the external thermometer.
6. If the ambient temperature sensor reading is not within +/-2 ^{o}C of the external thermometer, the ambient temperature sensor must be re-calibrated.

E-2.2.2.1.2 Filter Temperature Sensor (Operator's Manual Section 12.1.2)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll to "Service Mode," press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Press <F4: Filter Advance> to advance the empty cassette into the sampling position. This allows the calibration thermometer to be placed near the filter temperature probe.

5. Determine the current temperature in ^{o}C at the location of the sample filter in the FRM using the external thermometer.

6. Verify that the value for the temperature displayed as "Filter Temp" in the Audit Screen is within +/-2 ^{o}C of the external thermometer.
7. If the filter temperature sensor reading is not within +/-2 ^{o}C of the external thermometer, the filter temperature sensor must be re-calibrated.

E-2.2.2.2 Barometric Pressure Verification (Operators Manual Section 12.1.3)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Determine the current ambient barometric pressure in mm Hg.
5. Verify that the value for the "Ambient Pres" in the Audit Screen is within 10 mmHg of the measured ambient pressure.
4. If the sampler ambient pressure is not within 10 mmHg of the measured ambient pressure, the barometric pressure sensor must be re-calibrated.

E-2.2.2.3 External Leak Check (Operators Manual Section 12.1.5)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Attach the flow audit adapter to the sample tube and close the valve on the flow audit adapter.
5. Press <F5:Leak Check> to display the Leak Check screen. Press <F2:Start>, and follow the instructions displayed on the screen.
6. A "Pass," or "Fail," message will appear on the display. If the "Fail," message appears, conduct a second leak check with a different filter. If the sampler fails

again, follow the troubleshooting guide in the manual. If the “Pass,” message appears, slowly open the valve on the flow adapter.

E-2.2.2.4 Flow Rate Verification (Operators Manual Section 12.1.6)

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Carefully remove the 1st stage inlet from the sampler.
5. Attach the flow rate verification device to the sampler.
6. Turn on the pump by pressing <F2: Pump>, and then turn on the sample flow valve by pressing <F1: Valve>.
7. Determine the flow in units of actual (volumetric) LPM using the flow rate verification device.
8. Verify that the value for the flow rate displayed in the "Flow Rate" field of the Audit Screen is within +/-4% of the flow rate verification device.
9. If the flow rate reading is not within +/-4% of the flow rate verification device, a flow rate calibration must be performed.

E-2.2.2.5 Internal Leak Check

1. Install an audit magazine (containing an empty cassette with no screen in the top position, an external leak check cassette containing a filter in the second position, and an internal leak check cassette containing a solid disk in place of the filter in the third position) into the left or supply side of the sampler. Place an empty magazine on the right or exit side of the sampler.
2. Press <Menu> to display the master menu. Scroll down to "Service Mode," and press <ENTER>
3. Press <F1:Audit> to display the audit screen.
4. Press <F4:Filter Advance> to move the cassette with the leak check disk into the sampling position. Press <F5:Leak Check> to display the leak check screen.
5. Press <F2:Start>, and follow the instructions displayed on the screen.
6. The Partisol-Plus will run an automatic leak check. A "Pass," or "Fail," message will appear on the display.
7. Press <F4:FiltAdv> to move the leak check cassette to the storage magazine. If the "Fail," message appears, clean the cassette and leak check disk carefully, examining the disk for any scratches or nicks. Rerun the test with an undamaged leak check disk. If the sampler fails again, follow the troubleshooting guide in the manual.
8. If the "Pass," message appears, the internal leak check is complete. Remove the audit magazine from the supply side of the sampler and set up for normal sampling operations.

E-2.2.2.6 Clock/Timer Verification

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler.

Observe the sampler time from the Main Screen. Enter this value onto the calibration data sheet. At the same time, enter the value of your time keeping device. Identify your time keeping device on the calibration data sheet.

Include the make, model, ID number, date last certified, and bias of your clock.

The requirement in 40 CFR Part 50, Appendix L, Section 7.4 states that the sampler must not loose more than 1 minute per month.

If the sampler is greater than 12 minutes from true time, reset the system clock.

To reset the clock, from the Main Screen select <F5: Setup>, then select <F1: Edit>. Enter the correct time to +/- 1 minute from true. Enter the corrected time on your calibration data sheet.

GREAT BASIN UNIFIED
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AIR MONITORING QUALITY ASSURANCE

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX E-3

ACCEPTANCE TESTING
FOR
FRM PARTICULATE MATTER 10 MICRON (PM10) SAMPLERS

NOVEMBER 2002

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APPENDIX E.3

ACCEPTANCE TESTING FOR FRM PARTICULATE MATTER 10 MICRON (PM10) SAMPLERS

FIGURES

E.3.1.0 ACCEPTANCE TEST PROCEDURE

E.3.1.0.1 General Information

Federal Reference Method samplers for sampling of particulates of 10 microns and smaller (FRM 10) will be acceptance tested by the technical staff of the Great Basin Unified APCD and/or the Air Resources Board (ARB) Monitoring and Laboratory Division (MLD). Samplers may be supplied by various manufacturers. Samplers may be of a single filter, manual operation design, or may be of a sequential design utilizing rotating filter holder trays or filter cartridge magazines. Before beginning acceptance testing of the samplers, read the operator's manual supplied with each sampler.

Initiate an acceptance test log and an acceptance test mini-report (Figure E.1.0.1.1) for each sampler. Record the dates of the individual test, problems, contacts with the manufacturer, and any other pertinent information on the acceptance test log.

E.3.1.0.2 Physical Inspection

Unpack the sampler and check for physical damage if this has not already been done. Verify that the sampler is complete and includes two service manuals and all options and parts required by the purchase order. Refer to the packing list as necessary. Note any broken or missing parts.

Open access doors, or remove panels or covers as applicable to each individual model of sampler to make the following checks:

1. Verify that the cabinet and all connnections are weatherproof. Visually inspect the gaskets and seals for pin holes and/or damage.

2. Make sure that all circuit boards are properly seated in their connectors by removing and reinserting each board.

3. Check for correct power cord phasing; standard wiring configuration has the black wire connected to the brass terminal of the plug, white to the copper terminal, and green to earth ground.

4. Completely assemble the sampler; including the inlet head, and analyzer accessories following the procedures in the manufacturer's manual. Verify that the cabinet support structure is capable of keeping the sampler secure, steady and upright.

ACCEPTANCE TEST DATA SHEETS
FRM 10 SAMPLER

Manufacturer_____ Model _____ Serial No_____
Type: Sequential Multi-Channel _____ Single Channel _____

Testing performed by_____ Date Test Initiated _____
Test data reviewed by_____ Date Accepted _____

PHYSICAL INSPECTION				
	DATE			
	Completed	Passed	Failed	Final OK
Shipping Damage				
Two operator manuals				
Power cable phasing				
Internal Wiring				
Switch, lamps, controls				
PC board(s) seated				
Assembly				
OPERATIONAL TESTING				
Programming				
Power Failure / Memory				
Leak Check Test				
Calibrate Sample Flowrate				
Filter exchange mechanism				
Operation test “run”				
Data download				
ENVIRONMENTAL CHAMBER TEST				
16 Hour test run				
Flowrate Stability				
Temperature				

Comments, and corrections of failures: _____
_____

Figure E.3.1.0.1.1
Acceptance Test Data Sheets

E.3.1.0.3 Operational Checks

When the FRM PM10 sampler is completely assembled initate operational testing as outlined below. Record the results of each test on the acceptance test data report for each sampler.

1. Basic Operation

   Apply electrical power to the sampler (120 vac @ 60Hz) and turn on the sampler. Verify that all switches and controls, the internal fan and sampler delivery motor operate properly.

2. Programming:

   Program the sampler using the keypad and display. Verify programming and operation of the sampler by automatically initiating and terminating a short operational sample run.

3. Power failure / memory test:

   Interrupt power to the sampler for 3 to 5 minutes. Verify that the sampler restarts, maintains memory, and continues to operate properly after power is resored.

4. Leak check test:

   Perform a leak check on the sample train per the manufacturer's operator's manual. Verify the system's integrity.

5. Flowrate control / calibration:

   Adjust, set or calibrate the sample flowrate through the sampler using a certified mass flow meter (MFM) of the proper range or the calibration apparatus supplied by the manufacturer.

6. a. Filter exchange mechanism test (sequential multi-channel samplers):
      Operate the automatic channel/filter change mechanism for each channel to verify smooth and proper operation.

   b. Filter holder mechanism (single channel sampler):
      Install a filter into the holder apparatus to ensure proper operation of the mechanism and to check for proper sealing of the gasket(s).

7. Operational test run:

   Program the sampler to perform a complete sample "run" for at least four hours.

8. Data download test:

   Connect a laptop (or equivalent) computer or data recovery link provided by the manufacturer to the RS-232 communications port on the sampler and download the operational data resulting from the operational test run (#6 above). Print the data and attach it to the sample report form.

E.3.1.0.4 In Situ Temperature and Voltage Stability Tests

Install the FRM PM10 sampler at the sampling site or in a comparable setting. Connect a certified MFM to the sample inlet of the FRM PM10 sampler under test. Place the MFM near the sampler to measure and record the sample flowrate through the sampler.

Place a thermocouple in the filter holder in FRM PM10 sampler and bring the thermocouple leads outside the sampler housing to measure and record the temperature at the sample filter.

Program the FRM PM10 sampler to operate continuously during this test.

Enter the test results on the acceptance test data sheet and label the forms with the date of test, Manufacturer, Model and Serial Number of the sampler, parameter identification, temperature and voltage data. Clear, precise notations should be entered on the forms indicating when the tests were started and ended, pertinent information regarding sample flow, voltages, temperatures, and any unusual conditions observed. Any additional pertinent information should be attached to the final acceptance reports.

Verify that the FRM PM10 sampler operates properly with no malfunctions during and after the field testing.

E.3.1.0.5 Post Acceptance Test Documentation:

Review and assemble all acceptance test data and documentation and submit it to the designated acceptance test data reviewer. After the review of the data are complete and approved, the FRM PM10 sampler will be delivered to the monitoring site for installation.