

Implementation Plan

PM_{2.5} Monitoring Program

Monitoring and Quality Assurance Group
Emissions, Monitoring and Analysis Division
United States Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Note: Current through 3/30/98

PM_{2.5} Monitoring Implementation Plan
3/30/98

Table of Contents

1.0	Program Description, Resources, and Implementation	1
1.1	Program Goal and Objectives	2
1.2	Network Conceptualization and Major Program Components	3
	Compliance Monitoring	3
	Special Purpose Monitoring	4
	Continuous Sampling	5
	Chemical Speciation Sampling and Analysis	5
	Special Chemical Speciation Studies	6
	Integration with Visibility Measurements	6
	Quality Assurance	7
1.3	Implementing the Program: Milestones, Mechanisms, and Resources	8
	Schedules and Milestones	8
	Major National Procurements	11
	Resources and Grant Allocations	12
	Internal U.S.EPA Resources	14
	Training	14
1.4	Roles and Responsibilities	15
	State and Local Agency Responsibilities	15
	U.S.EPA Regional Office Responsibilities	16
	U.S.EPA Office of Air Quality Planning and Standards Responsibilities	17
	U.S.EPA Office of Research and Development Responsibilities	18
	U.S.EPA Contracts Management Division Responsibilities	18
	U.S. Department of Interior, National Park Service Responsibilities	18
1.5	Communications	19
2.0	Regulation Overview	24
2.1	PM _{2.5} Network Design	24
2.2	PM ₁₀ Monitoring Networks	24
2.3	Sampling Frequencies	25
2.4	Chemical Speciation	25
2.5	Quality Assurance (QA)	25
2.6	Data Use Moratorium	26
2.7	Monitoring Methodology	26
2.8	PM Monitoring Network Description	28

3.0	Network Design/Deployment of Samplers	29
4.0	Laboratory Analyses: Chemical Speciation and Mass	32
4.1	Introduction	32
4.2	Goals of Sample Speciation	32
4.3	Targeted Analytes	33
4.4	Sampling and Analysis	33
4.5	Program Objectives	36
5.0	Quality Assurance (Mass)	39
5.1	Introduction	39
5.2	Communication	40
5.3	QA Roles and Responsibilities	41
5.4	Planning	42
5.5	Implementation	45
5.6	Assessments	48
5.7	Reporting	49
5.8	Summary and Needs	50
6.0	Special Chemical Speciation Studies	52
6.1	Introduction	52
6.2	Objectives	53
6.3	Program Administration	54
6.4	Mechanisms for Identifying and Conducting Program	55
6.5	Schedule for Activities	56
7.0	Visibility/IMPROVE Program Integration with PM _{2.5} Monitoring	57
8.0	PM _{2.5} Data Interpretation/Analysis	60
8.1	Potential Uses of the PM _{2.5} Mass Data	61
8.2	Potential Uses of the PM _{2.5} Speciation Data	62
8.3	Schedule	63
9.0	Tracking - Program Implementation	65
9.1	Background	65
9.2	National PM _{2.5} Sampler Procurement Contract Tracking	65
9.3	Monitoring Site Information Tracking	65
9.4	Reporting	66

10.0	Training	67
	10.1 Introduction and Objectives	67
	10.2 Available Training Mechanisms	68
	10.3 Stakeholders and Participants	69
	10.4 PM _{2.5} Monitoring Milestones, Mechanisms, and Training	69
11.0	Tribal Land PM _{2.5} Funding Allocation, Monitoring and Deployment Strategy	72
	Common Acronyms in the PM _{2.5} Program	73
	Appendix - Internal U.S.EPA Resources	76
	Not included in Internet version due to sensitive procurement-related information.	

1.0 PROGRAM DESCRIPTION, RESOURCES, AND IMPLEMENTATION

The deployment of a new PM_{2.5} monitoring network is a critical component in the national implementation of the new PM_{2.5} National Ambient Air Quality Standard (NAAQS). Substantial resources are being provided to support a national monitoring network of approximately 1,500 PM_{2.5} sites as described within President Clinton's Directive of July 16, 1997. The network will follow the regulations provided in Title 40 of the Code of Federal Regulations (40 CFR), Parts 50, 53, and 58, and published in the *Federal Register* on July 18, 1997. The ambient data from this network will drive an array of regulatory decisions, ranging from designating areas as attainment or nonattainment, to developing cost-effective control programs, and to track the progress of such programs. It is important to establish the network as soon as practicable so that other programmatic efforts relying on PM_{2.5} environmental data are not delayed. This document outlines the actions that U.S.EPA and State/local air pollution control agencies must undertake to establish the PM_{2.5} monitoring network, and it will serve as the organizational basis for network implementation. This document is not a treatise on the fine particulate matter air pollution problem; rather, it is intended to provide a common foundation and approach for the many individuals and organizations responsible for developing and deploying the PM_{2.5} network. The objectives of this implementation plan are to:

- ! Describe the rationale underlying the network and its components.
- ! Establish and affirm major products (e.g., training programs, procurements) and timelines required to implement the network.
- ! Define roles and responsibilities of organizational groups and individuals.
- ! Generate consensus among those responsible for network deployment and operation.

This plan provides a description of the PM_{2.5} ambient air monitoring program implementation efforts including the basic rationale for the various network components, information on the implementation activities and resources, and a description of the various roles and responsibilities across organizations. After these elements are discussed, the document starts with an overview of the PM_{2.5} monitoring regulations (Chapter 2). Chapters 3 through 7 address major program components (network design and deployment of samplers, chemical speciation, quality assurance, special chemical speciation studies, and the integration of PM_{2.5} and visibility networks) representing core implementation elements that relate directly to budget allocation categories. Chapter 8 addresses the data analysis plan. Chapter 9 addresses the support and peripheral activities required to implement and track progress of the program. Chapter 10 provides information on the variety of training activities that will be used to ensure the success of this program, and Chapter 11 briefly describes the available information on PM_{2.5} monitoring on tribal lands. An Appendix of the U.S.EPA's internal Monitoring and Quality Assurance Group's budget is included for internal planning purposes.

An Executive Summary for this PM_{2.5} Implementation Plan is provided under a separate

cover. This full implementation plan and its executive summary will be updated as needed to reflect the most current schedules and activities related to the PM_{2.5} monitoring program. Both of these documents can be found on the Ambient Monitoring Technology Information Center (AMTIC) Internet site at <http://www.epa.gov/ttn/amtic/amticpm.html>, under the "Implementation" section.

1.1 Program Goal and Objectives

The goal of the PM_{2.5} monitoring program is to provide ambient data that support the nation's air quality programs, including both mass measurements and chemically resolved, or speciated, data. Data from this program will be used for PM_{2.5} NAAQS comparisons, development and tracking of implementation plans, assessments for regional haze, and assistance for studies of health effects, and other ambient aerosol research activities. Clearly, the most immediate and highest priority for this program is developing a mass measurement data base for PM_{2.5} NAAQS comparisons. Chemically resolved data serve the implementation needs and the development of emission mitigation approaches to reduce ambient aerosol levels. These needs include emissions inventory and air quality model evaluation, source attribution analysis, and tracking the success of emission control programs. Chemical measurements also provide support for scientific studies of health effects and atmospheric chemistry that will inform future reviews of the particulate matter NAAQS, and for regional haze assessments.

The following basic PM_{2.5} monitoring program objectives service the requisite PM_{2.5} program information needs:

1. Designation of federal reference and equivalent method (FRM/FEM) samplers to collect data for PM_{2.5} NAAQS comparison purposes.
2. Establishment of a network of 1,500 PM_{2.5} sites by December 31, 1999, with 1,100 PM_{2.5} sites established by December 31, 1998. These 1,500 sites includes those using FRM/FEM samplers, sites employing continuous analyzers, chemical speciation sites, visibility measurement sites, and special purpose monitoring sites.
3. Development of a national chemical speciation sampling and analysis program by December 31, 1998.
4. Collection, measurement and storage of quality assured data beginning on January 1, 1999, to support NAAQS comparisons, PM_{2.5} program implementation needs, and regional haze assessments.
5. Development of the Special Chemical Speciation Studies Program which provide information to inform existing and future studies on health effects and emission source apportionment activities inherent in the development of State implementation plans (SIP).

Each of the above objectives are tied into the Government Performance and Results Act

(GPRA) U.S.EPA air program goals related to the PM_{2.5} air quality program. These GPRA goals are a part of the program specific guidance elements that will accompany future grant guidance (FY99 and beyond) that is forwarded to the U.S.EPA Regions and State/local agencies.

1.2 Network Conceptualization and Major Program Components

The planned network serves multiple information needs, and reflects new siting and collection strategies. Consequently, the planned network is complex, difficult to describe, and subject to multiple interpretations based on an individual's perspectives and program familiarity. For example, the community-oriented siting of samplers and collection of mass data for comparison to the annual PM_{2.5} NAAQS is different than for other criteria pollutants, which focus on peak concentrations measured anywhere in the ambient air.

As discussed in the previous section, data from this program will be used for (1) PM_{2.5} NAAQS comparisons, (2) development and tracking of implementation plans, (3) assessments for regional haze, and (4) assistance for health studies and other ambient aerosol research activities. The federal reference method (FRM) sampler design and network concepts like community-oriented monitoring (including "spatial averaging") are predicated on the need to produce data commensurate with those health studies underlying the development of the PM_{2.5} NAAQS. The FRM, built with many design-specified components, is similar conceptually to the samplers used in the epidemiological studies supporting the PM_{2.5} NAAQS. However, the FRM may not completely characterize fine particulate which are complex multi-phase (gas, liquid, solid) mixtures composed of various chemical constituents which vary across particle size ranges. Under certain conditions, sampling can be subject to various positive and negative artifacts. The FRM design with a Teflon® filter can experience a loss of volatile constituents (i.e., release of nitric acid vapor from particulate ammonium nitrate), which can be more completely captured by other sampling approaches. However, the principal objective of the FRM sampler is to measure a particulate matter "indicator" which defines PM_{2.5} and which tracks back to those measurements used in the health studies supporting the PM_{2.5} NAAQS. The requirement that these instruments rely on specific design elements, rather than performance criteria alone, is structured to produce greater measurement precision and to avoid the data measurement uncertainties experienced in the PM₁₀ monitoring program. Because the FRM PM_{2.5} samplers do not provide temporally resolved data or full chemical characterization of ambient aerosols, other sampling instruments including continuous analyzers and speciation samplers will constitute part of the instrument mix utilized in the PM_{2.5} network.

Network Elements.

Compliance monitoring. The network design addresses the aforementioned four program objectives through a combination of siting and instrumentation strategies. The network design focus for compliance of both the annual and 24-hour PM_{2.5} NAAQS strives to locate monitoring sites in populated areas, with a major emphasis on communities exposed to concentrations representing larger areas, or area-wide concentrations. This emphasis on area-wide concentrations again reflects the need to be consistent with studies underlying the PM_{2.5} NAAQS,

analogous to the rationale for the FRM specifications.

The projected 1,500 site network includes 848 sites required as a minimum by the 40 CFR 58 regulation. (Typically, deployed regulatory networks are made of many more sites than the minimum required by regulation.) A strict interpretation of the regulations suggests that a minimum of 745 sites would be eligible for comparison to the PM_{2.5} NAAQS requiring the use of FRM/FEM samplers, and the remaining 103 sites are used to meet minimum background and transport requirements and may or may not employ FRM/FEM samplers. The 652 supplemental sites will be used to address the needs for broader coverage of populated areas, spatial averaging, special purpose monitoring, and visibility.

The description of the federal reference method for PM_{2.5} is included in 40 CFR 50, Appendix L, published as a final rule in the Federal Register on July 18, 1997. Essentially, the PM_{2.5} FRM is a gravimetric method that acquires deposits over 24-hour periods on Teflon®-membrane filters from air drawn at a controlled flow rate through a tested PM_{2.5} inlet. The inlet and size separation components are specified by design as published in the Code of Federal Regulations. The PM_{2.5} equivalent methods will vary from this basic FRM definition and are divided into three categories, Class I, II, and III. Definitions for each of these are provided in 40 CFR §53.1, published as a final rule in the Federal Register on July 18, 1997. The three classes of equivalent methods are used to describe the degree of variation between each equivalent PM_{2.5} method and the PM_{2.5} FRM design. A description of these differences is also included in the "Guidance for Network Design and Optimum Site Exposure for PM_{2.5} and PM₁₀," dated December 1997 and available on the U.S.EPA Internet site at <http://www.epa.gov/ttn/amtic/pmstg.html>.

It is important to emphasize that all PM_{2.5} sampling sites that provide data for comparison to either the 24-hour or the annual PM_{2.5} NAAQS for the purposes of addressing attainment/nonattainment must employ designated FRM/FEM sampling techniques.

Special Purpose Monitoring. Strict compliance monitoring for comparison to the PM_{2.5} NAAQS is the highest priority, but not the only one, for the network. Special Purpose Monitoring (SPM) sites will provide a means to characterize ambient aerosol levels in as many areas as possible. Historically, there have been monitoring disincentives associated with the consequence of a site showing violations of a NAAQS. As a result, the U.S.EPA has provided significant flexibility on the use of PM_{2.5} SPM data for the first two years of a PM_{2.5} SPM's operation. In accordance with regulations contained in 40 CFR §58.14, PM_{2.5} SPM data that are collected with FRM/FEM samplers would not be used for compliance purposes for the first two years of its operation. If the sampling period extends beyond the second year, all of the PM_{2.5} SPM data collected with a FRM/FEM would be subject to the same data analyses as other FRM/FEM sites. The U.S.EPA believes that there will be more than sufficient compliance monitoring sites; the flexibility provided by SPM sites allows for better spatial, temporal, and chemical characterization of ambient aerosols and ultimately a more sound information base for developing emission mitigation strategies. Monitoring agencies are also encouraged to use SPMs to identify and evaluate areas that might be impacted by elevated PM_{2.5} air pollution levels, and where additional FRM monitoring may be necessary. Note: the 40 CFR 58 regulations do not require SPM sites to be equipped with FRM/FEM samplers.

Continuous sampling. The 40 CFR 58, Appendix D, §2.8.2.3 regulation requires that a continuous sampler be placed in each of the nation's 52 largest metropolitan areas or cities. In addition, the monitoring regulations allow the use of continuous samplers to reduce the resource burdens of everyday sampling in other areas where FRM/FEM samplers are not required. Continuous PM_{2.5} data will provide useful data for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. If continuous samplers gain equivalency as a federal equivalent PM_{2.5} method, these samplers will be used for PM_{2.5} NAAQS compliance.

Chemical speciation sampling and analysis. The U.S.EPA recognizes that the PM_{2.5} network will be the major source of information for developing emission mitigation strategies and for tracking the success of implemented control programs. The basic objective of the chemical speciation analysis is to develop seasonal and annual chemical characterizations of ambient aerosols across the nation. These chemically resolved data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies and regional haze assessments. Note that comparisons of air quality model predictions and mass measurements alone provide unsatisfactory tests of model behavior and are complicated further by the inherent uncertainties in mass measurements due to sampling artifacts. Speciated data provide a wealth of information (as opposed to mass concentrations alone) that potentially can uncover model flaws and lead to greater confidence in model predictions. Development of this program element is being made in consultation with State and local agency representatives and the scientific/research community and in consideration for national scientific programs such as the Inner City Asthma Study being conducted in various locations across the country.

The U.S.EPA is developing laboratory standard operating procedures (SOPs) that will be consistent with techniques used by various agencies and research groups currently operating ambient air particulate matter speciation programs. Sampling for speciation purposes is a developing science, and as such, the U.S.EPA encourages creative approaches to speciation measurements. Retaining flexibility by not prescribing speciation sampling methods should be interpreted as a technology driver. Of course, the penalty for flexibility is some degree of data uncertainty stemming from different methods. The greatest uncertainty of the speciation sampling and analysis program exists in the laboratory protocols; therefore, the U.S.EPA is requiring greater standardization for the laboratory analysis component.

Funding is provided for approximately 300 sites which would sample specifically for the purpose of providing speciated data. Fifty speciation sites are required by 40 CFR 58, Appendix D, §2.8.1.5 regulation, the majority of which will be placed in high population areas and in areas with emissions of interest such as the existing Photochemical Assessment Monitoring Stations (PAMS) #2 sites or at other sites with collocated FRM/FEM samplers (with some exceptions for State and local air monitoring stations (SLAMS) sites designated as background or transport which may not include FRM/FEM samplers). The balance between the 50 required sites and 300 planned sites reflects the need for tailoring certain sites to area-specific needs. For example, some areas may choose to focus on episodes or specific seasons, such as winter time wood smoke. Retaining a minimum of 50 sites for consistency across space and time for longer-term trends allows other sites to use a wider variety of approaches to address particular regional and local

issues.

Because data from the chemical speciation sites is of interest to the scientific community, the U.S.EPA encourages State and local agencies to develop their chemical speciation networks in consultation with local and national researchers who are conducting health effects studies.

The U.S.EPA does not believe that a single nationwide approach to speciation sampling and analysis is the best approach everywhere. The U.S.EPA does expect agencies to use a more standardized approach to sampling and analysis at the 50 required trends sites; however, flexibility in the approaches used at other chemical speciation sites is provided. These approximately 250 additional speciation sites may follow a sampling and analysis program similar to the 50 trends sites; however, alternative speciation approaches will be considered on a case-by-case basis through negotiation with appropriate U.S.EPA Regional Offices and the Office of Air Quality Planning and Standards (OAQPS).

Special chemical speciation studies. The two primary objectives of the special chemical speciation studies are to support SIP development activities and to provide information to support health effects studies and the reviews of the particulate matter NAAQS. The more “routine” chemical speciation program described above is a critical tool that will support both of these activities; however, the U.S.EPA intends to supplement these data collection efforts with more intensive data collection activities referred to as “special chemical speciation studies”. The special chemical speciation studies will provide a better understanding of region-specific air pollution processes and improve on the subsequent SIP development process. Such monitoring is expected to include establishing “super” sites that sample for an array of chemical species on frequent sampling intervals at 5-7 locations, depending upon available resources, across the country. Other potential activities in special chemical speciation studies include enhancing some of the existing field studies, supporting existing programs, epidemiological and other health studies, developing focused approaches on unique problem areas, and conducting elevated sampling through aircraft or other means. The special chemical speciation studies will be coordinated with ongoing national and regional activities in order to take full advantage of these efforts and available funding. Chapter 6 provides additional details on the special chemical speciation studies.

Integration with visibility measurements. There are a variety of strong technical connections between visibility and fine aerosols monitoring that support a comprehensive monitoring program that services both PM_{2.5} and visibility assessments. The new PM_{2.5} monitoring regulations encourage the placement of PM_{2.5} monitors outside of population centers to facilitate implementation of the PM_{2.5} NAAQS and to augment the existing visibility fine particle monitoring network. The coordination of these two monitoring objectives will facilitate implementation of a regional haze program and lead to an integrated monitoring program for fine particles. Chapter 7 provides additional information on this integration and how the visibility monitoring program will be managed with regard to making PM_{2.5} data available.

Quality Assurance. The quality assurance (QA) program strives to ensure that the network produces PM_{2.5} data of the quality necessary to support the objectives of the program. The quality assurance program covers many areas:

1. Establishment of data quality objectives that will ensure the usability and defensibility of the PM_{2.5} data.
2. Development and implementation of a program for certifying federal PM_{2.5} reference and equivalent methods, ensuring that each type of monitoring instrument will operate within similar bias and precision limits.
3. Development of standardized operating procedures for field, sample handling, and laboratory activities, to ensure data comparability.
4. Requirements for a broad range of standardized quality control activities to evaluate and control measurement uncertainties or errors.
5. Collocation of samplers to quantify measurement precision.
6. Performance of a federally implemented independent FRM performance audit to quantify system bias.
7. Implementation of qualitative assessments at the local and Federal level to ensure the proper development and operation of the quality assurance program.

In addition, the consistency derived from the designation of federal reference and equivalent methods should be considered a major component of the quality assurance program. The complex nature of aerosols present substantial challenges in estimating system bias. Unlike criteria pollutant gases, aerosol standards for instrument calibration do not exist. Consequently, an important national FRM audit program will be implemented to capture overall system accuracy (bias and precision). Chapter 5 discusses the quality assurance program for mass measurements.

1.3 Implementing the Program: Milestones, Mechanisms, Training, and Resources

Schedules and Milestones. Table 1.1 provides a listing of the major actions, training, and milestones for the implementation of the PM_{2.5} monitoring network.

Table 1.1 PM_{2.5} Monitoring Implementation Schedule.

ACTION	MILESTONE
40 CFR 50, 53, and 58 PM _{2.5} regulation	July 18, 1997 Part 58 available on AMTIC* Parts 50 and 53 available on TTN Airlinks (http://www.epa.gov/ttn)
States & Regions develop network designs	September 1997 - June 30, 1998 Progress posted on AMTIC*
States establish 1,500 PM _{2.5} sites	September 1997 - December 31, 1999
U.S.EPA Regions send States §103 PM _{2.5} grant guidance memo from OAR	January 9, 1998
Network design guidance (draft 9/20/97)	December 15, 1997 - Available on AMTIC under Network Design*
Delivery of 50 prototype PM _{2.5} samplers to States via Regions	December 1997 - March 31, 1998
QA guidance on sampling/filter handling (Method 2.12) (Final Red Book guidance available in March 1998)	December 1997 - Draft available on AMTIC under Quality Assurance*
Delivery of 37 mm Teflon® filters for dichots (nat'l purchase)	December 1997
U.S.EPA Regions will negotiate §103 work plans	December 15, 1997 - January 31, 1998
Preliminary feedback from States on # samplers and site types	January 15, 1998
PM _{2.5} : A Fine Particle Standard specialty conference sponsored by Air and Waste Management Association (AWMA)	January 28-30, 1998 Long Beach, California
Award for national procurement contract to buy 46.2mm Teflon® filters	January 31, 1998
States §103 grant applications due to Regions containing approved program work plans and draft network plans	February 1, 1998
U.S.EPA Regions award §103 grants for PM _{2.5} monitoring	February 15 - March 1, 1998
U.S. EPA Network Design Videotape	March 1998 Jan Cortelyou, 919-541-5393
Model QA Project Plan Guidance Document	March 6, 1998 (mass mailing of final draft) March 31, 1998 final version signed by each Region
FY99 §103 grant guidance to Regions from OAR	March 1998

QA Handbook (Red Book) with final Method 2.12 (Draft Method 2.12 available in December 1997)	Mid-April 1998
APTI Course SI:433 - "Network Design and Site Selection for Monitoring PM _{2.5} and PM ₁₀ in Ambient Air" revised to include PM _{2.5}	March 1998 Deborah Miller, 919-541-5552
Regions provide OAQPS with sampler ordering information for FY98 based on State/local agency requests.	March 2, 1998
U.S. EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Network Design/Balance Room Focus	March 25, 1998 Jan Cortelyou, 919-541-5393
FRM/FEM designations granted	March 31, 1998 and ongoing
U.S.EPA awards nat'l PM _{2.5} sampler proc. contract & makes first orders (info on # and type of samplers must be compiled by Regions and to OAQPS by March 2, 1998.)	March 31, 1998
U.S.EPA Workshop on the Special Chemical Speciation Studies program design.	Summer 1998 (Specific details will be made available as soon as possible.)
U.S.EPA Regions provide comments to States on the draft network plans submitted with grant applications.	April 2, 1998
Continuous monitoring guidance (Draft in March 1998)	May 1998
U. S. EPA Videotape - Balance Room Set-up, COC	May 1998 Jan Cortelyou, 919-541-5393
Speciation monitoring guidance (Draft to work group for review on February 25, 1998)	May 1998
FRM Performance Audit Implementation Plan	May 1998
U. S. EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Monitoring Focus	May 1998 Jan Cortelyou, 919-541-5393
FRM Performance Audit Standard Operating Procedures	May 1998
U.S.EPA/AWMA Training on PM _{2.5} Laboratory and Sampling Equipment	May 20-21, 1998 in RTP, NC Details available on AMTIC*
U.S.EPA orders 46.2 mm filters for speciation samplers (national small purchase)	May 1998
Vendors begin deliveries of FRM/FEM samplers to States (from 3/31/98 order)	June 1, 1998
Delivery of 46.2mm Teflon® filters	June 1, 1998
FRM Performance Audit QA Project Plan	June 1998
APTI Course SI:434 - "Introduction to Ambient Air Monitoring" revised to include PM _{2.5}	June 1998 Deborah Miller, 919-541-5552
Site review guidance for "quality assuring 187 sites"	June 1998

U.S.EPA Videotape - Monitor Operations	June 1998 Jan Cortelyou 919-541-5393
States submit final PM _{2.5} network descriptions to Regions	July 1, 1998
Regions approve final PM _{2.5} network descriptions	July 31, 1998
APTI Course 435 - "Atmospheric Sampling" revised to include PM _{2.5}	July 1998 Deborah Miller, 919-541-5552
APTI Course 470 - "Quality Assurance for Air Pollution Measurement Systems" revised to include PM _{2.5}	August 1998 Deborah Miller, 919-541-5552
Speciation samplers delivered to States	September 30, 1998
Delivery of 46.2mm filters for speciation samplers (nat'l small purchase)	September 30, 1998
Portable QA FRM audit samplers delivered	October 30, 1998
APTI Course SI:471 - "General Quality Assurance Considerations for Ambient Air Monitoring" revised to include PM _{2.5}	October 1998 Deborah Miller, 919-541-5552
U. S. EPA APDLN Broadcast - PM _{2.5} Monitoring Update - QA/QC Focus	October 1998 Jan Cortelyou, 919-541-5393
U. S. EPA Videotape - PM _{2.5} Monitoring QA/QC	Fall 1998 Jan Cortelyou, 919-541-5393
Speciation laboratory analysis contract award	December 1998
U. S. EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Chemical Speciation Focus	December 1998 Jan Cortelyou, 919-541-5393
U. S. EPA Videotape - Chemical Speciation	December 1998/Winter 1999 Jan Cortelyou, 919-541-5393
Quality assurance project plans approved by Regions	December 1, 1998
1,100 PM _{2.5} sites are established	December 31, 1998
States begin "routine" data collection at 1,100 sites	January 1, 1999
1,500 PM _{2.5} sites are established (1,100 from 1998 + 400 add'l sites)	December 31, 1999
States begin "routine" data collection at 400 add'l sites (total of 1,500 sites nationally)	January 1, 2000
U.S.EPA Regions conduct oversight conference calls and/or visits with States on implementation of PM _{2.5} monitoring networks.	Quarterly
U.S.EPA reports on the States PM _{2.5} Monitoring Network implementation in mid-year and end-of-year grant reports.	Semi-annually

*For PM_{2.5} information on the AMTIC, see <http://www.epa.gov/ttn/amtic/amticpm.html>

Major National Procurements. The U.S.EPA is developing national procurement contracts for elements of the program that benefit from centralized (or regional) coordination.

Potential benefits include a net reduction in administrative burden, the advantage of economies of scale, consistency in services/products supplied, and the increased ability to account for expenditure of State Grant funds. National procurement efforts in place or under development include:

1. Multi-vendor, 5-year, National PM_{2.5} Sampler Procurement Contract for the purchase of PM_{2.5} mass samplers. The Request for Proposals was published on October 29, 1997, the vendor pre-proposal conference was held on November 6, 1997, and contract award is slated for March 31, 1998. Copies of the request for proposals can be downloaded from the U.S.EPA's AMTIC Internet site at <http://www.epa.gov/ttn/amtic/amticpm.html>. Four types of samplers will be available through this contract including:

Single Channel Sampler: This sampler is gravimetric filter-based with a single channel flow device (from inlet to filter) that produces a 24-hour concentration. This sampler will be used for the routine monitoring in the SLAMS network.

Sequential Sampler: This sampler is gravimetric filter-based with either a single channel flow device (Federal Reference Method) or a split flow device (Federal Equivalent Method) that produces a 24-hour concentration, and it can automatically set up for another 24-hour sample without operator assistance.

Portable Audit Sampler: This sampler is gravimetric filter-based with a single channel flow device (FRM) that produces a 24-hour concentration. This sampler is designed to be transportable and capable of frequent sampling, and it will be used to fulfill the requirement in the independent audit program.

Speciation Sampler: This sampler is gravimetric filter-based with three filter modules to capture specific PM_{2.5} particles to be used for speciation analyses and identification of those particles. The requirements for this sampler is the multiple filters, the capability to produce a 24-hour sample, and to a PM_{2.5} cut-point.

2. National 5-year contract for purchasing the 46.2 mm Teflon® filters used for the PM_{2.5} FRM/FEM; national small purchases for the 46.2 mm quartz and nylon filters used in the PM_{2.5} speciation modules; and a national purchasing vehicle for the 37 mm Teflon® filters used for dichotomous samplers.
3. Field and laboratory support for national FRM audits will be provided under a national effort to support the new QA program which involves auditing the new PM_{2.5} sites with a Portable Audit Sampler.
4. Laboratory services for chemical speciation filter analyses will be provided under a national contract to support the chemical speciation and identification of PM_{2.5} particles.
5. OAQPS small purchase orders for 50 prototype PM_{2.5} samplers for delivery to Regions

and then on to State and local agencies for subsequent use to familiarize monitoring contacts with sampler operation. Funds for these samplers were taken from U.S.EPA OAQPS' budget, and did not require a §103 grant tap. These samplers will be delivered to each Regional Office by March 31, 1998.

These procurement efforts are a service provided by the U.S.EPA, and although State/local agency participation is not mandatory, the practical considerations of resource planning by the government and the vendor community almost demand an extremely high level of participation in these efforts.

Resources and Grant Allocations. Funds to support the complete deployment of the 1,500 site PM_{2.5} network by December 31, 1999, are expected to be provided under authority of the Clean Air Act §103. These funds will cover all network establishment and operational costs (all categories of capital, operations and maintenance, and labor) in FY98 and FY99. A summary of the funded PM_{2.5} monitoring network elements is provided in Table 1.2. These grant funds cannot be spent on programs unrelated to establishing the PM_{2.5} network, nor for items that do not directly benefit the States/local agencies. Since several aspects of the monitoring program involve national procurements, substantial levels of Grant funds will be withheld to meet these expenditures. Categories subject to grant withholding include funding for samplers purchased from the National PM_{2.5} Sampler Procurement Contract (FRM/FEM, portable FRM audit samplers, and speciation samplers), filters, chemical speciation analyses, IMPROVE samplers, and national FRM performance audit costs.

Table 1.2 §103 Grant Funding and PM_{2.5} Monitoring Network Elements.

FY98 - \$35,678,000 §103 Grant Funding Provided to States <i>Elements Funded:</i>	FY99 - \$51,852,500 Submitted in President Clinton's FY99 Budget Request <i>Anticipated Elements:</i>
1,100 PM _{2.5} Sites (existing sites and new FRM/FEM sites, all categories of site preparation, site establishment, samplers, and associated equipment.)	1,500 PM _{2.5} sites (includes 400 additional sites plus costs for 1,100 existing sites, all categories of site operation and maintenance, site preparation, site establishment, samplers, and associated equipment. Also, includes sampler replacement costs for existing non-FRM/FEM sites--approx. 141 dichots, continuous samplers, PM ₁₀ -PM _{2.5} conversions, and nephelometers.)
Filters (46.2 mm Teflon®, nylon, & quartz, for use in FY99 + 37 mm Teflon® filters)	Filters (46.2 mm Teflon®, nylon, & quartz, for use in FY00 + 37 mm Teflon® filters)
Meteorological equipment, installation, operation and maintenance (25 stations)	Operation and maintenance for established meteorological stations
Continuous samplers (52)	Continuous Samplers (operation and maintenance for 52 sites + possible other new sites)
Characterization (or saturation) studies	Laboratory upgrades (weighing rooms, balances, etc.)
Laboratory upgrades (weighing rooms, balances, etc.)	Speciation sampling (additional modules, sampling and analysis, operation and maintenance)
Speciation sampler modules (20)	IMPROVE sites (58 additional sites + operation and maintenance for existing sites)
IMPROVE sites (30 upgrades to existing sites + 20 new sites)	National FRM performance audits
National FRM performance audit infrastructure costs	

President Clinton's FY99 budget request includes \$51,852,500 for PM_{2.5} ambient air monitoring activities. The FY99 budget must still be acted on by Congress, and its amount could potentially change during this process. It is expected that Congress will authorize funds under the authority of the Clean Air Act (CAA) §103, as was the case in FY98. At present, this amount for FY99 is less than what is expected to be needed to fully implement the entire PM_{2.5} monitoring program elements as listed in Table 2 above, although it is expected to be sufficient to fund the operation and maintenance of the PM_{2.5} sites established in FY98 and the establishment of 400 additional sites in 1999. Depending upon the final budget figure for FY99, it may be necessary to defer the implementation of some program elements into FY00. The U.S.EPA is currently reviewing the program needs for FY99 and identifying potential areas for deferment

should this become necessary. Some of the elements under consideration include the meteorological monitoring, portions of the routine chemical speciation and analysis program, savings from temporary reductions in mass sampling frequencies, portions of the continuous sampling element, and replacement costs for older existing particulate matter equipment. It is U.S.EPA's intention to take all measures to ensure that any deferment does not impact the basic deployment of the 1,500 sites. U.S.EPA will share this information on the FY99 budget, and any new information on the FY00 budget, as it becomes available.

To appropriately allocate monetary resources to the State and local agencies which will conduct PM_{2.5} monitoring and to accurately determine the national needs for hardware and infrastructure development, U.S.EPA has prepared detailed matrices of both estimated costs for monitoring and proposed allocations of the new PM_{2.5} samplers and all associated equipment and resource needs. In great part, the costs were initially based on independent information obtained from *Guidance for Estimating Ambient Air Monitoring Costs for Criteria Pollutants and Selected Air Toxic Pollutants* (EPA-454/R-93-042, U.S. Environmental Protection Agency, Research Triangle Park, NC, October 1993) and from data prepared for the PM_{2.5} ambient monitoring Information Collection Request dated July 1997. These data were updated to reflect real present costs prior to conducting PM_{2.5} cost projections and allocations.

Internal U.S.EPA Resources. The U.S.EPA is providing significant resources to the PM_{2.5} monitoring program in addition to the §103 State and local agency grant funds to support the mainstream monitoring and monitoring support operations. The additional U.S.EPA resources, spread among the Office of Air Quality Planning and Standards, the Office of Research and Development, the Contracts Management Division, and the Regional Offices, support a variety of activities including: overall program management, development of guidance and training products, and the management of grants, procurements, and contracts.

Training. The implementation of any new ambient monitoring program requires resources dedicated to providing appropriate training in a number of diverse subjects; deploying a network to monitor a new pollutant with a new sampling method requires exceptional efforts. Given that the new monitoring network for PM_{2.5} will involve the selection of new sites, the operation of new federal reference method (FRM) samplers, the evaluation of other candidate monitoring methods, the analysis of existing demographics, and new metrics, a comprehensive and diverse training program is required. This program is designed in cooperation with the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) PM Monitoring Training Subgroup to meet the needs of a range of environmental managers, data analysts, and technical staff, at the federal, state, and local government levels as well as selected representatives from the private sector.

Four PM_{2.5} monitoring training areas are currently being focused on, including PM_{2.5} network design, sampler operations and the FRM, laboratory procedures, and quality assurance/quality control for field and laboratory activities. The U.S.EPA is using a number of mechanisms for both formal and informal training with stakeholders in the PM_{2.5} monitoring program. The U.S.EPA's PM_{2.5} Training Program is described in Chapter 10 of this document.

1.4 Roles and Responsibilities

The degree of complexity and the number of agencies involved with the PM_{2.5} monitoring program require that the flow of information and associated communications be structured to optimize the collective resources. The only realistic perspective on implementing this large program is one that recognizes that deployment and operation of this network is a shared responsibility among the involved governmental entities at the national, state, and local levels. The purpose of the following descriptions of roles across programs is to facilitate communications, and to outline very basic responsibilities.

State and local agency responsibilities. U.S.EPA could not effectively plan and execute this program without State/local participation. State and local agencies bear a tremendous level of responsibility for developing, implementing, and tracking the PM_{2.5} monitoring program. It is imperative that State and local agencies work with the U.S.EPA Regional Offices throughout this process to identify problems as early as possible, and to help find solutions to many of these issues. Some of the major activities that States and locals will deal with during the period of this program include:

- ! Participate in the PM_{2.5} network development activities. Identify and communicate PM_{2.5} network implementation problems to Regions as early as possible. Characterize problems in spending resources adequately, in obtaining technical guidance, and other issues that might complicate the implementation of this program.
- ! Provide PM_{2.5} network descriptions; work with Regions in developing these descriptions; work with the scientific community in designing the chemical speciation site networks.
- ! Provide QAPPs; work with Regions in developing these QAPPs.
- ! Provide information to Regions for sampler and filter orders from national contracts and other procurement vehicles.
- ! Identify and establish PM_{2.5} monitoring sites.
- ! Purchase support equipment for PM_{2.5} monitoring sites and network.
- ! Prepare sites and install PM_{2.5} monitoring equipment.
- ! Conduct acceptance review of PM_{2.5} samplers upon receipt. Inform U.S.EPA of any major acceptance problems.
- ! Participate in/run characterization studies.
- ! Participate in training activities, including multi-State conferences, U.S.EPA satellite broadcasts, and other training vehicles.
- ! Operate and maintain PM_{2.5} sites including operating FRM/FEM samplers, continuous samplers, and speciation samplers.
- ! Work with an existing laboratory or establish laboratory capabilities to conduct mass analysis determinations.
- ! Work with speciation laboratories to conduct filter analyses.
- ! Input PM_{2.5} mass and supporting data into the U.S.EPA's AIRS; conduct associated data validation activities.
- ! Review PM_{2.5} networks annually, and provide SLAMS data reports.
- ! Communicate with the public, including providing information on the PM_{2.5} network as

requested, pollutant index reporting, and other bulletins.

- ! Provide PM₁₀ network reduction proposals to the Regional Offices as appropriate. PM₁₀ network reductions are encouraged as PM_{2.5} networks are being deployed.

The Office of Air and Radiation's Office of Air Quality Planning and Standards, the Office of Research and Development's National Exposure Research Laboratory, and the ten Regional Offices are the primary participants in the overall implementation of the PM_{2.5} monitoring network. The Office of Administration and Resources Management's Contracts Management Division is providing critical contractual support to establish the variety of national procurement contracts and small purchases. Major responsibilities for each of these offices are listed here.

U.S.EPA Regional Office Responsibilities. The U.S.EPA Regional Offices are the major communication link with State/local agencies in terms of both communicating the needs and concerns of States to U.S.EPA program offices and in communicating the objectives and guidance that often are developed by OAR to the State/local/tribal agencies. This role is rather complex and absolutely necessary in the development of effective policies and programs.

U.S.EPA's lead region for air monitoring issues is Region 6, and for air program issues it is Region 1; however, each of the ten Regional Offices have significant responsibilities toward developing, implementing, and tracking the PM_{2.5} program. These responsibilities include the following activities:

- ! Participate in the PM_{2.5} network development activities. Identify and communicate PM_{2.5} network implementation problems to OAQPS as early as possible.
- ! Provide support to the States as they develop their PM_{2.5} network descriptions; approve the initial network descriptions by July 31, 1998, and provide annual approvals thereafter.
- ! Provide support to the States as they develop their QAPPs; approve these QAPPs before formal data collection activities begin (January 1, 1999).
- ! Obtain and compile information from States for sampler and filter orders from national contracts; provide these orders to the OAQPS.
- ! Inform ORD and OAQPS of any major sampler acceptance problems identified during the State's acceptance review of PM_{2.5} samplers.
- ! Support the use of characterization, or saturation, studies.
- ! Participate in training activities, including multi-State conferences, U.S.EPA satellite broadcasts, and other training vehicles. Identify training needs and communicate these needs to OAQPS.
- ! Provide for the speciation laboratories to conduct filter analyses.
- ! Support the national FRM QA audits.
- ! Communicate with the public, including providing information on the PM_{2.5} network as requested, pollutant index reporting, and other bulletins.
- ! Provide SLAMS network approval authority and management activities. Take immediate action to review all SLAMS PM₁₀ proposed network reductions and all PM_{2.5} network additions. Work with State and local agencies to develop/amend QAPPs to consider PM_{2.5} measurements, and approve these plans prior to the collection of data.

U.S.EPA Office of Air Quality Planning and Standards responsibilities. Most budgetary and technical planning activities are coordinated through the OAQPS. The Monitoring and Quality Assurance Group (MQAG) within the Emissions, Monitoring, and Analysis Division (EMAD) is ultimately responsible for this implementation plan, most technical components (with support from ORD, Regional Offices, and States) and resource estimates underlying program implementation. Substantial additional support related to data analysis is provided from the Air Quality Trends and Analysis Group. Various forms of resource guidance necessary for the §103 and §105 grants distribution is coordinated through the Planning, Resources, and Regional Management staff within OAQPS. In addition, the Information Transfer and Program Integration Division is responsible for the AIRS data management system and for the Air Pollution Training Institute. OAQPS' responsibilities include:

- ! Primary responsibility for 40 CFR 58 regulation and communication to Regions, States/locals.
- ! Provide national program direction and planning.
- ! Provide §103 grant funding, allocations, and guidance.
- ! Provide for and support the AIRS national data repository.
- ! Provide training and guidance on the variety of elements required for the PM_{2.5} network deployment and operation; areas include network design, sampler operation, filter handling, speciation sampling and analysis, QA activities, etc.
- ! Work with the health effects research community to identify existing and future air monitoring needs to support epidemiological and other studies of health effects. Coordinate special chemical speciation studies program with these researchers and the ORD to ensure their usefulness to the health effects community.
- ! Assist in the development and approval of the PM_{2.5} networks; support both the Regional and State/local offices.
- ! Resolve issues associated with the PM_{2.5} program; act as a liaison with the Contracts Management Division, the Regions, and the ORD.
- ! Ensure that national or regional laboratories are available to support speciation and QA programs.
- ! Track progress in implementing the PM_{2.5} program. This includes working to identify air monitoring data needs to support State Implementation Plan activities.
- ! Identify and support characterization studies including the support of the saturation monitoring repository.
- ! Conduct management systems reviews of Regional Offices beginning in FY99.
- ! Provide support and direction for the national procurement contracts, including the preparation of statements of work, and technical evaluation of proposals.
- ! Establish communication links to Regions and State/local agencies through a variety of vehicles including work groups and electronic communications such as the Internet web site.
- ! Analyze and interpret the PM_{2.5} data, conduct comparisons against the NAAQS.
- ! Provide for the National Air Monitoring Station (NAMS) network approvals and for NAMS network management activities. Take immediate action to review all PM₁₀

proposed NAMS network reductions, and all PM_{2.5} NAMS network additions.

- ! Support the IMPROVE program and the operation of visibility measurement sites as they are integrated with the PM_{2.5} monitoring program.

U.S.EPA Office of Research and Development responsibilities: The ORD's National Exposure Research Laboratory provides many of the technical infrastructure elements for the program. This support includes:

- ! Designate PM_{2.5} samplers as FRM/FEM and provide technical support.
- ! Provide technical support for the national procurement contracts.
- ! Provide technical SOPs for filter weighing.
- ! Work with OAQPS and the Regions to support the QA program development, including providing Method 2.12 for PM_{2.5} monitoring.
- ! Provide technical SOPs and specifications for chemical speciation analyses.
- ! Work with OAQPS to develop the Special Chemical Speciation Studies program and act as a liaison with the health effects research community including the North American Research Strategy for Tropospheric Ozone (NARSTO) group.

U.S.EPA Contracts Management Division responsibilities. The Contracts Management Division (CMD) within the Office of Acquisition Management (OAM) is responsible for issuing contracts and various national procurements. These contracts are developed in concert with EMAD contract liaisons and MQAG and ORD technical staff. The CMD is responsible for all communications with vendors and extramural contract organizations. The CMD's responsibilities include:

- ! Develop national contracts for the sampler purchases and filter purchases; work with ORD and OAR contracts and technical staff to provide these products.
- ! Provide Contracting Officer and other contracting support for national procurements.

U.S. Department of Interior, National Park Service responsibilities. The National Park Service and federal land managers have a sincere interest in the Regional Haze program led by the U.S.EPA. They are currently operating IMPROVE visibility measurement sites, and they will continue to work with the U.S.EPA and other involved agencies in this regard.

- ! Work with State and local agencies to select class I areas to be monitored as part of the expanded IMPROVE/PM_{2.5} monitoring program.
- ! Deploy, operate, and maintain all IMPROVE sites in a cost-effective manner.
- ! Provide for upgrades and analytical support of aerosol monitoring at all IMPROVE sites as necessary.
- ! Provide existing and all new data from IMPROVE network to the U.S.EPA for storage in the AIRS database in a timely manner.

1.5 Communications

An organized communications framework is needed to facilitate the flow of information among the parties listed above as well as other users of the information produced by the PM_{2.5} network. Figure 1.1 provides an overview of the principal communications pathways. Note that in addition to communications among U.S.EPA and State/local agencies, other Federal agencies, industry and academia are important data users. Table 1.3 provides a listing of existing and emerging workgroups working within the PM_{2.5} program. Electronic transmission of information on this program is available through U.S.EPA's Internet site at <http://www.epa.gov/ttn/amtic/amticpm.html>.

Figure 1.1 Overview of Principal Communication Lines.

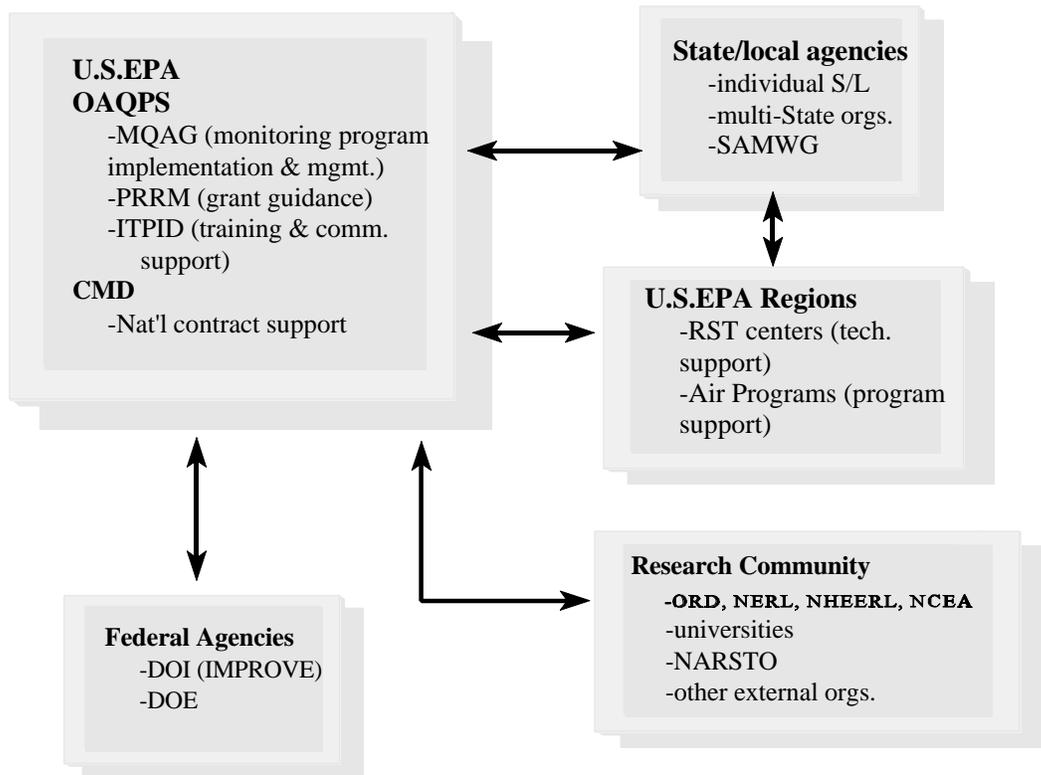


Table 1.3 Workgroups Addressing PM_{2.5} Monitoring Implementation

Existing Workgroups/Teams	Members & Primary Contacts	Function	Products
MQAG/U.S.EPA Implementation Team	MQAG/OAQPS/RO staff Lee Byrd, Rich Scheffe	Core working group to coordinate development of technical guidance products and budgets, and communicate program elements across OAQPS	State Grant Allocations; Cost Estimates; Consistent Communications; Overall Implementation Plan
PM _{2.5} Network Design Workgroup	OAQPS-MQAG, Regional Office staff Neil Frank	Core U.S.EPA monitoring workgroup to track progress and to deal with issues/problems related to the design of PM _{2.5} networks and their establishment.	Bi-monthly progress tracking reports; problem resolution on network design issues; network design guidance document
OAQPS PM _{2.5} QA Team	OAQPS-MQAG Mike Papp	Core team that is ultimately responsible for the development of the quality system and its associated guidance and training.	QA Guidance documents including distribution of Method 2.12 and QA Handbook revisions.
PM _{2.5} QA Workgroup	OAQPS-MQAG/Regional Office staff/ORD Mike Papp	Core work group to advise OAQPS PM _{2.5} QA Team on QA program	Technical input into guidance documents including Method 2.12 and QA Handbook revisions.
Chemical Speciation Workgroup	MQAG, RSTs, ORD, CARB Jim Homolya	Core work group to develop speciation program	Laboratory SOPs; Speciation Guidance Documents; Speciation Contract

National Monitoring Contract Workgroup	EMAD, CMD, OAQPS, ORD David Mobley, Vickie Presnell	U.S.EPA OAQPS Work group to develop National Monitoring Contract for Samplers	National PM _{2.5} Sampler Procurement Contract
PM Steering Committee/ Associated Work Groups: -Allocation/Programmatic -Process -Communications	U.S.EPA OAR, Regions 1 & 6, States/Locals	The Allocation/Programmatic Workgroup addresses funding issues (including tribal monitoring) and the network phase-in options. The Process Workgroup is responsible for the development of grant guidance materials. The Communications Workgroup is responsible for reviewing and supporting OAR communication activities.	§103 grant application form (completed) Internet site for PM _{2.5} program
Standing Air Monitoring Workgroup (SAMWG)	States/Locals; U.S.EPA OAQPS, U.S.EPA Regional Offices, Rich Scheffe	Advisory Panel to OAQPS on monitoring plans; programmatic, policy and technical issues; liaison with other State and locals	
STAPPA/ALAPCO Monitoring Committee	States/locals, MQAG U.S.EPA contacts: Rich Scheffe, Lee Byrd	Committee to identify and provide comment on State/local agency issues.	
IMPROVE Steering Committee	U.S.EPA; States; Universities Marc Pitchford Bruce Polkowsky	Directing IMPROVE visibility monitoring program	Provide for DOI operation of the IMPROVE visibility measurement sites.

Table 1.4 associates network implementation elements with key Office of Air Quality Planning and Standards contacts:

Table 1.4 Key Headquarters Contacts

Element	Lead contacts/organization	add. contact/organization
Regulation development/interpretation	N. Frank (MQAG)	F. McElroy-ORD (40 CFR 53); M. Wayland (40 CFR 58, App N); M. Papp (40 CFR 58, App A & B)
Network design/siting	N. Frank (MQAG)	
Congressional inquiries, communications, and program coordination	L. Byrd (MQAG)	
Quality Assurance	M. Papp (MQAG)	D. Gemmill, F. McElroy (ORD)
Data Management and Analyses	S. Eberly (MQAG)	M. Wayland (AQTAG)
FRM/FEM designations	F. McElroy, D. Gemmill, R. Wiener (ORD)	T. Hanley, D. Musick, J. Homolya (MQAG)
Sampler procurement from national contract	V. Presnell (EMAD)	L. Byrd (MQAG)
Filter procurements	D. Lutz (MQAG)	
Training	J. Elkins (MQAG), H. Wright (EORG)	D. Gemmill (ORD)
Instrumentation and filter weighing issues	D. Musick, T. Hanley, M. Shanis (MQAG)	D. Gemmill (ORD)
Chemical speciation and laboratory analyses	J. Homolya (MQAG)	R. Zweidinger (ORD)
Special chemical speciation studies	R. Scheffe, J. Rice, S. Eberly (MQAG)	J. Bachmann (OAQPS), R. Wiener (ORD)
Saturation monitoring studies	N. Berg (MQAG)	N. Frank (MQAG)
Grants, Resource allocation	L. Byrd, D. Lutz (MQAG)	J. Stubberfield (OAQPS)
Tracking	D. Lutz, E. Hanks (MQAG)	

Element	Lead contacts/organization	add. contact/organization
Tribal programs	L. Byrd (MQAG)	D. LaRoche (OAR, OPMO)
Program Management	R. Scheffe (MQAG)	B. Hunt, D. Mobley (EMAD)

2.0 MONITORING REGULATION OVERVIEW

The requirements set forth in the new monitoring regulations support the revised PM NAAQS. The major monitoring requirements and principles are summarized as follows:

2.1 $PM_{2.5}$ Network Design

Community-oriented (core) monitors that represent community-wide average exposure, form the basis of $PM_{2.5}$ network design. This approach is consistent with the data bases used to develop the NAAQS. While all population-oriented monitoring locations are eligible for comparison to the 24-hour $PM_{2.5}$ NAAQS, only locations representative of neighborhood or larger spatial scales are eligible for comparison to the annual NAAQS. Monitoring for regional transport and regional background is also required to assist with implementation of the air quality management program. Community monitoring zones (CMZ) with constrained criteria may be also used to define monitors acceptable for spatial averaging for comparison to the annual NAAQS. This approach permits the average of two or more core monitors to be used for comparison to the annual NAAQS. Eligible monitors must meet the requirement that annual average concentrations are within +/-20% of the CMZ average; should be principally affected by similar emission sources and generally well correlated on a day to day basis. The combination of emphasis on well-sited community-oriented monitors and the feasibility by the States to select the preferred community monitoring approach reduces complexity associated with network design and planning.

The number of required core $PM_{2.5}$ State and Local Air Monitoring Stations (SLAMS), and other $PM_{2.5}$ SLAMS results in a minimum national requirement of approximately 850 $PM_{2.5}$ sites; the total $PM_{2.5}$ network is projected to approach 1,500 sites. The latter includes both SLAMS/NAMS sites and Special Purpose Monitors. Approximately 175-200 utilizing a variety of existing fine particle samplers are currently operational. These include State and local monitors described as SPMs and IMPROVE samplers. Exceptions to the minimum number of required samplers may be approved by the U.S.EPA Regional Administrator. The regulation states that the mature network of 1,500 $PM_{2.5}$ sites would be in place within 3 years, with the required network elements deployed within 2 years. Through the budget planning process, U.S.EPA has accelerated this deployment of all 1500 monitoring sites to a 2-year effort ending on December 31, 1999.

2.2 PM_{10} Monitoring Networks

Requirements for PM_{10} network design and siting are unchanged from the existing regulatory requirements. Reductions in PM_{10} networks are encouraged in areas of low concentrations where the PM_{10} NAAQS are not expected to be violated. PM_{10} sites to remain include the NAMS trend sites, design value sites and those needed to protect against potential growth in emissions especially where the NAAQS may be threatened.

2.3 Sampling Frequencies

The sampling frequencies stipulated in 40 CFR 58.13 for both $PM_{2.5}$ and PM_{10} , have been

modified to reflect a 1 in 3-day minimum requirement.

The PM₁₀ sampling frequency is specified as one in three days in the regulation; however, the Regional Offices have the authority to waive this requirement to allow one in six day sampling as appropriate. Guidance for PM₁₀ sampling frequency waivers was provided in the December 2, 1997, memorandum from W. Hunt to the Regional Offices. Copies of this memorandum are available on the AMTIC Internet site <http://www.epa.gov/ttn/amtic/amticpm.html>.

Required every day sampling at certain core PM_{2.5} sites (2 sites per area over 500,000 population and 1 site per PAMS area) may be reduced to 1 in 6-day sampling during periods of low PM_{2.5} and to one in three days for the entire year after at least 2 complete years of data collection with a reference or equivalent method or when collocated with a correlated acceptable continuous (CAC) fine particulate monitor. All other PM_{2.5} SLAMS including background and regional transport sites and PM₁₀ sites are required to sample once every third day. However, exceptions to the minimum requirement may be approved by the U.S.EPA Regional Administrator for seasonal or year-round sampling. We anticipate that sites eligible for the waiver will include sites with a controlling annual standard and those that are not likely to violate the 24-hour NAAQS.

2.4 Chemical Speciation

A modest chemical speciation network of 50 PM_{2.5} sites that provides a first order characterization of the metals, ions, and carbon constituents of PM_{2.5} is a requirement of this rule. These sites will be part of the National Air Monitoring Stations (NAMS) network and will provide national consistency for trends purposes and serve as a model for other chemical speciation efforts. This required network represents a small fraction of all the chemical speciation work that U.S.EPA expects to support with Federal funds. Additional efforts may be used to enhance the required network and tailor the collection and analysis of speciated data to the needs of individual areas. Approximately 300 speciation sites are expected to be part of the national program, but the 250 sites non-trend sites may be different each year as needed to support the State programs.

2.5 Quality Assurance (QA)

The QA program is collectively based on a variety of tools. The key program requirements include:

- a. Independent field audits with a PM_{2.5} FRM are used to evaluate the bias of PM_{2.5} measurements. The number of PM_{2.5} audited sites include 25% of all SLAMS sites (including NAMS) and the audit frequency per site is 4 visits per year. These audits may be conducted by the States or through the assistance of the U.S.EPA Regional Offices, or a national contract effort as described in Chapter 5.
- b. Flow checks will also be used to evaluate bias of PM_{2.5} and PM₁₀ measurements and are

conducted on a quarterly basis.

- c. Collocation with PM_{2.5} FRM and Federal Equivalent Methods (FEM) samplers at SLAMS sites is used to judge precision. The number of collocated sites per reporting organization is 25 percent of all PM_{2.5} SLAMS sites and approximately 20 percent of all PM₁₀ SLAMS sites.
- d. Systems audits are used to evaluate an agency's QA system and will be performed by U.S.EPA every 3 years as originally proposed. In an effort to assist the State and local agencies in achieving the data quality objectives of the PM_{2.5} monitoring program, an incentive program has been established that is based on network performance and maturity that can reduce these QA requirements.

2.6 Data Use Moratorium

The new rule (40 CFR §58.14) provides for a moratorium on the use of PM_{2.5} special purpose monitor (SPM) data for the first 2 complete calendar years of operation of a new SPM. If such monitors produce valid data for more than 2 years, then all historical data for that site may be used for regulatory purposes. This provision is intended as an important incentive for new monitoring by the States or private entities. Special purpose monitoring will serve a variety of purposes and is viewed as very important for the new PM_{2.5} monitoring program.

2.7 Monitoring Methodology

The 40 CFR 58, Appendix C has been revised to allow the use of Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers at regional transport and regional background sites to satisfy the SLAMS requirements. Unless these monitors are certified as FEM samplers (which is not anticipated), their data will not be used for making regulatory comparisons to the NAAQS. The IMPROVE monitoring sites are expected to serve an important role in linking new PM_{2.5} background and regional transport monitoring sites to the historical data base of the existing IMPROVE network.

For any sampler to be used in the SLAMS network for NAAQS compliance determinations, the sampler must have received a designation as a Federal Reference Method (FRM) or Federal Equivalent Method (FEM). This designation process is performed by the U.S.EPA's Office of Research and Development (ORD) and is used to ensure that the sampling system will be valid, reliable, accurate and defensible to technical challenges. The designation process is defined in the Code of Federal Regulations Title 40 part 53 (40 CFR 53) and requires potential vendors to perform a series of technical tests to verify the monitor's performance and adherence to the specifications detailed in 40 CFR Part 50. Part 50 regulations define the specifications and requirements used to manufacture the PM_{2.5} samplers. Vendors must submit the data results from the reference and equivalent method tests to the ORD for review and evaluation. This review process may take from 60 to 120 days depending on the complexity and completeness of the designation package.

Vendors may submit applications for designation of their PM_{2.5} sampling systems to the ORD at any time. The 40 CFR 53 regulations stipulate that the ORD will evaluate the application within 120 days. For the initial designations for the PM_{2.5} network, the U.S.EPA's National PM_{2.5} Sampler Procurement Contract for four type of samplers will provide the mechanism for FRM/FEM designations. This contract has several aspects: (a) Resources for completing designation of PM_{2.5} samplers, (b) deployment and distribution of samplers to all States and local agencies who place orders, © use of First Article 'prototype' samplers for the evaluation of samplers, and (d) specific PM_{2.5} sampler inspection/acceptance procedures of each sampler that is ordered from the contract.

With respect to the U.S.EPA's method designation program, PM_{2.5} mass measurement methods can be divided into three categories: Federal Reference Method (FRM) samplers, Federal Equivalent Method (FEM) samplers, and other samplers. The non-FRM samplers are distinguished by their level of similarity in design to the FRM. The further from the FRM in design, the more stringent are the requirements for designation of an instrument as an equivalent method.

- Federal Reference Methods: Federal Reference Methods for PM_{2.5} are methods that have been designated as such under 40 CFR Part 53, having met design and performance characteristics described in Part 50, Appendix L; Part 53, Subpart E; and Part 58, Appendix A. Reference method samplers acquire deposits over 24-hour periods on Teflon-membrane filters from air drawn at a controlled flow rate through a tested PM_{2.5} inlet. The inlet and size separation components are specified by design, with drawings and manufacturing tolerances published in the CFR. Most of the other measurement components and procedures are specified by performance characteristics, with specific test methods to assess that performance.
- Class I Equivalent Methods: Class I equivalent method instruments maintain the same measurement principles as reference method instruments, but with minor design changes. Class I instruments are intended to provide for sequential sampling without operator intervention at measurement sites that sample every day. Testing of design and performance characteristics for Class I instruments is given in Part 53, Subpart E.
- Class II Equivalent Methods: Class II equivalent method instruments include all other instruments based on a 24-hour integrated filter sample with subsequent moisture equilibration and gravimetric mass analysis, but differ substantially in design from the reference method instruments. More extensive performance testing is required for a Class II equivalent instrument than for reference or Class I equivalent instruments. Testing of design and performance characteristics for Class II methods is given in Part 53, Subpart F (in addition to any relevant items contained in 40 CFR 53 Subparts A-E.)
- Class III Equivalent Methods: Class III equivalent method instruments include any candidate instruments that cannot qualify as Class I or Class II instruments. These may either be filter-based integrated samplers not meeting Class I or Class II criteria, or filter

or non-filter based continuous or semi-continuous samplers. Test procedures and performance requirements for Class III candidate method instruments will be determined on a case-by-case basis. The testing for these instruments will be the most stringent, because equivalency to reference methods must be demonstrated over a wide range of particle size distributions and aerosol compositions. Other methods include all non-FRM or non-equivalent measurement methods capable of characterizing fine particles that may not be or have not yet been classified as an equivalent method. Existing manual and continuous analyzers are in this category and potentially include the dichotomous sampler, IMPROVE samplers, nephelometers, beta attenuation monitors, and Tapered Element Oscillating Microbalances (TEOMs). Such instruments are not precluded from becoming equivalent on a site-specific, regional or national basis.

2.8 PM Monitoring Network Description

The State shall submit a PM monitoring network description to the U.S.EPA Regional Administrator by July 1, 1998, which describes the PM monitoring network, its intended community monitoring approach for comparison to the annual PM_{2.5} NAAQS, use of non-population-oriented special purpose PM_{2.5} samplers, and proposed exceptions to U.S.EPA's requirements for minimum number of monitors or sampling frequency. The description shall be available for public inspection and U.S.EPA shall review and approve/disapprove the document within 60 days. (For the initial year of the program, the Regional Offices are requested to approve these network descriptions by July 31, 1998.) A State air monitoring report with proposed network revisions, if any, shall be submitted annually.

3.0 Network Design/Deployment of Samplers

The design of PM_{2.5} networks, including sampler siting, selection of sampler designs, and selecting sampling frequencies, consists of several phases beginning with the promulgated 40 CFR 58 monitoring regulations which provide general national direction, and leading to the final iterative stages where the details of exact locations and sampler selections are coordinated between State/local agencies and U.S.EPA. The eventual network design will reflect a balance of practical considerations and desired conceptual characteristics. Some of these practical considerations include the accelerated 2-year phase-in schedule which shifts greater emphasis to the use of existing platforms (as opposed to new locations) and the use of the National PM_{2.5} Sampler Procurement Contract's impact on the timing of sampler orders and delivery. Although the regulation indicates that the State's plans are due to U.S.EPA by July 1, 1998, State participation in the National PM_{2.5} Sampler Procurement Contract and the new 2-year funding schedule will require that draft plans must be submitted to and reviewed by U.S.EPA in a shorter time frame (sampler orders will be placed in March 1998).

Network design can be broken into two phases, the first consisting of "national" estimates or general guidance, and the second more refined stage where exact locations and other details are proposed by State/local agencies and approved by U.S.EPA Regional Offices. The first design phase (a 1,500 site network deployed over a two year period) is complete and was formed by a combination of a basic network providing minimal population coverage together with a largely top-down allocation of supplemental monitoring sites proposed by U.S.EPA. The combination of required SLAMS monitoring sites which will utilize FRM/FEM samplers together with supplemental monitoring sites which can use alternative samplers will provide the States with broad flexibility in establishing their networks.

The more important second phase is largely a State/local activity that is coordinated with U.S.EPA Regional Offices. The means through which network design descriptions are finally developed can be broken into four categories:

1. Major National guidance
 - 40 CFR 58 monitoring regulations
 - Network design guidance documents
 - Grants guidance and associated resource allocations
2. Continuing guidance
 - Correction notices to existing regulation
 - Memoranda on specific topics such as waivers for every day sampling and changes to sampling protocols
 - Network design workgroup input
3. Workshops and meetings

4. Discussions/negotiations, technical reviews, and site visits among State/local and U.S.EPA agencies.

Once complete, the final network description will be forwarded to the appropriate Regional Office by July 1, 1998, for approval by the Regional Administrator by July 31, 1998. Each network description will contain information on site locations; monitoring methods; sampling frequency; monitoring objectives; optional community monitoring zones and sites intended for making comparisons to the PM_{2.5} NAAQS; and a plan for deployment of future sites, implementation of QA procedures and other needed changes to the monitoring network.

An OAQPS/Regional Office work group has been established to help facilitate the development of the new particulate matter monitoring networks. Through bi-weekly conference calls, the group has been reviewing network design issues, preparing supplemental guidance, and resolving technical issues related to establishment of the new PM_{2.5} monitoring sites. The group has adopted a network design status tracking report within which each Region summarizes the network design activities among its States. This report is available on the AMTIC Internet site at <http://www.epa.gov/ttn/amtic/amticpm.html>. The network design status tracking report will allow Regional and OAQPS management to judge the positive movement of network design activities and highlight problem areas that require additional attention or problem solving. The tracking system will first report on general activities such as completed Regional/State discussions/meetings and will later discuss specifics such as identification of monitoring equipment, numbers and location of monitoring sites and completion of grant agreements. Issues that cannot be resolved or major impediments to the implementation of the network will be identified for management review.

To ensure national consistency in the development of the particulate matter networks and adherence to the principles and goals set forth in the 40 CFR 58, the OAQPS/Regional Office work group will compare and evaluate the State network plans across all 10 U.S.EPA Regions. The group will serve in an advisory role and its review will focus on (a) consistent deployment of compliance monitoring sites which principally represent community-oriented air quality and (b) uniform implementation of allowable waivers for sampling frequency, siting and other network requirements. An initial review was conducted based upon the January 15, 1998, submittal of draft network plans and periodically thereafter as revisions to the network plans are received. A final review will occur upon submittal of the July 1, 1998 formal network descriptions. This process is also intended to facilitate information exchange, to assist the States in benefitting from innovative ideas and capitalizing on opportunities to make efficient use of available monitoring resources.

Table 3.1 summarizes the steps, associated vehicles and milestones associated with network design and deployment of monitors.

Table 3.1. Network design components and key milestones.

Component	Role	Date
Monitoring Regulations	Description of network components and requirements	7/18/97
EPA and State Workshops	Forum for dissemination of guidance, regulation interpretations, and establishing initial network descriptions [MARAMA, NESCAUM, WESTAR, SAMWG, U.S.EPA OAQPS and Regional Office workshops]	9/97-continuous
Network Design Guidance	Conceptual guide to sampler placement, data uses and interpretation of U.S.EPA regulations. Available on AMTIC at http://www.epa.gov/ttn/amtic/amticpm.html .	draft 6/97; final 12/97
Grant Allocations to Regions	OAQPS estimate of monitoring sites and associated resources by State	12/97
Draft network descriptions to U.S.EPA RO's	Initial estimates of # and type of sites and samplers Numbers and types of sites and samplers for March order (These activities accelerate the schedule for developing draft network descriptions.)	1/15/98 3/2/98
Deployment of 50 prototype samplers	Initial U.S.EPA funded samplers delivered to each State for testing/familiarization purposes	12/97 - 3/98
National PM _{2.5} Sampler Procurement Contract	Vehicle to procure samplers for network	contract award 3/31/98
Network descriptions	Final network descriptions submitted by States to U.S.EPA RO's	7/1/98; approval by 7/31/98

4.0 LABORATORY ANALYSIS: CHEMICAL SPECIATION AND MASS

4.1 Introduction

Chemical speciation is included in the discussion of major monitoring requirements and principles set forth by the revised 40 CFR Part 58 Regulations, specifically those promulgated as part of the PM_{2.5} National Ambient Air Quality Standard (NAAQS) review completed in 1997. A chemical speciation network of 50 PM_{2.5} sites that provides a first order characterization of the metals, ions, and carbon constituents of PM_{2.5} is a requirement of this rule. These sites will be part of the National Air Monitoring Stations (NAMS) network and will provide nationally consistent data for trends assessments and it will serve as a model for other chemical speciation efforts. This required network represents a small fraction of all the chemical speciation work that the U.S. Environmental Protection Agency (U.S.EPA) expects to support with Federal funds. U.S.EPA anticipates that approximately 300 sites will participate in a full chemical speciation network. Additional efforts may be used to enhance the required network and tailor the collection and analyses of speciated data to the needs of individual areas.

Since there will be some variability in the design, implementation, and operation of PM_{2.5} chemical speciation monitoring networks at the State level, U.S.EPA is providing guidance on selection and use of PM_{2.5} speciation samplers. At a minimum, chemical speciation will quantify significant PM_{2.5} components of trace elements and geological material, sulfate, nitrate, ammonium, organic carbon, elemental carbon, and mass concentrations. U.S.EPA is providing guidance (“Particulate Matter (PM) Speciation Guidance Document” Draft dated February 25, 1998) to network operators, laboratory services support personnel, and regulatory compliance data analysts. The guidance:

- Identifies useful aerosol properties that can be measured on filter deposits.
- Provides specific technical guidance for collection and measurement of chemical species.
- Describes principles and instruments used to sample and analyze filter deposits for particle and precursor properties.
- Specifies strategy and procedures for aerosol sampling and analysis.
- Describes data uses - NAAQS support and Implementation plan development (trends, control strategies, model validation, source apportionment, and visibility).

4.2 Goals of Sample Speciation

Physical and chemical speciation data can be used to support several areas of need which include:

- Using speciation data as input to air quality modeling and emissions inventories evaluations.
- Understanding the effects of atmospheric constituents on visibility impairment and regional haze.
- Using the speciated particulate data to aid in monitoring network design and siting adjustment.
- Aiding in source attribution analyses, trends, and providing data to assess the effectiveness of control and attainment strategies.
- Correlating speciation data with mass concentrations at sites where PM_{2.5} mass and speciation monitors are collocated to obtain additional information about species that contribute to total mass measurements.
- Aiding the interpretation of health studies by evaluating the potential linkage of health effects to PM_{2.5} constituents.

4.3 Targeted Analytes

Currently targeted analytes of interest include:

- ! Cations: particulate ammonium, ionic sodium, calcium, and magnesium;
- ! Anions: particulate sulfate, particulate nitrate, particulate chloride;
- ! Carbon: total, organic and elemental;
- ! Trace elements: sodium, magnesium, etc., through lead; and
- ! Semi-volatile organic particles.

4.4 Sampling and Analysis

The approach to be used for chemical speciation involves both sampling and analysis components. The single channel, 46.2-mm polytetrafluoroethylene (PTFE) filter, FRM/FEM monitor is not capable of completely supporting a comprehensive set of analyses required to characterize the components of a PM_{2.5} sample. The design of speciation samplers can be flexible to include additional filter collection media best-suited for the analysis of specific components. The 40 CFR Part 53 requirements for designation of reference and equivalent methods for PM_{2.5}, do not require designations for speciation monitors.

Sampling for speciation purposes is a developing science, and as such, the U.S.EPA wants to encourage creative approaches to speciation sampling. Retaining flexibility by not prescribing speciation sampling methods should be viewed as a technology driver. Of course, the penalty for flexibility is some degree of data uncertainty stemming from different samplers. It is critical to establish an analytical laboratory framework with consistent data quality for supporting analysis of

several thousand filter samplers per year using a range of analytical methods. The U.S. EPA is requiring greater standardization of the laboratory analysis component. Accordingly, a common set of standard operating procedures (SOPs) for all speciation analyses must be established. The SOPs must be based on analytical methods with proven application to the analysis of ambient particulate matter filter samples. The U.S.EPA is developing laboratory SOPs that will be consistent with techniques used by various agencies and research groups operating ambient air particulate matter speciation programs.

The “National PM_{2.5} Sampler Procurement Contract” includes the provision for the purchase of over 300 speciation monitors, including accessories, and replacements for establishing the speciation monitoring network. The FRM/FEM PM_{2.5} sampler is not entirely adequate for collecting aerosols for chemical characterization. The design of the FRM/FEM samplers and their deployment in a community-oriented monitoring network are based on the need to produce data comparable with those health studies underlying the development of the PM_{2.5} NAAQS. The FRM, built with many design-specified components, conceptually is similar to samplers used in the health studies supporting the PM_{2.5} NAAQS. However, the FRM/FEM does not completely characterize ambient aerosols. Ambient aerosols are complex multi-phase (semivolatile, liquid, solid) mixtures composed of various chemical constituents which vary across particle size ranges. Sampling for these aerosols can be subject to various positive and negative artifacts.

For example, the Federal Reference Method (FRM) design with a Teflon filter does experience loss of volatile constituents (i.e., release of nitric acid vapor from particulate ammonium nitrate, which can be more completely captured by other sampling approaches. Because the FRM/FEM PM_{2.5} samplers do not provide full chemical characterization of ambient aerosols, alternative approaches are used for speciation sampling. Filters are the most commonly used collection substrates for sampling atmospheric aerosols for measuring composition. Sampling times vary with ambient loadings, sampling rates, substrate blanks, and analytical sensitivities, but typically vary from several hours in urban areas, to a day or more under clean background conditions. While filter samplers are relatively inexpensive, they require manual operation. Also the number of filters that must be analyzed in a monitoring network can be large.

The proposed sampling approach for the PM_{2.5} speciation monitoring network is consistent with that in the IMPROVE program. IMPROVE samplers are used at regional background and transport sites to fulfill State/local Air Monitoring Station (SLAMS) requirements. They were developed to quantify PM chemical components that affect visibility at Federal Class I areas that include National parks, national Monuments, and Wilderness Areas. Currently, the IMPROVE data base is the most comprehensive national program for characterization of aerosols across the U.S. and consistency with this program is a specific objective to optimize the combined use of data. From a practical standpoint, IMPROVE is considered part of the national PM_{2.5} network.

IMPROVE samplers consist of up to four parallel filter and inlet combinations controlled by a common timer. Each of three modules utilizes a cyclone as a PM_{2.5} inlet, followed by a filter

holder assembly, a volumetric flow control device, and a pump. The fourth module is used for sampling PM₁₀ aerosols. A single PM_{2.5} module uses a Teflon membrane filter to collect aerosols for mass measurement and subsequent analysis for trace elements (Na to Pb). A second PM_{2.5} module is equipped with a nylon filter to measure total particulate nitrate. The third PM_{2.5} module contains two pre-fired quartz-fiber filters in series to measure organic and elemental carbon on the first filter and to assess the extent of organic artifacts on the backup filter.

In addition to guidance on sampling and handling, the U.S.EPA will also develop guidance and documentation for SOPs on the measurement of the target analytes which includes laboratory quality assurance guidelines specific to the methods of analysis; and guidelines on standardized data reduction, validation, and reporting formats. The U.S.EPA plans for the speciation data to be submitted to the Aerometric Information Retrieval System (AIRS) data base.

The laboratory analysis of PM_{2.5} involves many considerations including:

- target analytes of interest.
- sample handling.
- analytical SOPs.
- quality assurance.
- data reduction, reporting, validation, and ensuring adequate laboratory capacity to support the analysis of several thousand samples annually.

The methods used for analyses of these filter media include gravimetry (electro-microbalance) for mass; X-ray fluorescence (XRF) for trace elements; ion chromatography (IC) for anions and selected cations; controlled-combustion for carbon; and gas chromatography/mass spectroscopy (GC/MS) for semi-volatile organic particles. In addition to chemical analyses, special measurement needs may include determining particle size and morphology through optical and/or electron microscopy.

The U.S.EPA's approach to providing the speciation laboratory support services will begin with developing the laboratory specifications, analytical SOPs, and associated quality assurance requirements. These guidelines will be utilized through a national laboratory services support program consisting of contracted services with up to three qualified laboratories. The extent of these services will depend upon capacity needs as well as the level of participation of government laboratories for providing analytical services. Speciation site operators will be able to access analytical support from these laboratories through three U.S.EPA Regional Project Officers, who will be located at Regional Offices located in the eastern (Region 1), Midwestern (Region 5), and western (Region 8) parts of the country. The Project Officers will service site needs for those States located in the three geographic areas.

The operational schedule for providing the speciation laboratory support services begins with development of a program team of U.S.EPA Office of Air Quality Planning and Standards (OAQPS) and Regional Office personnel. OAQPS will lead the development of the required

guidance information and the SOPs with input from the Office of Research and Development (ORD), U.S.EPA Regional Offices, and the PM_{2.5} monitoring technical community. Initial deployment of the speciation monitors is projected for the fourth quarter of calendar 1998. Allowing for time by site operators to be trained in the use of the monitors, we project that the laboratory services support portion of the National PM_{2.5} Speciation Program will be in place by February of 1999.

4.5 Program Objectives

The goal of the PM_{2.5} monitoring program is to provide ambient data that support the Nation's air quality programs. Mass measurements are used principally for PM_{2.5} NAAQS comparison purposes in identifying areas that meet or do not meet the PM_{2.5} NAAQS, and in supporting area designations as attainment or nonattainment. In prioritized order, the programmatic objectives for PM_{2.5} chemical speciation include:

Objective 1 - Annual and Seasonal Characterizations of U.S. Aerosols

Typically, the samples will be collected on several filter media (Teflon, nylon, quartz) over 24-hour sampling periods, on a 1/6 day schedule. The analytes, sampling periods and frequency, spatial resolution, and data accuracy affect the utility of the data. Accordingly, the primary use of these data will be to develop general characterizations of aerosols across the major urban areas of the country depicting seasonal and annual patterns. To the extent that networks include sites located in transport and/or "background" locations, similar characterizations of rural/regional environments, especially in combination with the IMPROVE program, are an expected product. This objective serves the important need to gain an understanding of aerosol character nationwide. The following objectives all require this initial characterization step, which in practice translates in developing common spatial and seasonal/annual displays of aerosol components. Accordingly, this objective is the highest priority.

Objective 2 - Air Quality Trends Analysis and Tracking Progress of Control Programs

The use of observational data playing a central role in ongoing SIP improvement has been encouraged by the scientific community through the 1991 National Academy of Sciences Report on Tropospheric Ozone, and the forthcoming NARSTO assessment. The ability to detect trends in ambient concentrations that associate with planned air quality control efforts must be incorporated in SIP assessments.

Objective 3 - Developing Emission Control Strategies

The major difference between this and the preceding objective is the fixed time frame associated with "development." A combination of prospective air quality modeling and semi-quantitative source attribution analyses will generate objective information for decision makers underlying emission control decisions. Accordingly, speciated data will be used in evaluating air

quality model performance and the requisite emission fields. A variety of source attribution techniques will be exercised. Recognizing the uncertainties and limitations in models, inventories and sampling/analysis methods, this objective is of lower priority because we must minimize the risk of not conducting ongoing assessments.

Objective 4 - Informing Studies of Health Effects

There exists a constant need to develop information that may lead to more definitive associations between adverse health impacts and specific aerosol properties. The speciated program provides greater chemical resolution than the standard mass measurements, and therefore should provide value to health studies. This is not designated as the highest priority because several research efforts are underway to support health studies. Nevertheless, this routine speciation program must enlist input from health scientists to optimize overall value

Table 4.1 Laboratory Analyses: Chemical Speciation And Mass

- Objectives: 1. Provide technical assistance for PM_{2.5} mass concentration measurements.
 2. Develop National PM_{2.5} Speciation Laboratory Program.
 3. Develop guidance and support for particle size and morphology analyses.

Product	Time	Resources	Mechanism
1.1 Specifications for laboratory facility/instrumentation requirements.	11/97	ORD/NERL + MQAG	Designated program team (Zwiedinger, Homolya, et al.)
1.2 Standardized SOPs for mass filter weighings.	11/97	ORD/NERL + MQAG	Designated program team (Gemmill, Homolya, et al.)
1.3 Procedures for filter archiving.	12/97	ORD/NERL + MQAG	Designated program team (Gemmill, Homolya, et al.)
1.4 Standardized data report formats.	12/97	MQAG	Papp and Homolya
1.5 QA for mass concentration measurements and data validation.	12/97	MQAG	Papp and Musick
2.1 Standardized SOPs for measurement of target analytes	4/98	ORD/NERL + MQAG,	Chemical Speciation Workgroup
2.2 Specifications for speciation monitor sample handling, transport, and storage.	4/98	ORD/NERL + MQAG,	Chemical Speciation Workgroup
2.3 Standardized formats for data reduction, validation, and reporting.	4/98	MQAG	Papp and Homolya
2.4 Quality assurance guidelines for laboratory analytical SOPs	4/98	MQAG	Papp and Musick,
2.5 Scope of work for National PM _{2.5} Speciation Laboratory Program	5/98	MQAG, ORD/NERL, CMD Regions, \$3M.	Homolya, Weant, CMD., Regional DOPOs
2.5.1 National PM _{2.5} Speciation Laboratory Contract(s)	12/98	MQAG, ORD/NERL, CMD, Regional DOPOs	Homolya, Weant, CMD, Regional DOPOs, Funding
2.5.2 Contracts in place for laboratory services support	2/99	CMD, MQAG, Regional DOPOs	Homolya, Regional DOPOs.
3.1 Guidance on use of optical/electron microscopy for particle sizing and morphology	2/98	MQAG, DRI	Homolya, DRI-Grant(Chow)
3.2 Quality assurance for optical/electron microscopy	2/98	MQAG, ORD/NERL, DRI	Papp, Homolya, Zwiedinger, DRI-Grant(Chow)

5.0 QUALITY ASSURANCE (MASS)

5.1 Introduction

An important concern in any organization that is collecting and evaluating environmental data must be the quality of the results. A quality system must be developed and documented to ensure that the PM_{2.5} monitoring results:

- ▶ meet OAR's regulatory and scientific data needs;
- ▶ satisfy customers expectations;
- ▶ comply with applicable standards and specifications;
- ▶ comply with statutory (and other) requirements, and
- ▶ reflect consideration of cost and economics.

In order to develop the quality system the following are key assumptions or ideas that should be kept in mind:

- ▶ **A quality system is required to evaluate and control measurement system bias and precision-** The measurement system represents all data collection activities, from initial preparation of the filters, through field and laboratory activities, to the data reduction and reporting. At each phase of this process, errors can enter the system. Development of a quality system is necessary in order to understand where these errors are occurring, determine their magnitude, and to improve data quality.
- ▶ **The DQO Process drives the quality system-** The DQO Process established the acceptable risk (decision error) for attainment/nonattainment decisions. The acceptance requirement for total precision is 10% CV and for total bias is $\pm 10\%$.
- ▶ **Independent assessments and internal quality control are important-** Development of a quality system requires both components. An independent assessment provides an objective review of the measurement system. The FRM audits, NPAP, and other technical system audits would be considered independent assessments. Internal quality control includes types of samples that allow personnel implementing the measurement system real-time information to evaluate and control measurement error in order to meet the DQOs (i.e., collocated samples and flow rate checks).
- ▶ **QA data represents routine data precision and bias-** The intent of a good quality system is to collect enough precision and bias information to adequately represent the measurement uncertainty of routine data with a specified degree of confidence. Usually, when a new measurement system is being implemented, more QA/QC information is required; once the measurement system has been determined to be in statistical control, the quality system requirements may be reduced. Therefore, the quality system needs to be developed so that each method designation has adequate representation within a time frame that corrections can be made without a significant loss of routine data.

- ▶ **Incentive for acceptable performance-** Once the measurement system for a monitoring organization (reporting organization) proves to be in statistical control, based upon demonstrated performance, the quality system can be reduced to a level that provides adequate information that acceptable data quality is being maintained.

This intent of this chapter is to describe how the major phases of the PM_{2.5} quality system will be implemented, not to describe the detailed technical aspects or rationale for the quality system; this is discussed in a number of guidance documents. The implementation strategy will be categorized into the following sections:

- ▶ Communication
- ▶ QA Roles and Responsibilities
- ▶ Planning
- ▶ Implementation
- ▶ Assessments
- ▶ Reporting
- ▶ Summary/Needs

5.2 Communication

The development of a quality system for PM_{2.5} requires a coordinated effort between U.S.EPA Headquarters and Regions, and the State and local monitoring community. Figure 5.1 represents the communication network for QA activities. This communication network will be used to develop and implement the PM_{2.5} quality system and resolve QA issues. The various groups in this figure have the following responsibilities:

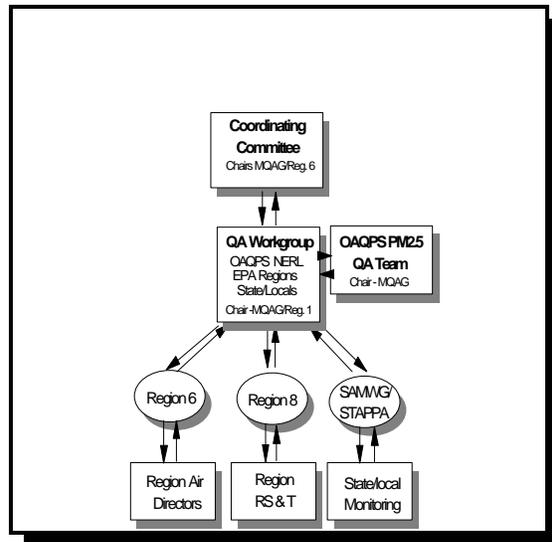


Figure 5.1 Communication Network

Coordinating Committee -This committee, co-chaired by Region 6 (M. Kemp) and OAQPS/MQAG (L. Byrd) has been established to address issues related to the implementation of the monitoring program. The co-chairs of the QA workgroup sit on this committee and report on QA issues needing resolution or clarification. This committee meets every two weeks.

PM_{2.5} QA Workgroup- This group is made up of OAQPS, NERL, U.S.EPA Regions, and State and local participants and it is used as an advisory group to assist the OAQPS PM_{2.5} QA Team develop an appropriate and “implementable” quality system. The workgroup is chaired by Region 1 (N. Beloin) and OAQPS/MQAG (M. Papp). It is used to help develop consensus QA approaches, resolve specific QA issues, and is also used as a communication device to ensure the Regional Air Directors, Regional Science and Technology (RS&T) Directors, and State and local monitoring communities have input into the development of the quality system. This group meets every two weeks.

OAQPS QA Team- The QA Team is made up of QA personnel in the OAQPS Monitoring and Quality Assurance Group (MQAG) and meets weekly to address implementation of the PM_{2.5} quality system, develop budget allocations, develop/revise regulations, guidance and training, address specific technical issues and ensure proper communications among OAQPS, Regions, ORD, and State and local monitoring community. This group is ultimately responsible for the development of the quality system and its related guidance and training.

Region 6- In FY98, Region 6 is responsible for the coordination of monitoring activities. The Region is responsible for the assisting in the dissemination of information from OAQPS to the Regional Air Directors and coordinating the responses and issues from the Regions.

Region 8 - Similar to Region 6's responsibilities, Region 8 is responsible for acting as a liaison between OAQPS and the Regional Science and Technology (RS&T) Divisions. These Divisions will play an important role in the mass activity by assisting in the FRM Performance Audit, establishing two national weighing laboratories, and a standards program and will also play an important QA role in the speciation work.

SAMWG/STAPPA/ALAPCO - These organizations represent the State and local perspective of the monitoring program and will participate on many of the QA conference calls. STAPPA/ALAPCO also has initiated a conference call with OAQPS and the Regions. The QA Workgroup chairs attend this conference call.

The coordination scheme presented in Figure 5.1 helps to ensure that all organizations with technical responsibility for program implementation are communicating and efficiently disseminating QA information.

Ambient Monitoring Technology Information Center (AMTIC)

Another important avenue of communication on QA activities is AMTIC. AMTIC presently has an area devoted to PM_{2.5} monitoring. Included in this area is a topic on QA. Important information and guidance documents are being posted in this area as soon as they are developed and available. In addition, a communication forum has been developed that will allow State/local organizations and the public to post technical questions. These questions are forwarded to the appropriate technical contact within the U.S.EPA, and their answers will then be available for other organizations to read as well. The U.S.EPA will continue to use AMTIC extensively throughout the implementation process.

5.3 QA Roles and Responsibilities

The two major entities involved in the PM_{2.5} implementation include the Federal organizations (OAQPS, NERL and U.S.EPA Regions) and the State and local organizations. Following the theme of planning, implementation, assessment and reporting, Table 5.1 provides a list of the QA roles and responsibilities of these organizations. Table 5.1 illustrates that a number of activities (e.g., DQOs, field/laboratory training) are shared responsibilities that will be

discussed and coordinated through the PM_{2.5} QA Workgroup.

Table 5.1 QA Roles and Responsibilities

PM _{2.5} QA Activities	
Activity/Organization	Responsibilities
Planning OAQPS NERL EPA Regions State/ Locals	QA Regs, DQOs, Speciation SOPs (field/ laboratory), QA/QC samples, acceptance criteria, guidance documentation, training SOPs FRM audit, national meetings, AMTIC QA Guidance Document 2.12 DQOs, FRM audit, systems audit Quality system development, QAPP development, collocation sites
Implementation OAQPS NERL EPA Regions State/ Locals	Field/laboratory training, management system reviews, QA Workgroup, FRM Performance Audit, AMTIC Technical arbiter, reference and equivalent method program Field/laboratory training, answering technical questions. ESAT WAM, QAPP approval, technical systems audits, network reviews, data reviews Quality control, verification, validation, data flagging, corrective action , network reviews, local training
Assessments OAQPS NERL EPA Regions State/ Locals	Network reviews, management systems reviews, P&A assessments, data quality assessments, critical review reports Reference and equivalent methods Network reviews and reports, technical systems audits and reports Performance audits, data quality assessments
Reporting OAQPS NERL EPA Regions State/locals	P&A reports, QA reports, Data quality assessments, MSR reports Special studies Network reviews, Technical system audit reports, Data quality assessments, Technical system audit reports

5.4 Planning

The development of a quality system for PM_{2.5} requires a coordinated effort between U.S.EPA Headquarters and Regions, and the State and local monitoring community. Elements of the quality system include planning, implementation, assessment, and reporting, as illustrated in Figure 5.2. The topics within each element will be discussed in their perspective sections.

The majority of the QA planning efforts will initially occur with the OAQPS QA Team and the QA Workgroup. These two groups have contributed to the development of this Implementation Plan.

5.4.1 PM_{2.5} Data Quality Objectives

Data collected for the Ambient Air Quality Monitoring Program are used to make very specific decisions that can have an economic impact on the area represented by the data. Data quality objectives (DQOs) are a full set of performance constraints needed to design a monitoring

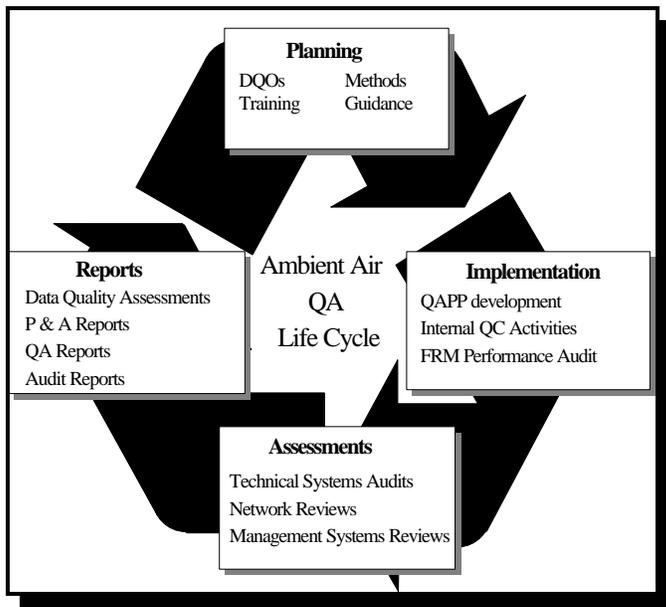


Figure 5.2 QA life cycle

network, including a specification of the level of uncertainty that a decision maker (data user) is willing to accept in the data to which the decision will apply. Decision makers need to feel confident that the data used to make environmental decisions are of adequate quality. The data used in these decisions are never error free and always contain some level of uncertainty. Because of these uncertainties or errors, there is a possibility that decision makers may declare an area “nonattainment” when the area is actually in “attainment” (false positive error) or “attainment” when actually the area is in “nonattainment” (false negative error). By applying the DQO Process to the development of a quality system for PM_{2.5} the U.S.EPA guards against committing resources to data collection efforts that do not support a defensible decision.

During the spring and summer of 1997 OAQPS implemented the DQO process in order to identify the bias and precision required to make attainment/nonattainment decisions within a known level of confidence. In summary, precision should be controlled to 10% coefficient of variation and bias to $\pm 10 \mu\text{g}/\text{m}^3$ in order to make attainment decisions with a 95% probability of making the correct decision. The DQO process will be used by the OAQPS QA team to develop the implementation requirements for collocated sampling, the federal reference method (FRM) performance audit and the acceptance criteria for various quality control samples implemented at the various measurement phases of the data collection effort.

5.4.2 Methods

In order to ensure consistent implementation of PM_{2.5} environmental data operations, the following methods have or will be developed:

QA Guidance Document 2.12 - The National Exposure Research Laboratory is responsible for the development of this guidance document. The QA Guidance Document 2.12 will include field and laboratory guidance for the routine operation of designated reference or class 1 equivalent methods. It will be placed on AMTIC for State/local review and comment in early December. The final method will be incorporated into the *Quality Assurance Hand Book for Air Pollution Measurement Systems- Volume II Ambient Air Specific Methods*. This document will be referred to as the *QA Hand Book* for the remainder of this section. Anticipated completion date - 3/98

FRM Performance Audit Standard Operating Procedures (SOPs) - Detailed SOPs will be developed for this activity and will be included in the FRM Performance Audit QAPP. Anticipated completion date - 5/98

5.4.3 Training

A number of training activities for QA have been planned, as discussed in Chapter 11. The QA workgroup will solicit responses from the monitoring community on their training needs and also ask for an evaluation of the training courses for continuous improvement.

In order to ensure the consistent implementation of the quality system, some training activities will require certification or approval. This process ensures that individuals are qualified to perform certain QA tasks. Presently, some type of certification will be required for field and laboratory activities of the FRM Performance Audit. The QA Workgroup will determine what other QA activities will require certification.

5.4.4 Guidance

Guidance serves to provide additional details and explanations of the Federal Regulation for PM_{2.5}. The following guidance documents are planned for this program. At the end of this chapter, Table 5.2 contains a listing of all the required QA guidance documents for the PM_{2.5} QA Program.

QA Hand Book -The major guidance document for the PM_{2.5} program will be the QA Hand Book. Where appropriate, each chapter of this document will include information for PM_{2.5} for the mass measurement. Anticipated completion date - 3/98

Model QAPP - Due to the accelerated time frame for implementation of this program, OAQPS, in cooperation with the U.S.EPA Regions and State and Local organizations, has developed a model QAPP that will serve as an example of the type of information and detail necessary for the QAPPs submitted by State and local organizations to U.S.EPA Regions. Anticipated completion date - 3/98

FRM Performance Audit QA Project Plan (QAPP) - Since the FRM Performance Audit will be implemented at a federal level, a QAPP is required to ensure that data of adequate quality is collected. Anticipated completion date - 6/98

FRM Performance Audit Implementation Plan -a detailed implementation plan will be developed in order to ensure that all facets of the program are adequately planned and implemented in appropriate time frames. Anticipated completion date - 4/98

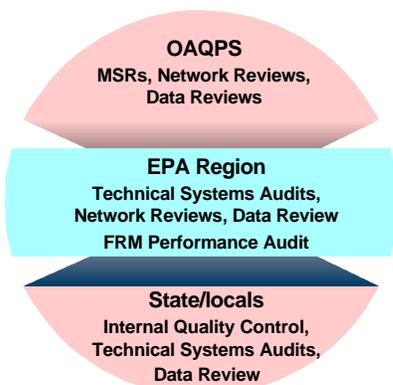
Network Review - Due to the agreements reached with regard to the Government Performance and Results Act (GPR) impact on grant terms and conditions, the U.S.EPA Regions will be responsible for quality assuring a percentage of sites each year. OAQPS will revise the Network Review Guidance Document to include the review of PM_{2.5} sites. Anticipated completion date - 6/98

Technical Systems Audit (TSA) - Both U.S.EPA Regions and State/locals are required to perform technical systems audits at required frequencies. The TSA guidance currently available

for the Ambient Air Monitoring Network included in the *QA Hand Book* will be revised as appropriate for PM_{2.5}

5.5 Implementation

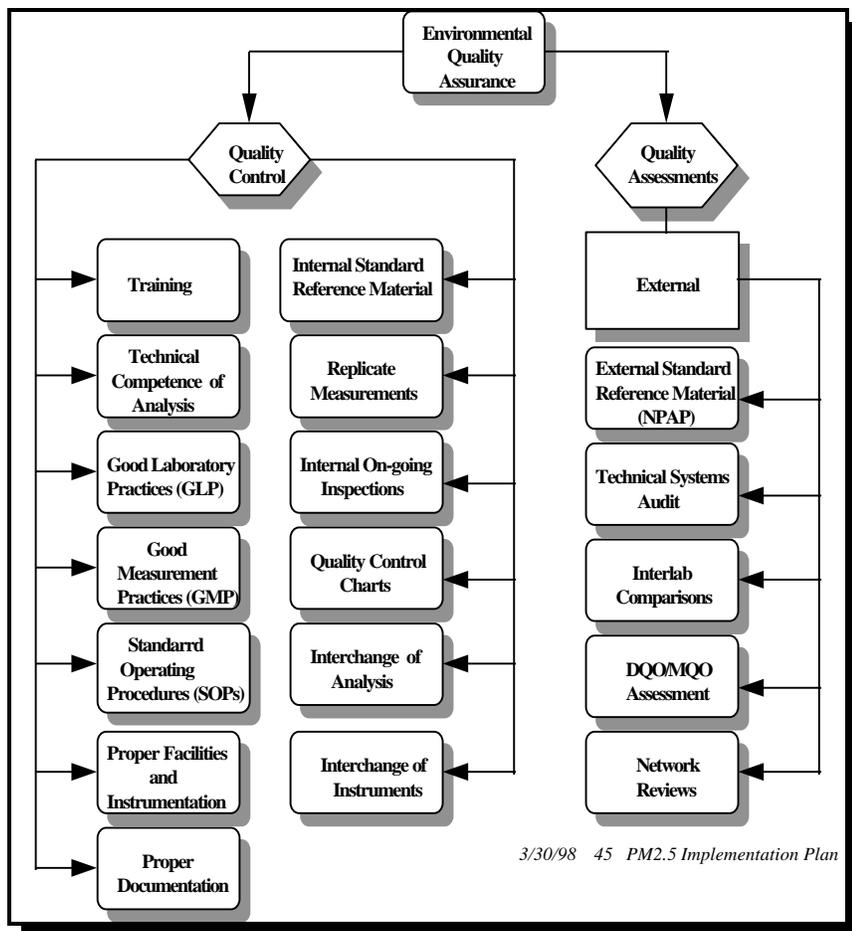
Table 5.1 presents a listing of the implementation responsibilities of the organizations participating in the PM_{2.5} monitoring activity. Implementation in the PM_{2.5} quality system is defined as those quality assurance activities whose intent it is to control and/or evaluate either the entire measurement system or a phase of the system. Due to the fact that many of the QA activities have been successfully implemented for other criteria pollutants in the ambient air monitoring network, their implementation does not need to be discussed here. This section will focus on some of the more major QA/QC activities



5.5.1 QA Implementation Structure

The quality system for PM_{2.5} has been developed at three levels of oversight. Since U.S.EPA policy states that data collected using the public resources must have a quality system in place and it also states that quality assurance is an inherently governmental function, OAQPS and the U.S.EPA Regions have developed a quality system that will allow for independent assessments of the quality assurance program, at each level, to ensure that

the DQOs are met.



5.5.2 Quality Control

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 customer; that are used to fulfill requirements for quality. Figure 5.3 illustrates a number of QC tools. In the case of the ambient air quality monitoring network, QC activities are used to ensure that measurement uncertainty, is maintained within established acceptance criteria for the attainment of the DQOs discussed above.

Figure 5.3 Types of Quality Control and Quality Assessment Activities

Federal regulation provides for the implementation of a number of qualitative and quantitative checks to ensure that the data will meet the DQOs. Each of the checks attempts to evaluate phases of measurement uncertainty. All of the required QA/QC activities are included in *QA Guidance Document 2.12* and the *QA Hand Book*. Figure 5.4 represents a few of the checks that are used in the PM_{2.5} quality system. However, the precision and bias DQOs discussed in section 5.4.1 are based upon two quality control activities; the collocated sample pairs and the FRM performance audits, since they provide the greatest level of aggregation of errors across the measurement system.

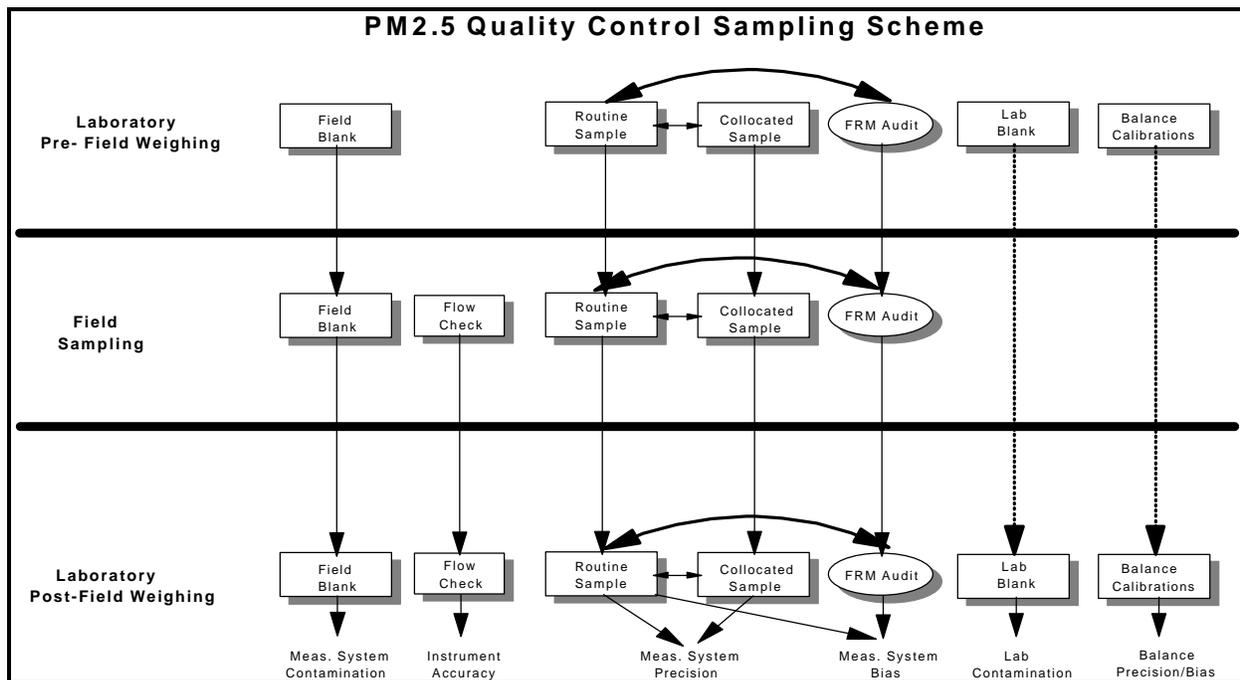


Figure 5.4 Flow of quantitative quality control samples

Collocated Monitoring --

The implementation of the collocated monitors for PM_{2.5} will be very similar to the collocated monitoring scheme for PM₁₀ and should not present an implementation problem. The 40 CFR Part 58 Appendix A and the QA Hand Book discuss the implementation aspects of this QC activity. State/locals organizations will be responsible for the implementation of this activity which will be discussed in their QAPPs.

FRM Performance Audit -

The intent of the FRM performance audit is to provide an estimate of total measurement system bias, for evaluation against the bias DQO. This performance audit will produce the most

reliable results if it is conducted by an organization independent of the organization routinely collecting samples. This will allow for a complete estimate of measurement system bias. Any deviations from this process could provide estimates of bias at various phases of the measurement system. Since the FRM Performance Audit is a State/local responsibility, a definition of independent assessment was required. A definition, modified from the *American National Standard - Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (Figure 5.5) was developed through QA Workgroup discussions. State and locals can implement the FRM performance audit if they can meet the definition of independence. Due to a number of reasons, both technical and logistical, OAQPS decided to encourage the State/local agencies to utilize a federally implemented program the initial 2 years. OAQPS will “buy-in” to the Superfund Environmental Service and Assistance Team (ESAT) contract. The ESAT contract has technical personnel stationed in each U.S.EPA Region who will be available to perform the field activities for the performance audit. For laboratory activities, two U.S.EPA Regions, (Regions 4 and 10) have volunteered to serve as national weighing laboratories and will utilize ESAT contractors to perform the required technical activities. After this initial 2-year period, the State/locals will determine, on a yearly basis, whether to continue using Federal implementation, by directing their appropriate percentage of grant resources back to OAQPS, or implement the audit themselves. OAQPS has 2 plans to continue federal implementation: 1) Continue to utilize the ESAT contract if it has shown to be successful, or 2) implement the activity through the new NPAP contract that is currently being developed. OAQPS developed language in the new NPAP statement of work for the FRM performance audit.

As mentioned earlier, an implementation plan, a QAPP, and field and laboratory SOPs will be developed for this activity. Two training activities are also anticipated. Start up of this activity is planned for January 1999.

Focusing QA Resources

Although all data are important to U.S.EPA, sites producing data close to the NAAQS would be the sites to focus limited QA resources. Therefore, the frequency of QA/QC (precision and bias) samples will be prioritized to sites in areas likely to be designated nonattainment, or at least to sites with higher concentrations. U.S.EPA recommends focusing 80% of the QA resources on sites with concentrations $\geq 90\%$ of the annual $PM_{2.5}$ NAAQS (or 24-hour NAAQS if that is affecting the area), and each area determined to be in violation should be represented by at least one collocated monitor. The remaining 20% of the resources should be focused at sites with concentrations $< 90\%$ of the annual NAAQS. If an organization has no sites at concentration ranges $\geq 90\%$ of the annual NAAQS, 60% of the resources should be implemented at those sites with the annual mean concentrations among the highest 25% for all $PM_{2.5}$ sites in the network. Obviously, for a new network, the selection will be somewhat subjective and based upon the experience of State and local organizations.

Independent assessment - an assessment performed by a qualified individual, group, or organization that is not part of the organization directly performing and accountable for the work being assessed. This auditing organization must not be involved with the generation of the routine ambient air monitoring data. An organization can conduct the FRM Performance Audit if it can meet the above definition and has a management structure that, at a minimum, will allow for the separation of its routine sampling personnel from its auditing personnel by two levels of management, as illustrated in Figure 1. In addition, the pre and post weighing of audit filters must be performed by separate laboratory facility using separate laboratory equipment. Field and laboratory personnel would be required to meet the FRM Performance Audit field and laboratory training and certification requirements. The State and local organizations are also asked to consider participating in the centralized field and laboratory standards certification process.

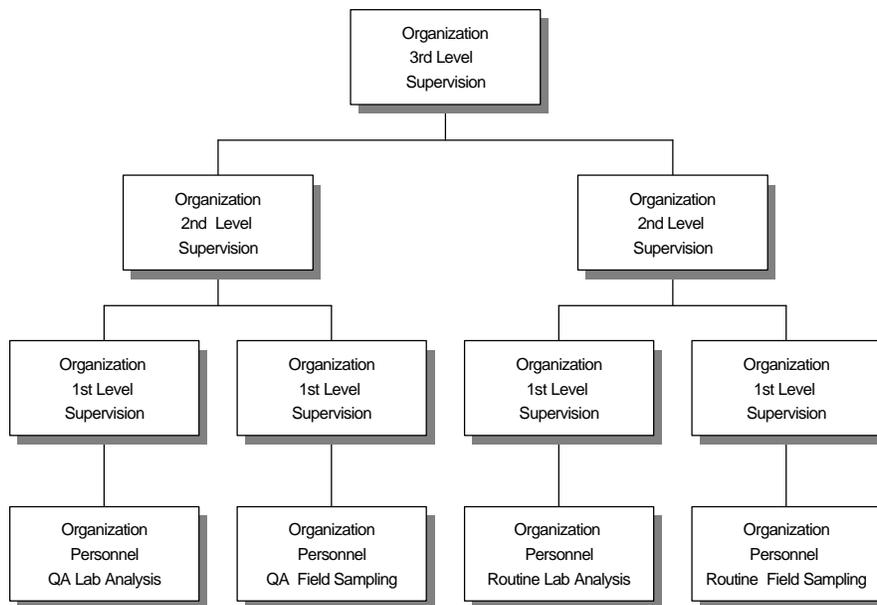


Figure 1

Organizations planning to implement the FRM Performance Audit must submit a plan demonstrating independence to the U.S.EPA Regional Office responsible for overseeing quality assurance related activities for the ambient air monitoring network.

Figure 5.5 Definition of independent assessment

5.6 Assessments

An assessment is an evaluation process used to measure the performance or effectiveness of the system and its elements. For the PM_{2.5} network, assessments will include: network reviews technical systems audits, management systems reviews, and peer review. Table 5.1 indicates the organizations responsible for the various assessments.

Network Reviews - Conformance with network requirements of the ambient air monitoring network set forth in 40 CFR Part 58 Appendices D and E are 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. The network reviews will be accomplished by the U.S.EPA Regional Office. In order to maintain consistency in implementing and collecting information from a network review, U.S.EPA has developed *SLAMS/NAMS/PAMS Network Review Guidance*. This document is still in draft form but will be completed in 6/98 by OAQPS with cooperation from the U.S.EPA Regions. In FY98 the U.S.EPA Regions will utilize the guidance mentioned to quality assure 187 sites.

Technical Systems Audits - A systems audit is an on-site review and inspection of a State or local agency's ambient air monitoring program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data. A systems audit of each state or autonomous agency within an U.S.EPA Region is performed annually by a member of the Regional Quality Assurance (QA) staff. As part of the NAAQS revision, the technical systems audit was revised from every year to once every 3 years for a State and local organization. Detailed guidance of the audits performed by the U.S.EPA and the State and local organizations is found in the *QA Handbook*. Tracking of the audits will occur on the AIRS system. In addition, State and locals also perform these audits as an independent assessments of the data collection activities. State and locals will include information on the details and the frequencies of the audits in their respective QAPPs. In addition, State and locals will be invited to audit the FRM performance audit activities which include audits of the field and national laboratories.

Management Systems Reviews (MSR) - This is a qualitative assessment of a data collection operation or organization 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. This would allow OAQPS to assess consistency of operation among the Regions and improve the quality system. The MQAG QA Team proposes implementing ~3 management systems reviews each year of the U.S.EPA Regions on their implementation of the ambient air monitoring program. OAQPS will team up with the U.S.EPA QA Division during their management systems reviews of the Regions. Implementation of MSRs are anticipated in FY99.

Peer Review - is a documented critical review of work product conducted by qualified individuals who are independent of those performing the work but are collectively equivalent in technical expertise. The OAQPS plans on using the peer review process to assess its products and guidance to ensure these products will serve the ultimate QA goal to produce data of acceptable quality.

5.7 Reporting

PM_{2.5} data will require data assessments to evaluate the attainment of the DQOs and reports of these assessments reviews. The following types of reports are anticipated

Data quality assessment (DQA) -is the scientific and statistical evaluation to determine if data are of the right type, quality, and quantity to support their intended use. Since DQOs have been developed for the PM_{2.5} attainment/nonattainment objective, the QA/QC data can be statistically assessed at various levels of aggregation to determine whether the DQOs have been attained. The statistics to be used to evaluate precision and bias were included in *40 CFR Part 58 Appendix A*. The data quality assessments of precision and bias will be aggregated at the following three levels.

- ▶ **Monitor**- monitor/method designation
- ▶ **Reporting Organization**- monitors in a method designation, all monitors
- ▶ **National** - monitors in a method designation, all monitors

It is anticipated that these calculations will be performed on the data in the Aerometric Information Retrieval System (AIRS) which will allow for the generation of reports at the levels specified above. The QA Workgroup will develop the data review criteria by 7/98. A discussion on the implementation of the DQA activities will be included in the *QA Hand Book*.

P & A Reports - These reports will be generated quarterly and annually and evaluate the precision and bias data against the acceptance criteria using the statistics documented in *40 CFR Part 58*.

Assessment Reports - Technical systems audits and network reviews will be on file at the U.S.EPA Regional Office with tracking information on AIRS. Management systems audits will be on file in MQAG.

QA Reports - A QA report provides an evaluation of QA/QC data for a given time period to determine whether the data quality objectives were met. This report will be more evaluative in nature than the P&A reports in that it will combine the various assessments and the QA data to report on the overall quality system. The QA Workgroup will discuss the elements of this report and the frequency of distribution. It is anticipated that this information would be developed by in FY99, with the first report generated 6 months after the first full year of data collection.

5.8 Summary and Needs

In summary OAQPS is coordinating with the U.S.EPA Regions and State and locals to develop a quality system that will ensure that there is sufficient quality assurance data to assess attainment of the DQOs and sufficient implementation techniques control data quality. In order to be successful in this endeavor, resources in terms of personnel and contract funding are required to ensure that the products that are required for the successful implementation of the quality system are developed in a timely manner. In FY98, the main focus is on the development of the necessary guidance and training materials to implement a quality system. In FY99 and beyond the focus will be on implementing various assessments and the statistical evaluation of quality assurance data. Table 5.2 provides a summary of the activities mentioned in this section, the tentative dates for completion, and the time required to complete these products.

Table 5-2 Products and Deliverables

Product/Deliverable	Completion
Planning Products	
QA Hand Book	3/98
Mass DQOs	10/97
Mass Model QAPP	2/98
FRM Performance Audit Implementation Plan	5/98
FRM Performance Audit SOPs	5/98
FRM Performance Audit QAPP	6/98
Network Review Guidance	6/98
Data Review Guidance	1/99
Implementation (Dates are implementation dates)	
FRM Performance Audits	1/1/99
Technical Systems Audits	1/1/99
Network Reviews	9/30/98
Management Systems Reviews	1/1/99
Assessments	
Data Quality Assessments	9/30/99
P & A Reports	6/3/99
QA Reports	1/1/00

6.0 SPECIAL CHEMICAL SPECIATION STUDIES

6.1 Introduction

The PM_{2.5} air monitoring program consists of three major measurement components: mass, “routine” speciation, and special chemical speciation studies. The first two of these components are described in some detail within the 40 CFR 58 regulation. The mass measurement portion is used primarily to obtain data for comparison with the PM_{2.5} National Ambient Air Quality Standard and related activities at 1,500 sites across the country.

The routine chemical speciation program as described in 40 CFR 58 regulation will provide a national picture of various particulate matter constituents for both long-term trends and short-term data assessment needs. This routine chemical speciation program will consist of 50 long-term sites in large metropolitan areas using standardized equipment and sampling schedules, and an additional 250 sites (approximate) whose sampling techniques and schedules will be determined by the agencies using the data.

In order to complete the national picture and to provide data for confident State Implementation Plan development, the routine speciation program will be supplemented with more advanced speciation activities described here as “Special Chemical Speciation Studies.” The Special Chemical Speciation Studies will focus on four to seven regions of the country, each of which have distinct particulate matter problems. These regions could include the northeastern corridor (impacted by urban/industrial/transport), the southeast (impacted by urban/industrial sources with questions about anthropogenic/nonanthropogenic source contributions and distinct urban versus rural problems), the southwest (potentially 3 distinct airsheds including Los Angeles, Phoenix, and the San Joaquin Valley), the northwest (impacted by urban and woodsmoke sources), and the midwest (impacted by urban/industrial/agricultural sources). Of these various regions, the only airshed in which chemical speciation has been intensively studied is the Los Angeles area. Each of these regions also have sub-regions with a variety of airshed characteristics. The Special Chemical Speciation Studies will not take place in all sub-regions; however, data collected through these studies and supplemented with data from the mass and routine speciation networks will be useful in understanding particulate matter pollution for all areas of the country.

The assessment of emission inventories, air quality models, and other technical tools which predict over continuous time and space frames will benefit from monitoring that has increased spatial, temporal, and chemical composition resolution. Historically, regulatory air programs have been criticized for not more fully conducting special intensive studies to test the technical tools used for air quality management. To address these concerns, the Special Chemical Speciation Studies element of the PM_{2.5} monitoring program is dedicated to conducting specialized monitoring and data analyses, including establishing “super” sites that sample for an array of chemical species on frequent sampling intervals. The sampling and analysis might provide diurnal profiles of size-resolved and chemically speciated aerosols. In addition, aerosol precursor, intermediate and termination species including organic compounds, nitric acid, ammonia, nitrogen dioxide and other NO_y constituents, peroxides and peroxy radicals could be

measured to provide challenging tests of chemical mechanisms within air quality models. These measurements offer the peripheral advantage of supporting ozone and deposition assessments as well, since many of the physical and chemical processes operate across several pollutant categories. Similarly, chemical, temporal, and size delineation enhancements to routine data assist health studies which investigate associations between adverse effects and pollutant parameters.

These applied science studies directly support the State and local agencies' air quality management activities by optimizing resources and by fostering collaboration among government agencies, universities and industry.

6.2 Objectives

The principal goal of the Special Chemical Speciation Studies program is to complement data collected under the routine program elements such that the entire PM_{2.5} monitoring program will (1) provide decision makers with the ability to make informed choices on emission mitigation strategies, and (2) assist the health community in developing associations between specific aerosol properties (i.e., size, chemical composition) and adverse effects. Several peripheral but worthwhile objectives emerging from this program include establishing partnerships with both state and federal governments, universities, and the regulated community; and the testing of advanced instrumentation prior to applying them in routine applications. Special studies historically have resulted in partnerships with industry and universities because the data collected from these programs are of a diagnostics/investigative nature rather than for strict regulatory comparison with the NAAQS. Important technical questions that will be addressed by this program include:

- 4) What is the contribution of regional PM_{2.5} to observed urban levels?
- 5) How does the chemical composition of regional aerosols differ from urban aerosols?
- 3) How do aerosol chemical components change diurnally? Same for size fraction?
- 4) How do aerosol chemical components vary over size fraction?
- 5) What are the important sampling artifacts imposed on aerosol measurements?
- 6) What is the chemical composition of the organic aerosol component? Can contributions due to secondary processes be separated from primary emissions?
- 7) What is the relative contribution of vapor phase organics to sampled aerosols? And, what is the preferred manner to separate gaseous material from sampled aerosols?
- 8) What is the variation (size, concentration, composition) of aerosols throughout the mixed layer?
- 9) What is the relation of aerosol precursor species (e.g., SO₂, NO_x, VOC, NH₃) to atmospheric termination products (nitrates, sulfates, condensible organics, peroxides) and intermediate species? Are these observed relationships replicated in air quality models?
- 10) What associations exist between adverse health effects and chemical composition, particle size and diurnal patterns?
- 11) How well do ambient measurements reflect emission estimates; in time and chemical composition?
- 12) What are the most efficient emission abatement approaches, and how does reduction in a particular precursor affect other pollutants?

The programmatic and technical objectives that address these questions include:

Programmatic:

- Develop effective emission control strategies via:
 - S air quality model evaluation
 - S emissions evaluation
 - S source attribution analysis[Note: continued tracking of emission changes must be part of a longer operating routine program]
- Assist current health studies and those that will be used in the 2007 particulate matter National Ambient Air Quality Standard (NAAQS) review.
- Develop partnerships between State/local agencies and universities.
- Promote advanced measurement technologies.

Technical: [Specific activities to meet programmatic objectives]

- Establish regional/urban super sites that perform simultaneous measurements of temporally resolved aerosol components, related gaseous precursors (SO₂, NH₃, VOC, NO_x; NO_y), and important gases (nitric acid, hydrogen peroxide) and intermediate species (peroxy radicals).
- Conduct comparisons between routine measurement systems and advanced techniques to ascertain biases in routine techniques, and to promote eventual routine use of advanced systems.
- Develop and/or use data analysis methods to diagnose air quality model behavior, evaluate emission estimates and support development of emission control strategies.

6.3 Program Administration

Program Administration will be governed by the following general principles:

- (1) Participation of primary stakeholders (Research scientists, State/Local agencies, Industry)
- (2) Using or complementing existing special study efforts
- (3) Appropriate mix of atmospheric chemistry (i.e., supporting source apportionment, air quality modeling tools) and health effects research communities

The U.S.EPA will work closely with State and local agencies, academia, other federal agencies, and interested industry stakeholders in establishing this project. In particular, the work

will be coordinated with ongoing and planned research programs.

The anticipated FY99 budget for the Special Chemical Speciation Studies is \$15M in Science and Technology funding. These funds, and any additional funding received in later years, could be extended to conduct studies over a longer period of time.

6.4 Mechanisms for Identifying and Conducting Program

The OAQPS will need to determine the most appropriate mechanism for soliciting the Special Chemical Speciation Studies projects, and for allocating resources. The mechanisms for conducting these projects may include any combination of existing Cooperative Agreements, Grants, and contracts with the capacity and ability to participate in special studies, as well as new competitive mechanisms.

To ensure adequate scientific input, it will be necessary to consult with the internal and external research community that includes health effects scientists, particulate matter monitoring experts, and atmospheric scientists. The EPA's Office of Research and Development in conjunction with NARSTO will help to coordinate this activity by organizing a workshop of technical experts and stakeholders to be held in the summer of 1998 to provide advice on the selection of sites and types of measurements to be conducted. Prior to the workshop, a select steering committee of National experts will set the agenda for the workshop and develop preliminary strawman proposals for project design. This input would include discussions on the approaches for identifying study areas and super site locations as well as discussions of PM_{2.5} analytical work and interpretive data analyses that would support the PM_{2.5} air program as a whole. States will be represented at this workshop in addition to the scientific community.

This Special Chemical Speciation Studies Program will focus on two areas. The first would include identifying 4-7 regions to study in detail, each with "super sites" where advanced particulate matter constituent measurements would be taken. Each of these regions would also have a data analysis plan and be required to present results in a reasonable time frame after the data have been collected. The second focus is on providing a data analysis mechanism that would be useful to the research and scientific community in analyzing available particulate matter data beyond those analyses that would be conducted as part of the routine program such as NAAQS comparisons and routine speciation data analyses.

The OAQPS will decide upon the process for administering resources for these efforts and include input from the workshop, and other agencies and stakeholders. As part of this evaluation, the OAQPS will identify the various elements that must be addressed within each project including items such as: project objectives, quality assurance elements, equipment handling and deployment to study location, equipment installation and removal, site preparation, operation/maintenance of equipment, data management and analysis, communication and application of results, cost estimates, and schedule.

6.5 Schedule for Activities

- ! February 11, 1998 Briefing for OAQPS management on Special Chemical Speciation Studies Program.
- ! February 20, 1998 Complete internal OAQPS discussions of special chemical speciation study project goals & requirements. This would include identifying and addressing legal considerations for how to solicit input from the research community, FACA implications, and identifying the members making up the expanded SAMWG.
- ! May 1998 Hold Steering Committee meeting to design workshop and develop initial strawplan designs.
- ! Summer, 1998 Hold larger workshop of scientific community and stakeholders to develop completed technical design plan
- ! Determine study locations (for planning purposes, assume one each in northeast, southeast, southwest, northwest, and the midwest.)
- ! Establish mechanisms for funding such as cooperative agreements, contracts, extensions to existing mechanisms.

7.0 PM_{2.5} & VISIBILITY PROGRAM INTEGRATION

The 40 CFR 51 Regional Haze Regulation, proposed in the *Federal Register* on July 31, 1997, includes visibility monitoring requirements. This proposed haze regulation makes monitoring data representative of class I areas important to the states since they are the basis for determining whether additional emission reductions would be needed to meet visibility targets. The states would have the responsibility for ensuring the collection and use of the data to determine whether the targets are met. There are strong technical connections between visibility and fine aerosols monitoring that support a comprehensive monitoring program that services both PM_{2.5} and visibility assessments. These technical links include:

1. Fine particles are responsible for nearly all pollution-related visibility degradation.
2. Visibility extinction budgets are calculated through speciated aerosol measurements; the measurement and analysis approaches virtually are the same.
3. Spatial scales associated with visibility measurements (regional) are frequently the same as spatial scales associated with background and transport PM_{2.5} measurements (regional, urban). It is important to consider data collected in the regional haze program as part of the PM_{2.5} data analysis activities.
4. Sources that affect visibility are the same sources that affect PM_{2.5}, and control programs that impact visibility impact PM_{2.5} levels.
5. The new PM_{2.5} monitoring regulations permits the use of the IMPROVE samplers for background and transport sites, in spite of the fact that the IMPROVE sampler is not a federal reference or equivalent method for PM_{2.5}.

Clearly, the technical justification exists for merging these monitoring efforts. Since the late 1980's, the IMPROVE Steering Committee has managed and coordinated a network of approximately 30 IMPROVE sites and 40 IMPROVE "look-alike" sites to provide visibility-related information about aerosols and their chemical constituents in rural/remote environments. The IMPROVE chemically speciated data will also be useful in the overall PM_{2.5} program. In fact, the nation is currently in the unusual position where aerosols are better characterized in rural/remote environments relative to urban and populated areas, due to the effectiveness of the IMPROVE program. Similarly, there is pragmatic value of combining resource planning and network deployment efforts simultaneously as combined planning is far less burdensome than separate efforts.

For the past several years, State §105 grant funds have been used to support visibility monitoring via the IMPROVE program. The IMPROVE Network is operated by a Steering Committee that includes representatives of U.S.EPA, National Oceanic and Atmospheric Administration (NOAA) and the federal land managers (FLM) who are responsible for preserving and improving air quality over the lands in their charge (National Park Service, Forest Service, Fish and Wildlife Service and Bureau of Land Management). Their involvement in such

monitoring programs represents a major advantage to U.S.EPA and the States for a number of reasons. They have access to secure monitoring locations and have provided staff to operate the equipment. For many sites, they have contributed the resources to purchase and operate complimentary monitoring equipment. They provide contract management for all phases of the field program (equipment procurement, deployment and maintenance; sample analyses; quality assurance; and data management). The IMPROVE Steering Committee also includes representatives from three state-based organizations (State and Territorial Air Pollution Program Administrators (STAPPA), Western States Air Resource Council (WESTAR), and Northeast States for Coordinated Air Use Management (NESCAUM)) in recognition of the States' interest in this program. With the technical connections between visibility and fine aerosols logically pointing to a comprehensive monitoring program that services PM_{2.5} and visibility assessments, a technical plan has been developed to integrate the PM_{2.5} network with the existing IMPROVE network. This plan includes establishment of 78 additional IMPROVE sites in or near Federal Class I areas over the next two years. Combined with the existing 30 IMPROVE sites funded through §105 Grants, these 108 sites, whose principal objective is visibility, will be considered part of the 1,500 site PM_{2.5} network. The estimated costs are \$2.47 million for 1998, and \$4.39 million for 1999. The plan also specifies that the IMPROVE protocol be changed to make it more compatible with the national PM_{2.5} monitoring program. Specifically, the IMPROVE sites would operate on a 1 day in 3 schedule for PM_{2.5} sampling, the past and new data would be stored in the new Aerometric Information Retrieval System (AIRS) database, and that a fraction of the IMPROVE sites would have collocated PM_{2.5} sampling with either IMPROVE or federal reference method samplers for gravimetric precision and inter-method comparison. It is anticipated that an expanded IMPROVE network will provide PM_{2.5} data that could be useful at some locations to aid States in the implementation of the new PM regulation.

The IMPROVE Steering Committee is committed to work closely with the States to select the class I areas for the expanded network as well as specific sites for monitors within the selected areas. The first priority is to deploy monitoring sites that are representative of all of the class I areas that can be accomplished in a cost-effective manner. This may be done by some combination of high elevation and low elevation sites in a region with clusters of nearby class I areas (e.g. along the Cascade or Sierra mountain ranges).

By March 6, 1998, the IMPROVE Steering Committee Chair will send a preliminary list of 25 to 30 class I areas to all appropriate State representatives for their comments and suggestions. The letter will also invite State representatives to accompany the FLM and IMPROVE contractors to select the specific locations for equipment during field trips (Spring 1998) to selected areas in their states or adjoining states. Responses from the states concerning the first 20 class I areas will be requested within three weeks. The same process operated on a somewhat more leisurely schedule will be conducted for the remaining 58 sites to be installed in 1999.

The IMPROVE Steering Committee has adopted several resolutions to facilitate the integration of the PM_{2.5} and Visibility networks:

- * The IMPROVE Steering Committee agrees to select additional sites in close consultation

and full partnership with affected states for an expanded IMPROVE network in visibility-protected class I areas that can be monitored routinely in a cost-effective manner.

- * The IMPROVE Steering Committee endorses a continued and expanded state-FLM partnership to provide for the upgrade, continued operation and analytical support of aerosol monitoring at the 30 existing IMPROVE monitoring sites and the expansion of this network from 30 to 108 sites. The committee will seek recommendations from the States and FLMs for selection of areas and sites for representative visibility monitoring and will strive for consensus in development of the new national network. The purpose of this expansion is to track visibility in 156 mandatory class I areas and to provide information about regional transport of fine particles that will support PM_{2.5} SIPs. The State's contribution of \$103 and \$105 grant dollars will pay for new or upgraded monitors, quality assurance and analytical support. The FLMs will coordinate and arrange for all operational support for the collection of aerosol samples.

- * The IMPROVE Steering Committee agrees to the following in order to promote integration of the IMPROVE aerosol monitoring with the national PM monitoring program:
 - ! the sampling schedule will be changed to a 1 day in 3 schedule starting in 1998;
 - ! that all past and new data will be provided to U.S.EPA for storage in the new AIRS database; and
 - ! that a fraction of the monitoring sites will include routine collocated sampling to allow precision and comparability assessments.

8.0 ANALYSIS OF PM_{2.5} MASS AND SPECIATED DATA

The data collected by an ambient air network are of little use unless analyzed. Hence the analysis of the data collected by the PM_{2.5} ambient air monitoring network is an integral part of the PM_{2.5} Implementation Plan. Although data collection precedes analysis and interpretation, an understanding of the data's use, particularly with respect to making comparisons to the PM_{2.5} NAAQS, must drive the design of the data collection program. Analyses are performed at various levels including State and local agencies, consortiums, Regional Offices, and OAQPS/EMAD. To assist with data analysis, EMAD has planned the following activities.

- **Guidance Documents** detailing potential uses for the PM_{2.5} mass and speciation data. These documents will be based on (1) techniques described in the published literature and (2) concepts offered by the State and local agencies, the Regional Offices, and EMAD. After a panel of experts peer reviews each document, the documents will be made publicly available through the Internet.
- **Development of Tools** to assist with some of the analyses described in the guidance documents. Many software packages have already been developed for other criteria pollutants and some may be modified to accommodate PM_{2.5} mass and speciation data. Examples include VOCDat and PAMSDAS. Also, an U.S.EPA website called PM Fine Data Analysis will be available, consisting of topics such as General Information, Publications, Papers and Reports, and Data Analysis Support. The site will provide direct links to PAMS data analysis, Toxics data analysis, and the Virtual Workgroup described below.
- **Training and Workshops** will be conducted to demonstrate proven data analyses, to present potential limitations of the conclusions from the data analyses, and to demonstrate the software tools that have been developed/modified specifically for PM_{2.5} data analysis. These workshops will be conducted in accordance with the Regional and State and local needs.
- **Periodic Reports** describing the national trends and the quality of the data collected by the PM_{2.5} network.

These activities will provide guidance, tools, and summaries that will ensure that the data from the PM_{2.5} monitoring network is being reviewed and analyzed both for attainment decisions and for increasing the understanding about the formation, maintenance, and removal of PM_{2.5}.

The creation and evolution of the guidance documents, tools, workshops, and reports will be aided by two groups:

- **Virtual PM Fine Data Analysis Workgroup**, an interactive website that will solicit ideas and comments from the ambient air monitoring and analysis community at large, particularly from groups such as NESCAUM, MARAMA, WESTAR, LADCO, TNRCC, CARB, A&WMA, and STAPPA/ALAPCO, to mention a few.
- **Ad Hoc PM Fine Data Analysis Workgroup** comprised of individuals from EMAD, AQSSD, Regions, and States who have expertise in ambient air data analysis, chemistry, and addressing issues such as confounding factors like meteorology. This group will

consolidate and synthesize their expertise and that provided by the virtual workgroup.

The PM_{2.5} data analysis will proceed in three phases. The first phase includes the period when the PM_{2.5} network is being deployed up to the initial PM_{2.5} data reporting efforts. During this time, the draft guidance on the techniques useful in analyzing PM_{2.5} data and beta versions of the software will be developed. The second phase will occur from the time that the reporting organizations first begin to report data until a couple of quarters of data are available. During this time, EMAD will assess the data for its bias and precision and conduct some preliminary exploratory data analyses. The purpose of this phase is to provide a report documenting the quality of the data initially collected and steps needed to ensure adequate remedies to problems identified in this process. The third phase begins once there is sufficient, quality-assured data to conduct the analyses based on several quarters worth of data. During this third phase, EMAD will produce annual reports summarizing the PM_{2.5} data and will work with the Regional Offices to conduct workshops to assist the State and local agencies with their individual data analyses.

Following is a description of some of the potential uses for the data collected by the PM_{2.5} network. Although support of the new PM_{2.5} NAAQS is an important use of the data, it is not the only use. In particular, increasingly greater reliance is being placed on observational data for air quality planning needs beyond NAAQS comparisons. Many of the recommendations from the National Academy Report on Tropospheric Ozone (NRC, 1991) reflected the need to better integrate observations into air quality planning rather than relying completely on emissions-based air quality modeling approaches. The message is being reinforced through the current ozone Science Assessment conducted through the North American Research Strategy for Tropospheric Ozone (NARSTO) and scheduled to be released in 1998. Dmerjian et al. (1995) present an approach for integrating observations in air quality planning through continuous iterative assessments revisiting program objectives and adjusting, where practical, implementation strategies. Although these reflections are based on ozone planning experiences, they probably are more relevant for PM_{2.5} given the newness of this program and the attendant system uncertainties.

8.1 Potential Uses of the PM_{2.5} Mass Data

Support of the PM NAAQS. After at least 3 years of data are available, the measured PM_{2.5} levels will be compared to the 24-hour and annual NAAQS for the purpose of determining nonattainment designations. Prior to the designations, the data will be analyzed for informational purposes and as part of the ongoing PM NAAQS review process.

Trends. The annual trend in PM_{2.5} concentrations will be analyzed to track progress in solving PM_{2.5} air quality problems. Initially, a baseline will be established, from which progress can be evaluated.

Exploratory Data Analysis. Currently, our understanding of the extent of transport contributions, temporal variability, spatial variability, and impact of meteorology for PM_{2.5} concentrations is limited due to the minimal network currently measuring PM_{2.5} concentrations. Exploratory data analyses will be performed to enhance our understanding of the sources of variability. This understanding is essential for developing strategies for controlling PM_{2.5}

concentrations.

Episode Selection for Air Quality Modeling. Since air quality models predict concentrations for only a few days per year, due to the expense of running such models, it is important to determine which days, or episodes, to model. The PM_{2.5} monitoring network will provide the needed data for determining the relationship between urban scale and mesoscale meteorological observations and PM_{2.5} concentrations to aid in episode selection.

Review of Network Design. The data from the PM_{2.5} monitoring network will provide the spatial and temporal information needed for evaluating the sampling frequency and siting of the monitors.

8.2 Potential Uses of the PM_{2.5} Speciation Data

PM_{2.5} Physical Characterization. Little is known about the physical characterization of the PM_{2.5} mass data. Exploratory data analyses will enhance our understanding of the particle size and morphology comprising the fine particulate matter. Such understanding might lead to improved source apportionment techniques which might aid in the development of attainment strategies.

PM_{2.5} Chemical Characterization. Little is known about the chemical characterization of the PM_{2.5} mass data. Exploratory data analyses will enhance our understanding of the various chemical components of fine particulate matter. Such understanding might lead to improved source apportionment techniques which might aid in the development of attainment strategies.

Source Apportionment. The PM_{2.5} mass monitors will identify the regions of the country with high PM_{2.5} concentrations. The speciation network will be used to determine which constituents contribute to the high mass concentrations. Such information might aid in the development of strategies for controlling PM_{2.5}.

Develop/Verify Attainment Strategies. Identifying the species that contribute to the high PM_{2.5} mass concentrations will aid in the development of attainment strategies. After implementing strategies, the speciation network will provide the information necessary for verifying the efficacy of those strategies.

Trends. The annual trend in PM_{2.5} constituents will be analyzed to track progress in solving PM_{2.5} air quality problems. Initially, a baseline will be established, from which progress can be evaluated. Additionally, it is possible to construct estimates of visibility from the constituents monitored at the PM_{2.5} speciation sites. Thus, trends in visibility can be analyzed.

Air Quality Model Evaluation. The speciation network will provide the data necessary to compare the concentrations predicted by the air quality models to the ambient concentrations, at a species level. Such comparisons will be useful for identifying ways to improve the air quality models and will aid in evaluating the emissions inventories that are integral to the modeling process. Speciated data play an especially important role, as the deterministic models predict

exact chemical components which can be compared to some of the specific measured analytes. The PM mass measurements from FRM/FEM samplers reflect a “health indicator” that is difficult to describe in deterministic physicochemical terms. Of course, all surface point sampling systems whether measuring exact “gases” or complex aerosols reflect space and time frames that may not be compatible with averaging schemes used in models. The sampling complexity of aerosols adds greater complexity to model-observation comparisons.

Correlation with FRM Mass Concentrations. Where PM_{2.5} mass and speciation monitors are collocated, it will be useful to develop an empirical relationship between the PM_{2.5} mass observations and the mass concentration obtained from the speciation monitors. Such an analysis will provide information about the comparability of the measurements from the FRMs and from the speciation monitors.

Health Studies. Speciated PM_{2.5} data will be important to continued epidemiological studies into the health effects of PM_{2.5} and its constituents.

Synthesis with Oxidant Data. At the sites with both PM_{2.5} speciation monitoring and monitoring for oxidant precursors and sinks, it will be possible to perform analyses to investigate the relationships between PM_{2.5} constituents and other important atmospheric constituents to gain better process understanding of both PM_{2.5} and ozone formation, maintenance and removal.

Integration with Other Databases. There are several other databases containing speciated PM_{2.5} data, for example, the data collected through the IMPROVE network, Clean Air Status and Trends Network (CASTNet), and the data used in the numerous health effects studies. It will be important to integrate the data from these various databases to increase the amount of information in one of the networks using the information in these other networks.

Review of Network Design. As with the mass data, the data from the PM_{2.5} speciation monitoring network will provide spatial and temporal information for evaluating the sampling frequency and siting of the monitors.

8.3 Schedule

Table 8.1 provides details regarding the schedule for the documents/products to be developed to assist with the analysis of the data collect by the PM_{2.5} monitoring network. These documents and products will be made possible through in-house OAQPS activities, the Ad Hoc PM Fine Data Analysis Workgroup, and contractor support.

Table 8.1 Data Analysis Documents and Other Products

Document/Product	Completion
Guidance Documents Guideline on Data Handling for the Revised PM NAAQS (Appendix N) Draft Final Guidance for PM _{2.5} Mass Data Analysis Draft Final Guidance for PM _{2.5} Speciation Data Analysis Draft Final	 6/98 12/98 6/98 12/98 6/98 12/98
Tools VOCDat modified for PM _{2.5} data analysis PAMSDAS modified for PM _{2.5} data analysis Beta version Final version Website for PM _{2.5} data analysis activities Software tool for assisting with network design Beta version Final version	 12/98 5/98 12/98 5/98 9/98 12/98
Training/Workshops Data validation and analysis training at spring Monitoring Meeting A&WMA-EPA International Symposium on the Measurement of Toxic and Related Air Pollutants Additional workshops in accordance with Regional and State/local needs	 5/98 9/98 Ongoing
Reports Trends Report, including trends for PM _{2.5} mass and speciated data Summary of Quality of Initial Data Collected by PM _{2.5} Network Annual Reports of Quality of Data Collected by PM _{2.5} Network	 Annually 6/99 Annually

9.0 TRACKING - PROGRAM IMPLEMENTATION

9.1 Background

The ambient air monitoring program for PM_{2.5}, constitutes a genuine challenge to U.S.EPA and the State and local air pollution control agencies to evaluate, purchase, install and operate approximately 1500 new monitors within the short timespan of 2½ years. To ensure that appropriate records are maintained, schedules are met, and monies are distributed equitably, a unique tracking system for the program will be instituted through FY-99, as a minimum. Through an established communications networks among the States/local governments, the U.S.EPA Regional Offices, and U.S.EPA Headquarters, the tracking system will be updated quarterly and reports issued through the AMTIC (<http://www.epa.gov/ttn/amtic/amticpm.html>).

9.2 National PM_{2.5} Sampler Procurement Contract Tracking

The following parameters will be tracked for PM_{2.5} samplers purchased through the U.S.EPA's National PM_{2.5} Sampler Procurement Contract:

- Type of sampler and vendor
- Shipping location for samplers (Region, city, state)
- Price of each sampler, accessories, and shipping charges
- Anticipated and actual delivery dates
- Receipt of inspection/acceptance forms for each sampler
- Any problems with equipment

9.3 Monitoring Site Information Tracking

The following parameters are candidates for tracking under this new system:

- ! Delivery information (when monitor delivered/where)
- ! Location (city/state)
- ! AIRS Number
- ! Operation Start Date
- ! Type of Instrument (FRM, Non-FRM, Speciation, Collocated, etc.)
- ! Sampling Frequency
- ! Type of Site
- ! Meteorological Monitoring
- ! Data Completeness/Capture
- ! Special speciation and saturation studies
- ! PM characterization studies
- ! Data analysis studies
- ! Continuous monitoring requirements

9.4 Reporting

Reporting will be initiated in FY98 and continue quarterly through FY99; at that point the reporting requirements will be re-evaluated and adjusted to reflect the current need for implementation data tracking.

10.0 TRAINING

10.1 Introduction and Objectives

The U.S.EPA promulgated revisions to the NAAQS on July 16, 1997. Because fine particles, those measuring 2.5 micrometers in diameter and smaller ($PM_{2.5}$), are some of the most damaging to human health, the July rule established an ambient air standard for $PM_{2.5}$ and a requirement to establish and maintain an ambient air monitoring network for $PM_{2.5}$. The implementation of any new ambient monitoring program requires resources dedicated to providing appropriate training in a number of diverse subjects; deploying a network to monitor a new pollutant with a new sampling method requires exceptional efforts. Given that the new monitoring network for $PM_{2.5}$ involves the selection of new sites, operation of new Federal Reference Method (FRM) monitors, evaluation of other candidate monitoring methods, and analysis of existing demographics and new metrics, a comprehensive and diverse training program is required. To meet this need, the STAPPA/ALAPCO and U.S.EPA chose to develop a new training effort as a model project. Spearheading this effort, the STAPPA/ALAPCO's Joint Training Committee established a subgroup made up of subject matter and training specialists that has led to the plan discussed in this paper.

The $PM_{2.5}$ monitoring training program is designed to meet the needs of a range of environmental managers, data analysts, and technical staff at the Federal, State, and Local government levels as well as selected representatives from the private sector. Four technical $PM_{2.5}$ monitoring areas were identified early in the process. These four technical $PM_{2.5}$ monitoring areas are: monitoring network design; monitor operation; monitoring quality assurance/quality control (QA/QC); and Chemical Speciation. To address training needs in these four technical $PM_{2.5}$ monitoring areas, U.S.EPA developed a $PM_{2.5}$ Monitoring Training Plan. This Plan defines a strategy for streamlining the development and revision of training materials (See Figure 1). An U.S.EPA subject matter expert was designated in each of these areas. Additionally, coordinators were designated in the technical and training areas to appropriately integrate the $PM_{2.5}$ monitoring activities. U.S.EPA's technical and training components work cooperatively to develop a variety of training materials delivered via several mechanisms. The training objectives for this effort include:

- ! Provide detailed, complete explanations of the revisions to 40 CFR 58 concerning the monitoring requirements for $PM_{2.5}$.
- ! Explain the $PM_{2.5}$ Network Design.
- ! Explain and demonstrate the routine operations and maintenance requirements of the Federal Reference Method for $PM_{2.5}$.
- ! Describe the laboratory procedures for $PM_{2.5}$ gravimetric and chemical speciation analyses.
- ! Delineate the appropriate quality assurance/quality control procedures for both $PM_{2.5}$ field and laboratory activities.

10.2 Available Training Mechanisms

EPA is using a number of mechanisms for both formal and informal training with stakeholders in the revised particulate monitoring program. The following are examples of these efforts:

- ! **Workshops** - U.S.EPA technical staff have visited each Regional Office to discuss the requirements of the particulate matter (PM) rule. U.S.EPA has sponsored a PM_{2.5} Network Design workshop. U.S.EPA has co-sponsored several workshops, specialty conferences and meetings with several organizations including Northeast States Consortium of Air Use Managers (NESCAUM), the Western States Air Resources Council (WESTAR), the Mid-Atlantic Regional Air Management Association (MARAMA), the Air and Waste Management Association (A&WMA), the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), and others.

- ! **Satellite Training** - U.S.EPA has a total of 5 specific satellite broadcasts that are associated directly with the PM_{2.5} monitoring part of the (NAAQS). Video tapes of these broadcasts are available to support future PM_{2.5} training needs. See Table 10.1 for broadcast dates.

- ! **Courses** - U.S.EPA's Air Pollution Training Institute (APTI), is conducting training courses for the benefit of stakeholders. Courses are in the form of on-site training, satellite broadcasts, or self-instructional courses. Additionally, efforts are underway to incorporate, as appropriate, PM_{2.5} monitoring information into five existing APTI courses. These are: "Network Design and Site Selection for Monitoring PM_{2.5} and PM₁₀ in Ambient Air" (APTI Course SI:433), "Atmospheric Sampling" (APTI Course 435), "Introduction to Ambient Air Monitoring"(APTI Course SI:434), "Quality Assurance for Air Pollution Measurement Systems" (APTI Course 470), and "General Quality Assurance Considerations for Ambient Air Monitoring" (APTI Course SI:471). See Table 10.1 for availability dates.

- ! **Videotapes** - U.S.EPA is developing stand-alone video tapes approximately 1-hour in length to summarize important issues within the four technical PM_{2.5} Monitoring areas. Titles and availability dates are included in Table 10.1.

- ! **Guidance Manuals** - U.S.EPA is issuing appropriate guidance to cover such subjects as rule interpretation, sampler operation, quality assurance, network design, data management/analysis, monitoring plan approval process, etc. The complete list and availability dates are found in Table 10.1.

- ! **Web Site** - Technical information pertaining to PM_{2.5} monitoring is posted on AMTIC. The URL address is [HTTP://WWW.EPA.GOV/TTN/AMTIC/AMTICPM.HTML](http://www.epa.gov/ttn/amtic/amticpm.html). The current seven categories of PM_{2.5} information are:
Federal Register; Network Design; Federal Reference Method; Points of Contact;

Implementation; Quality Assurance; Speciation; Training; National Monitor Procurement.

- ! **End User Provided Training** - Each of the Stakeholders in this project are supplying some PM_{2.5} training. U.S.EPA is supporting each of these training activities as appropriate. This often includes providing technical subject matter experts to speak at these training sessions. An ongoing effort is underway to list these under the PM_{2.5} Training Section of AMTIC. Additional information is also available by contacting the individual Stakeholder of interest.

- ! **Technical Assistance** - U.S.EPA is providing technical expert assistance from the Office of Air and Radiation, the Regional Offices and Office of Research and Development scientists and engineers in the design and implementation of specific PM_{2.5} monitoring networks.

10.3 Stakeholders and Participants

Given the complexity of the training process, the enormity of the effort of instituting a new nationwide monitoring program, the variety of expected problems, and the logistics of supporting such a large undertaking in a relatively short period of time, U.S.EPA and STAPPA/ALAPCO formulated a PM_{2.5} Training Sub-Group to provide counsel in the development of this PM training program. Currently U.S.EPA is engaging the assistance of such varied groups as the Northeast States Consortium of Air Use Managers (NESCAUM), the Western States Air Resources Council (WESTAR), the Mid-Atlantic Regional Air Management Association (MARAMA), the California Air Resources Board (CARB), the Air and Waste Management Association (A&WMA), the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials, and others to ensure that PM_{2.5} monitoring training needs are being identified and met.

10.4 PM_{2.5} Monitoring Milestones, Mechanisms, and Training

Schedules and Milestones. Table 10.1 provides a listing of the major guidance, regulatory actions, and training activities for the implementation of the PM_{2.5} monitoring network.

Table 10.1. PM_{2.5} Monitoring Implementation Schedule.

ACTION	MILESTONE
40 CFR 50, 53, and 58 PM _{2.5} regulation	July 18, 1997 Part 58 available on AMTIC* Parts 50 and 53 available on TTN Airlinks (http://www.epa.gov/ttn)
U.S.EPA Regions send States §103 PM _{2.5} grant guidance memo from OAR	January 9, 1998
Network design guidance (draft 9/20/97)	December 15, 1997 - Available on AMTIC under Network Design*
QA guidance on sampling/filter handling (Method 2.12) (Final Red Book guidance available in March 1998)	December 1997 - Draft available on AMTIC under Quality Assurance*

PM _{2.5} : A Fine Particle Standard specialty conference sponsored by Air and Waste Management Association (AWMA)	January 28-30, 1998 Long Beach, California
U.S.EPA Network Design Videotape	March 1998 Jan Cortelyou, 919-541-5393
Model QA Project Plan Guidance Document	March 6, 1998 (mass mailing of final draft) March 31, 1998 final version signed by each Region
FY99 §103 grant guidance to Regions from OAR	March 1998
QA Handbook (Red Book) with final Method 2.12 (Draft Method 2.12 available in December 1997)	Mid-April 1998
APTI Course SI:433 - "Network Design and Site Selection for Monitoring PM _{2.5} and PM ₁₀ in Ambient Air" revised to include PM _{2.5}	March 1998 Deborah Miller, 919-541-5552
U.S.EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Network Design/Balance Room Focus	March 25, 1998 Jan Cortelyou, 919-541-5393
U.S.EPA Workshop on the Special Chemical Speciation Studies program design with scientific community.	Spring 1998 (Specific details will be made available as soon as possible.)
Continuous monitoring guidance (Draft in March 1998)	May 1998
U.S.EPA Videotape - Balance Room Set-up, COC	May 1998 Jan Cortelyou, 919-541-5393
Speciation monitoring guidance (Draft to work group for review on February 25, 1998)	May 1998
U.S.EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Monitoring Focus	May 1998 Jan Cortelyou, 919-541-5393
U.S.EPA/AWMA Training on PM _{2.5} Laboratory and Sampling Equipment	May 20-21, 1998 in RTP, NC Details available on AMTIC*
APTI Course SI:434 - "Introduction to Ambient Air Monitoring" revised to include PM _{2.5}	June 1998 Deborah Miller, 919-541-5552
Site review guidance for "quality assuring 187 sites"	June 1998
U.S.EPA Videotape - Monitor Operations	June 1998 Jan Cortelyou, 919-541-5393
APTI Course 435 - "Atmospheric Sampling" revised to include PM _{2.5}	July 1998 Deborah Miller, 919-541-5552
APTI Course 470 - "Quality Assurance for Air Pollution Measurement Systems" revised to include PM _{2.5}	August 1998 Deborah Miller, 919-541-5552
APTI Course SI:471 - "General Quality Assurance Considerations for Ambient Air Monitoring" revised to include PM _{2.5}	October 1998 Deborah Miller, 919-541-5552
U.S.EPA APDLN Broadcast - PM _{2.5} Monitoring Update - QA/QC Focus	October 1998 Jan Cortelyou, 919-541-5393

U.S.EPA Videotape - PM _{2.5} Monitoring QA/QC	Fall 1998 Jan Cortelyou, 919-541-5393
U.S.EPA APDLN Broadcast - PM _{2.5} Monitoring Update - Chemical Speciation Focus	December 1998 Jan Cortelyou, 919-541-5393
U.S.EPA Videotape - Chemical Speciation	December 1998/Winter 1999 Jan Cortelyou, 919-541-5393

*For PM_{2.5} information on the Ambient Monitoring Technology Information Center (AMTIC), see <http://www.epa.gov/ttn/amtic/amticpm.html>

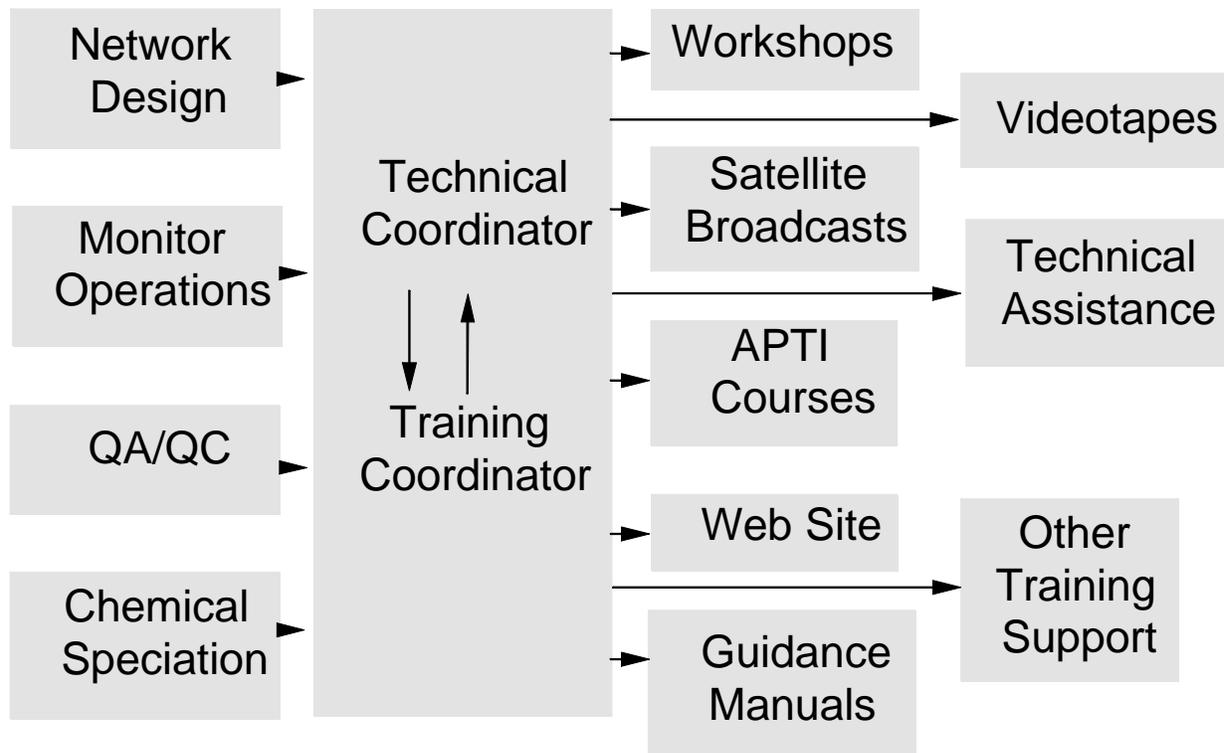


Figure 10.1: EPA's PM_{2.5} Monitoring Training Plan

**11.0 TRIBAL LAND PM_{2.5} FUNDING ALLOCATION, MONITORING,
AND DEPLOYMENT STRATEGY**

To be provided as information is available.

Common Acronyms in the PM_{2.5} Program

AIRS - Aerometric Information Retrieval System (maintained by the U.S.EPA)

ALAPCO - Association of Local Air Pollution Control Officials

AMTIC - Ambient Monitoring Technology Information Center, from U.S.EPA Internet site at <http://www.epa.gov/ttn/amtic>. Particulate matter information is available at <http://www.epa.gov/ttn/amtic/amticpm.html>.

APDLN - Air Pollution Distance Learning Network, U.S.EPA

APTI - Air Pollution Training Institute, U.S.EPA

AWMA - Air and Waste Management Association

CAA - Clean Air Act

CFR - Code of Federal Regulations

CMD - Contracts Management Division (within the Office of Acquisition Management, U.S.EPA)

CMZ - Community monitoring zone

CORE - Community-oriented monitoring

DOI - U.S. Department of Interior

DOPO - Delivery order project officer(s)

DQA - Data quality assessment

DQO - Data quality objectives

EORG - Education and Outreach Group, Information Transfer and Program Integration Division, Office of Air Quality Planning and Standards, U.S.EPA

FACA - Federal Advisory Committee Act

FLM - Federal land manager

FRM/FEM - Federal Reference Method/Federal Equivalent Method as approved by U.S.EPA

GPRA - Government Performance and Results Act

IMPROVE - Interagency Monitoring of Protected Visual Environments

ITPID - Information Transfer and Program Integration Division (within U.S.EPA OAQPS)

MARAMA - Mid-Atlantic Regional Air Managers Association

MQAG - Monitoring and Quality Assurance Group (within Emissions, Monitoring & Analysis Division of the Office of Air Quality Planning and Standards, U.S.EPA)

MSR - Management Systems Review

NAAQS - National Ambient Air Quality Standard

NARSTO - North American Research Strategy for Tropospheric Ozone

NAMS - National Air Monitoring Station(s)

NCEA - National Center for Environmental Assessment, U.S.EPA

NERL - National Exposure Research Laboratory (within the Office of Research and Development, U.S.EPA)

NESCAUM - Northeast States for Coordinated Air Use Management

NHEERL - National Health and Environmental Effects Laboratory, U.S.EPA

NOAA - National Oceanic and Atmospheric Administration

NPAP - National Performance Audit Program

NPS - National Park Service, U.S. Department of Interior

OAQPS - Office of Air Quality Planning and Standards, Office of Air and Radiation, U.S.EPA

OAR - Office of Air and Radiation

OPMO - Office of Program Management Operations, Office of Air and Radiation, U.S.EPA

ORD - Office of Research and Development, U.S.EPA

PAMS - Photochemical Assessment Monitoring Station

PRRM - Planning, Resources, and Regional Management Staff (within U.S.EPA OAQPS)

PTFE - polytetrafluoroethylene

QA - Quality assurance

QAPP - Quality assurance project plan

RO - U.S.EPA Regional Office

RST - Regional Science and Technology laboratories/centers, U.S.EPA Regional Offices

RTP - Research Triangle Park, North Carolina

SAMWG - Standing Air Monitoring Work Group

SIP - State implementation plan

SLAMS - State or Local Air Monitoring Station(s)

SOP - Standard operating procedure

SPM - Special purpose monitor

STAPPA - State and Territorial Air Pollution Program Administrators

TSA - Technical systems audit

XRF - X-ray fluorescence

WESTAR - Western States Air Resources Council

Appendix - Internal U.S.EPA Resources

For U.S.EPA internal resource planning. This information is not generally being provided publically due to need for sensitivity regarding national procurements.