

AIR MONITORING STRATEGY FOR  
CRITERIA POLLUTANTS AND VISIBILITY

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## CONTENTS

### LIST OF TABLES

- I. Program Objectives and Information Needs
- II. Background
- III. Development of the Strategy
- IV. Use of the Strategy Document
- V. Air Quality Monitoring and Data Reporting Regulations
  - A. Criteria Pollutants
  - B. Visibility Protection
  - C. Compliance Status - Meeting Data Needs
- VI. Maintenance and Enhancement of The Air Monitoring Program
  - A. SAMWG Activities
  - B. EPA Activities
    - 1. Oversight of State and Local Monitoring
    - 2. Identification of Data Gaps
    - 3. provide for Expanded Analysis of Data
    - 4. Provide for Improved Air Data System
    - 5. Resource Summary

### REFERENCES

## LIST OF TABLES

### Table

- 1 Principal Uses of Aerometric Data by Use Level
- 2 SLAMS Status Through December 1984
- 3 NAMS Status Through December 1984
- 4 National Summary of Air Monitoring Stations
- 5 Criteria Pollutants Resource Summary

## AIR MONITORING STRATEGY FOR CRITERIA POLLUTANTS

### I. Program Objectives and Information Needs

The Office of Air Quality Planning and Standards has as its criteria pollutant monitoring goal, the establishment and operation of an air monitoring program to meet the variety of data uses identified in Table 1. The list of uses shows the importance of monitoring data for several phases of the air program. Furthermore, the list displays how the needs vary according to the functions and responsibilities of the user. As part of the monitoring strategy there are uniform monitoring methods, siting criteria, quality assurance programs and data handling, and reporting procedures which must be followed whenever ambient air monitoring data must be collected.

### II. Background

Section 110 of the Clean Air Act (CAA) requires ambient air quality monitoring and data reporting for purposes of State Implementation Plans (SIPs). The Environmental Protection Agency (EPA) promulgated regulations in August 1971, for the preparation, adoption, and submittal of SIPs under Section 110 of the Act. Included in these regulations were requirements for States to establish and operate ambient air monitoring networks and to report the data to EPA. These data were to be used for such purposes as evaluation of national control efforts, tracking attainment and maintenance of the National Ambient Air Quality Standards (NAAQS), reevaluation of the NAAQS, development of national control policies and strategies, and the preparation of national trends in ambient air quality.

### III. Development of the Strategy

In the mid-1970's, several critical reviews of environmental monitoring programs identified major deficiencies in several aspects of the existing monitoring systems. A Standing Air Monitoring Work Group (SAMWG) was formed to review and provide recommendations to overcome these deficiencies. The work group prepared a listing of the major activities of an air monitoring program and used these as the bases for writing a series of nine issue papers. These papers were extensively circulated for review by State and local agencies and EPA offices. From the recommendations of the reviewers and the work group's other findings, SAMWG prepared a draft of an overall air monitoring strategy for SIP's in December 1976. The draft strategy was circulated for review by 50 State and 180 local agencies and EPA offices. Four regional workshops were also held to provide State and local agencies with the opportunity for open discussions of the overall concepts of the strategy, as well as the specific details of the monitoring program elements. The final air monitoring strategy document which was formally approved by the Administrator reflected the deliberations of

the workshops and comments that were received on the draft strategy.

TABLE 1. PRINCIPAL USES OF AEROMETRIC DATA BY USE LEVEL\*

USES	EPA HQ	EPA RO	STATE/LOCAL AGENCIES
1. Judge attainment/non-attainment of NAAQS	1	3	3
2. Evaluate progress in achieving/maintaining NAAQS or State standards	1	3	3
3. Develop or revise SIP's to attain/maintain NAAQS	1	3	3
4. New Source Review and prevention of significant deterioration	1	3	3
5. Develop or revise national control policies (e.g., NSPS, tall stacks, SCS)	2	N/A	N/A
6. Model development and validation	3	3	3
7. Support enforcement actions	2	3	3
8. Public information (e.g., air quality indices)	1	1	3
9. Health research/establish standards	3	3	3
10. Develop or revise local control strategy	1	2	3
11. Determine specific cause of pollution in an area	1	2	3
12. Determine nature of air pollution problem in an area	3	3	3

\*Use level refers to the detail, extent, and frequency of reporting of data needed by the user for the stated purpose.

1. Refers to a low level of detail, extent, and frequency of reporting
2. Refers to a moderate level of detail, extent & frequency of reporting
3. Refers to a high level of detail, extent and frequency of reporting

N/A - Not Applicable

#### IV. Use of the Strategy Document

Since it was approved by the Agency in 1977, the "Air Monitoring Strategy for State Implementation Plans,"<sup>1</sup> has served as the basis for developing Federal, State, and local long-range air monitoring programs. In particular, the Agency used the document in preparing its annual program guidance, which highlighted the monitoring objectives for the ensuing fiscal year. Since the primary goal of the strategy was to ensure that air quality managers at all levels had reliable air quality data and information, it served as a blueprint for proposing changes in the Agency's regulations covering State and local agency air quality surveillance and data reporting.

#### V. Air Quality Monitoring and Data Reporting Regulations

##### A. Criteria Pollutants

In May 1979, EPA promulgated monitoring regulations for the criteria pollutants.<sup>2</sup> The provisions of the regulation (40 CFR Part 58) covered the following major elements:

1. Provided for fixed and movable monitoring sites.
2. Established uniform monitoring criteria.
3. Required that reference or equivalent methods be used.
4. Imposed an annual network review.
5. Required public reporting of an air quality index daily.
6. Provided for the quarterly reporting of all NAMS data and the annual summary reporting of SLAMS data.

Two types of stations are described in the regulations, State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS). Each is designed to serve different data needs and must be established according to specified reporting, siting, and instrumentation requirements. SLAMS consists of a carefully planned network of fixed monitoring stations whose size and distribution is largely determined by the needs of State and local air pollution control agencies to meet their respective SIP requirements.

These stations are the backbone of the ambient monitoring program relative to State Implementation Plan (SIP) activities. The NAMS are a subset of the SLAMS network with emphasis being given to urban and multisource areas. In effect, they are the key SLAMS with emphasis on

areas of maximum concentration and high population density. NAMS, like SLAMS, must conform to EPA siting criteria and operate according to quality assurance procedures that equal or exceed EPA's minimum specifications. January 1, 1981 was the deadline by which all NAMS were to meet all of the requirements in the regulations; the SLAMS had until January 1, 1983.

In addition to the SLAMS and NAMS networks, the regulations provide for Special Purpose Monitoring stations. This type of monitoring is more flexible than the other two networks thus, it can be adjusted to accommodate changing priorities. Since monitoring resources are not expected to increase dramatically at any level, SPM should be used to supplement the fixed network to make the overall effort more effective.

## B. Visibility Protection

In December, 1980, EPA promulgated regulations requiring 36 States to amend their SIP's to provide for visibility protection in Mandatory Class I Federal areas.<sup>3</sup> The visibility protection regulations consisted of the following major elements:

1. General plan provisions including control strategies for existing sources which could be reasonably attributed to cause visibility impairment.
2. Integral vista identification.
3. Monitoring strategy .
4. Longterm strategy.
5. New source review procedures.

The visibility monitoring strategy required the affected States to develop a "strategy for evaluating visibility in the Mandatory Class I Federal areas by visual observation or appropriate monitoring techniques."

Because of litigation challenges and administrative petitions for reconsideration of the visibility regulations, only two States developed visibility protection plans. In April 20, 1984, EPA entered into a settlement agreement with the Environmental Defense Fund to develop protection plans for any deficient States. On October 23, 1984, EPA proposed a visibility monitoring strategy and new source review procedures for 34 States. The settlement agreement requires EPA to promulgate these two provisions by July 6, 1985 for any State that has failed to submit revised SIP's by May 6, 1985.

In the October 23 proposal, EPA stated that two types of visibility data were required to meet the objectives of the visibility protection program; 1) background data on prevailing visibility conditions in the mandatory Class I Federal areas and 2) specific attribution data on the possible sources of identified visibility impairment. If promulgated, EPA would establish a background visibility data collection network and an attribution program for identified

visibility impairment in cooperation with the Federal land managing agencies. This program would be applicable in any of the 34 States that fails to submit an acceptable visibility monitoring strategy . The implementation of the Federal program would begin in FY-86 .

C. Compliance Status - Meeting Data Needs

Overall, State and local progress in meeting the requirements of the Part 58 regulations has been excellent. Tables 2 and 3 summarize the SLAMS and NAMS status in January 1985. Table 4 lists, by pollutant, the number of SLAMS and NAMS.

Table 2 shows a total of 4888 planned SLAMS monitors of which 4726 or 98 percent were in operation. This number is about the maximum expected since monitoring station shutdowns routinely occur because of lost leases, urban renewal projects, and changing ambient air monitoring priorities. Therefore, using 4726 operating monitors as a practical base, 4695 or 99 percent of the operating monitors are meeting all requirements of the regulations. The remaining two percent should meet the requirements with some small changes in monitor siting and improvements in the standard operating procedures in the near future.

Table 3, shows that of the 1360 planned NAMS, 1347 or 99 percent were in operation as of the end of December 1983. Of the operating monitors, 100 percent were meeting all requirements of the regulations.

TABLE 2. SLAMS Status through December 1984

	Number of Monitors	Percent of Network
Total planned network*	4888	-
Monitors operational	4726	98
Monitors using uncertified or unacceptable equipment	0	0
Monitors improperly located	25	1**
Monitors operating under an approved or conditionally approved quality assurance plan and submitting precision and accuracy data	4695	99**
Monitors not meeting all of the quality assurance requirements	31	1**

Monitors in operations meeting all requirements of the regulations	4695	5	99**
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\* Includes NAMS monitors

\*\* Based on 4726 operating monitors

TABLE 3. NAMS Status through December 1984

	Number of Monitors	Percent of Network
Total planned network	1360	-
Monitors operational	1347	99
Monitors using uncertified or unacceptable equipment	0	0
Monitors improperly located	0	0
Monitors operating under an approved or conditionally approved quality assurance plan and submitting precision and accuracy data	1347	100*
Monitors in operation meeting all requirements of the regulations	1347	100*

\*Based on 1352 operating monitors

TABLE 4. National Summary of Air Monitoring Stations

POLLUTANT	SLAMS (Including NAMS)	NAMS
TSP	2495	642
SO <sub>2</sub>	566	220
NO <sub>2</sub>	250	58
CO	433	115
O <sub>3</sub>	599	216
Pb	383	109
TOTAL	4726	1360

In summary, the revised air monitoring regulations have brought about a number of major improvements in the quality of ambient monitoring data. Ambient monitoring data are now accompanied by precision and accuracy information which provides data of known quality. The data are also comparable from area to area since uniform criteria for siting, sampling probe height, and use of standardized monitoring equipment must be adhered to. Redundant and/or unneeded data are at a minimum with the elimination of some 4000 obsolete monitors since 1977 with essentially no loss in geographic coverage. Changes in both reporting requirements and enhancements to the data processing activity have resulted in more timely receipt of data.

The monitoring regulations promulgated in 1979 also met all of the requirements of Section 319 of the 1977 Clean Air Act (CAA), as amended, which requires:

- o Uniform air quality monitoring criteria and methodology.
- o Air quality to be measured according to a uniform air quality index.
- o Monitoring stations in major urban areas and other appropriate areas throughout the United States.
- o Daily analysis and reporting of air quality using a uniform air quality index.
- o Certain record-keeping and reporting to the Administrator.

Assessments of the existing air monitoring network by SAMWG, and by internal and external reviews have concluded that the SAMWG strategy has been successfully implemented. A national monitoring network has been established, as recommended by the strategy, provides coverage for major populated areas or areas with known or potential pollution problems and provides data that satisfies the needs listed in Table 1. Further, the strategy allows for the network to be flexible and to expand, contract, or add additional pollutants in response to program requirements. The network is providing data of a known quality in a timely manner and is cost effective in its operation. These conclusions are supported by a 1980 "Study of the Adequacy of Air Monitoring"<sup>3</sup> which was conducted by the National Commission on Air Quality. The commission reported, "The new regulations, an excellent tool from the EPA, provide a comprehensive method for ensuring the quality and appropriateness of air quality data and information. There are no fundamental inadequacies in the regulations, only minor deficiencies."

## VI. Maintenance and Enhancement of the Air Monitoring Program

### A. SAMWG Activities

The Standing Air Monitoring Work Group currently meets on a regular basis (twice yearly) as part of an ongoing effort to review and evaluate the effectiveness of current air monitoring programs, identify problems or deficiencies, and suggest appropriate corrective actions. Minor revisions to the strategy by way of modifications to the regulations have occurred through the SAMWG efforts. Since the original promulgation, revisions to the regulation have been made for lead in October 1984 and have been proposed for PM10 in March 1984.5 A comprehensive 5-year review (including substantial input from STAPPA and ALAPCO) has been completed. Based on the review, no major changes in the original regulation were identified. The need for minor changes were recommended and were proposed in March 1985. Other issues that SAMWG is discussing are the replacement of worn-out/obsolete monitors, and the handling of exceptional or unusual air quality data. Costs to replace obsolete or worn out monitors are estimated to total \$6 million.

## B. EPA Activities

The continuing successful implementation of the national air monitoring program will require sustained management oversight by the Agency as well as continued technical guidance and assistance to the States and local agencies. Management oversight will require periodic assessments of the program as to meeting air program data needs and to assure that projected funding levels will be adequate to continue full implementation of the SLAMS network. Projected requirements for the monitoring program are discussed in three areas: (1) oversight of State and local monitoring; (2) need for expanded data analysis; and (3) need for improvement of air data system.

### 1. Oversight of State and Local Monitoring

Relative to the State/local ambient monitoring programs, OAQPS, working with the Regional Offices, must continue to carry out the following activities:

- ° Direct oversight of the national ambient monitoring programs to ensure consistency in implementation of both NAMS and SLAMS and visibility monitoring among the Regional Offices, identify specific deficiencies, identify resources needed to correct them, and prepare plans and budgets for correction of the deficiencies.

- ° Annually assess the impact of Section 105 grant funds in partially subsidizing the overall operation of the States' ambient and visibility monitoring programs and issue policy/guidance relative to allocation of grant funds to air monitoring activities.

- ° Provide surveillance of the NAMS operations through periodic on-site audits to ensure that all NAMS continue in full compliance and all NAMS data accepted for storage in EPA's central data

system are valid.

- ° Prepare an annual assessment of the States' ambient and visibility monitoring programs to include status of networks implementation of required programs, and evaluation of the effectiveness of operational programs.

- ° Provide guidance on acceptable visibility monitoring techniques and encourage States to develop their own programs.

Present OAQPS resources required to provide for oversight and management of the national air monitoring program in FY-85 are 5.9 FTE for a total of \$360K (includes in-house and extramural costs). This level of funding provides for: on-site audits of approximately 20 percent of the NAMS annually; maintenance and updates of the NAMS site information files; the assessment and documentation of the NAMS network relative to regulatory criteria; issuance of annual program guidance and technical manuals; screening and validation of NAMS air quality data; and oversight of the implementation of the SLAMS program by the Regional Offices.

The resources assigned the Regional Offices for their role in the management of the national monitoring program in FY-85 are 45 FTE and \$1,900K. Funding at this level provides for: implementation of the mandated quality assurance program; evaluation and approval of the SLAMS monitors; annual reviews of the States' monitoring plans and 105 Grants; management, validation, and analysis of air quality data.

The Office of Research and Development (ORD) is also involved, as they are responsible for the development and updating of technical guidance on quality assurance, the surveillance of the States' quality assurance programs and the testing of monitoring equipment for equivalency to reference methods. Present resources are 15 FTE and approximately \$1,500K which includes: the development and issuance of quality assurance manuals and guidelines; on-site quality control audits, workshops, and the review of quality assurance plans; national interlaboratory audits and management of the certified reference material program; and the evaluation of commercial instruments for consistency with equivalency regulations. These services are all essential to the continued success of the national monitoring program in providing air quality data of known quality.

Our evaluation of the ambient monitoring program concludes that each of these management, oversight, and service activities must continue if the program is to remain successful. Without the expenditure of these resources, as well as continuing the 105 Grants to the States at levels comparable to present allocations (approximately \$21 million for ambient monitoring), the networks will slowly degrade and again become subject to the same problems that existed in the 1970's.

## 2. Identification of Data Gaps

The current strategy and associated regulations adequately address and satisfy the data requirements for the SLAMS and NAMS criteria pollutant networks. Also the SPM concept is designed to satisfy State and local agency short-term program specific activities.

In support of the Federal Visibility Program, ORD will require approximately \$500K per year starting in FY-86. To enable States to assume responsibility for their own visibility monitoring program, would require about \$500K from Section 105 grant monies beginning in FY-86. These activities are necessary to meet the Clean Air Act and visibility regulations. Since no visibility reference method currently exists, \$200K is needed in FY-86 for ORD method development.

Additionally, in anticipation of the Agencies potential establishment of a visibility standard, or a fine particulate standard, there is a need to obtain fine particulates and visibility data in the Eastern portion of the country. An Eastern visibility and fine particle research network has been designed to operate for the next 5 years. ORD will require \$400K and 2 to 3 man-years per year over the next 5 years starting with FY-8~ to oversee operation of the program, develop quality assurance procedures, analyze the data and issue reports.

## 3. Provide for Expanded Analysis of Data

In the future, the role of ambient air quality data is expected to increase in importance as an input to major air policy decisions. While the 1970's saw steady improvements in ambient trend analyses and in statistical interpretation of the NAAQS, the current trend to incorporate uncertainty into the decision-making process will require the development and use of more sophisticated statistical methods for analyzing air quality information.

FY-85 resources assigned to the development of statistical techniques for the analysis of air quality data are 5.5 FTE for a total of \$425K. This level allows continuing examination of statistical forms of the NAAQS and begins to extend the probability concepts associated with the statistical form of the NAAQS to the SIP process. They provide for: the assessment of national air quality and emission trends; evaluation of possible forms of the ambient air quality standards and the associated necessary regulatory analyses; statistical guidance on sampling frequency, acceptable data completeness, the treatment of missing data, the fitting of statistical distribution to air pollution data, the screening of data for acceptable quality, the preparation of regulatory air quality data bases for reviewing NAAQS; and the development of computer software to analyze air quality data.

Additional resources beyond those currently allocated will be required to extend the use of probability concepts to quantify the uncertainties involved in air quality management decisions. The increased use of probability concepts should be incorporated into control strategy development as is being done for the Expected Exceedences Method for incorporating variable emissions. A probabilistic framework should be developed for attainment/nonattainment decisions so that a certain level of confidence will be associated with these classifications. A parallel effort should also be undertaken to incorporate statistical concepts such as confidence intervals into the estimation of design value taking measurement uncertainty into account. The statistical techniques of time series analysis and multivariate analysis will need to be adapted and applied to solve unique problems involved in comparing and evaluating model performance and in evaluating the impacts of model performance on design values. Statistical indicators and techniques should be developed for determining area-wide trends and broad regional changes for pollutants such as ozone and sulfates. The development and use of these techniques would provide air quality managers with a better basis for making more technically supportable decisions.

#### 4. Provide for Improved Air Data System

The present air data system has become obsolete and does not represent state-of-the-art technology. Moreover, State and local agencies, who provide most of the air data, do not have direct access to the EPA computer. This introduces problems affecting the timeliness and/or validity of the air data and decreases cost-effectiveness of storage-retrieval operations. Additionally, the existing data system does not provide adequately for visibility monitoring data.

The development of a new Aerometric Information Reporting System (AIRS) will consolidate and improve air data support to users, largely eliminate data validity problems and be more cost-effective. The major objective of AIRS is to provide an interactive, user-oriented data management system which will easily facilitate the collection, validation, storage, retrieval, analysis, and summarization of all air data.

FY-85 OAR resources utilized in the operation and maintenance of the existing air data system are \$35K, with a computer timesharing budget of \$940K. Regional Office resources for this program area are approximately \$415K.

Current schedules call for the implementation of the AIRS air quality subsystem by the end of FY 1986. This should provide for substantial resource savings within EPA's Regional Offices. Total computer time-sharing costs will remain approximately the same (adjusted for inflation) with the use of the new system; however, the distribution of the budgeted time-sharing funds will significantly

change as new allocations required by State and local agencies will offset corresponding decreases for OAQPS and the Regional Offices. During FY-84, development of the air quality subsystem continued but progress was constrained by funding limitations. Through reprogrammings from other areas, FY-85 funding for AIRS was increased from \$225K to \$388K. This allowed somewhat accelerated development of the AIRS Air Quality Subsystem. A \$500K increase for FY-86 was included in the Agency's request but was not included in the President's budget. Since the current system will soon be seriously degraded and unable to meet the Agency's data storage and retrieval needs, it is essential that Operating Plans for FY-86 address this critical need. Through planned reprogrammings, a total of \$490K will be allocated to AIRS development in FY-86. Given these resource constraints, current plans call for direct State access to be implemented slowly with initial State tie-ins beginning in the middle of FY87. An initiative to provide an additional \$6500K in FY-87 will be requested to accelerate direct State/local access to AIRS. Even with that funding, however, AIRS will not be completed until early in FY 1987.

#### 5. Resource Summary

Table 5 provides a project summary of the resources required to implement the strategy.

Table 5. Criteria Pollutants Resource Summary (\$000)

	<u>FY-85</u>	<u>FY-86</u>	<u>FY-87</u>	<u>FY-88</u>	<u>FY-89</u>
OAQPS Oversight of NAMS/SLAMS, Development of Regulations/Guidelines	360	385	390	395	400
OAQPS Data Analysis, Statistical Interpretation of NAAQS, Development of Probability Concepts, Statistical Indicators, and Techniques	425	430	435	440	450
Regional Office of NAMS/SLAMS, Quality Assurance Data Validation and Analysis, Grants Management, Special Studies	2800	2800	2900	3000	3100
Office of Research & Development NAMS/SLAMS Develop and Update Quality Assurance Guidance, Reference and Equivalent Methods, Development of Regulation					
Complete Development and Begin Operation of New Aerometric Information Reporting System, Provide Storage and Retrieval of Air Data	390	490	750	750	600
Regional Office Operation and Maintenance of Air Data system	435	455	475	500	525
Procure PM10 Monitoring Equipment	1335a	400b			

Replace Monitoring  
Equipment

600b

1700b

1800b

1500b

1500b

ORD Federal Visibility Program in Class I areas - National oversight, equipment	--	480	500	510	520
ORD - Development of Visibility Reference Method, Develop and Update Quality Assurance Guidance	--	225	230	235	240
ORD - Eastern U.S. Fine Particle and Visibility Program - Method Evaluation Operation of Network, Quality Assurance	--	400	400	400	410
State Visibility Monitoring Program	--	500b	500b	500b	500b

TOTAL

a - funds authorized in FY-84, but procurement and distribution completed in FY 85.

b - To be provided through Section 105 Grants.

## References

1. Air Monitoring Strategy for State Implementation Plans, EPA Publication No. EPA-450/2-77-010. June 1977.
2. Air Monitoring and Data Reporting Regulations, 40 CFR 58, Federal Register, 44, (92):27558 (May 10, 1979).
3. Visibility Protection for Federal Class I Areas, 40 CFR 51.300-307, Federal Register, 45 (233):80084 (December 2, 1980).
4. E. Shelar, Jr. and R. E. Ruff, "Study of the Adequacy of Air Monitoring," for National Commission on Air Quality, SRI Project 1006, September 1980.
5. Air Monitoring and Data Reporting Regulations for Lead, 40 CFR 58, Federal Register, 45 (199):67564 (October 10, 1980).
6. Air Monitoring and Data Reporting Regulations for PM10, 40 CFR 58, Federal Register Proposal 44 (55):10435 (March 20, 1984).