Conceptual Strategy for Ambient Air Monitoring

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1.0 Background/Motivation

The United States spends well over $100 million annually on routine ambient air monitoring programs, which are primarily operated by State and Local agencies. Although the aerometric data from these programs are already used in a variety of ways, the State and Local agencies are subject to continual changes in local, state, federal and academic priorities and information needs. Driving forces which effect change across these networks, include new national ambient air quality standards (NAAQS), observed air quality improvement under existing standards, as well as an increased understanding of what parameters we need to measure (including how little we know about atmospheric chemistry and associated health effects). Historically, ambient monitoring networks were designed to collect information on one particular pollutant; currently, however, agencies are attempting to optimize their networks by measuring multiple pollutants whenever practicable. As new scientific findings emerge and new standards are established, there has been a net investment in the growth of monitoring networks, mirroring an increase in national ambient air standards and scientific knowledge.

The incentives for growth in ambient monitoring activities are clear and compelling. Less clear are the justification and incentives for divesting in existing monitoring programs. Divestments and changes in State and air monitoring programs are complicated exercises because of the following:

- national needs and objectives are at times in conflict with state, local, or regional needs,
- the basic infrastructure for state and local air pollution control operations are substantially intertwined with air monitoring programs,
- shifting national monitoring priorities often requires new expertise or extramural support that can significantly affect personnel at the State or Local agency level,
- only minimal savings are realized from incrementally reducing existing network operations due to core fixed costs, and
- reductions in monitoring efforts are often perceived by the public perceived as reductions in public health protection.

The increased recognition of the importance of a “one-atmosphere” approach toward air quality management partially[1]conflicts with the historical single-pollutant network design approach. In addition, organizational changes strongly impact the monitoring program. For example, since EPA’s Office of Research and Development (ORD) has discontinued routine ambient monitoring technical support, these needs will need to be addressed by other means. Collectively, the current demands and interest placed on the nation’s monitoring networks suggest that network planning be revisited to ensure a systematic approach which allows air pollution control agencies to accommodate change, realize efficiencies, and minimize the degradation of individual programs.

[1] Depending on the objectives of a monitoring site and the pollutants involved, the need to collocate monitors for different pollutants may range from negligible to strong.

The purposes of this document are to outline a national ambient monitoring strategy which:

- is responsive to regulatory and scientific goals and objectives (see **Section 2.0**);
- defines clear and realistic monitoring priorities over a multi-year period (e.g., at least 5-10 years) (see **Section 3.0**);
- provides for adequate resources to support national, state, and local monitoring programs;
- recognizes the need for change, such as reductions in certain monitoring efforts (e.g., SO_2 and PM_{10}) and the phase-in of others (e.g., air toxics);
- establishes principles for decision making for accommodating change including divestments; and
- provides near term recommendations to assist the Office of Air and Radiation (OAR) in FY2001 budget discussions (see **Section 5.0**).

The inclination to perform long term planning is complicated by an array of changing priorities for the national ambient monitoring program. For example, a discreet planning target for 2010, based on a reliable projected network design, would enable an organized planning process to predict the interim steps needed to achieve the desired results. Unfortunately, projected networks are “moving targets” given the uncertainties in future air quality, changing air quality standards, and available resources. Therefore, the establishment of basic decision making and design processes for ambient monitoring networks become requisite objectives. Two factors which dominate the implementation of monitoring programs today are:

- the balancing of national objectives with flexibility for State/Local agency discretionary monitoring, and
- the balancing of needs for long term air quality trends data with the necessity of adjusting to new priorities and technologies.

This document focuses on the regulatory-based monitoring operations conducted by State and Local agencies (with oversight and guidance provided by the EPA), to realize economies in time and planning. Several related monitoring programs (e.g., the Clean Air Status and Trends Network or CASTNet, Great Waters, etc.) outside this EPA-State-Local agency model must also be considered as integral parts of any national strategy.

2.0 Monitoring Program Objectives

Program assessment or review activities must start with an inventory of current program efforts (**Section 3.0**) to establish a frame of reference. This assessment will also serve to articulate the objectives of the program to determine if the (1) the objectives are relevant, and (2) if current efforts are adequate to fulfill these objectives.

2.1 NAAQS Comparisons

The primary objective of criteria pollutant data is for comparisons with the air quality standards to determine if areas are attaining the National Ambient Air Quality Standards (NAAQS). This objective is well understood and is subject to little misunderstanding. Federal reference or equivalent monitoring techniques (40 CFR 50) following established quality assurance procedures (40 CFR 58) are required for any data that are used for regulatory purposes including the designation of an area's attainment status.

2.2 SIP Development

Broadly speaking, those uses of ambient data that support the development of emission mitigation strategies are relevant State Implementation Plan (SIP) development objectives, and include such activities as air quality model evaluation and application, emission inventory evaluation, and source apportionment. All of these activities are closely related and often represent the same activity. Note that the use of ambient data in large scale air quality modeling has evolved largely into emphasizing evaluation approaches (operational and diagnostic) as the time periods and spatial domains have minimized reliance on ambient data for setting initial and boundary conditions. However, other source apportionment modeling techniques, e.g., Chemical Mass Balance (CMB) models, UNMIX, and Positive Matrix Factorization (PMF), are driven explicitly by ambient data. For clarification purposes, air quality modeling in this document refers to the use predictive systems driven by emissions and meteorological inputs, e.g., Urban Airshed Model, version V (UAM-V), MODELS3, the SARMAP Air Quality Model (SAQM), and the Regulatory Modeling System for Aerosols and Deposition (REMSAD). Source apportionment refers to those techniques that utilize ambient data to delineate the contribution of different source types at a receptor. Further complicating these delineations is the fact that air quality models are capable of performing source apportionment. Moreover, the evaluation of emissions typically is performed as part of a more comprehensive air quality model evaluation. General air quality characterizations that help identify the sources of air pollution are obviously relevant to SIP development objectives.

2.3 Air Quality Trends and SIP Tracking (Control Measure Effectiveness)

More general air quality characterizations that extend for long periods (perhaps decades) are critically important data sets for determining air quality progress and, relatedly, the effectiveness of emission control strategies. The EPA annual trends reports[2] provide classic examples of depicting air

[2] U.S. Environmental Protection Agency (1998). ***National Air Quality and Emissions Trends Report***, 1997. EPA 454/R-98-016. Research Triangle Park: Office of Air Quality Planning and Standards (OAQPS). (Note that this report is issued annually.)

quality trends, especially for criteria pollutants. SIP tracking includes the monitoring of precursor species which are better indicators for evaluating the effectiveness of emission control programs rather than relying only on the fact that emission controls were implemented as designed. This air quality objective is an important component of overall "accountability" articulated in the recent NARSTO (North American Research Strategy for Tropospheric Ozone) critical review (reference), and addresses the shortcomings in the SIP process articulated in the National Academy of Sciences (NAS) 1991 report, ***Rethinking the Ozone Problem in Urban and Regional Air Pollution***.

2.4 Determining Maximum Exposure Concentrations

2.5 Public Information and Reporting of Data

Many weather forecasting services and State and Local agencies utilize ambient air quality data as indicators of current air quality and to forecast the next day's air quality. The Environmental Monitoring for Public Access and Community Tracking (EMPACT) program and ozone mapping activities are other examples where air quality data is provided in near real time to communities.

2.6 Technology Testing and Evaluation

Supersites, special studies, etc....

2.7 Permitting and PSD Applications

Someone add some thoughts here...

2.8 Health Effects and Exposure Research

For example, utilizing the $PM_{2.5}$ speciation network as an infrastructure on which other measurements (supported by non-government resources) could be added for effects and exposure research.

2.9 Atmospheric Process Characterization

For example, utilizing the Photochemical Assessment Monitoring Stations (PAMS) and $PM_{2.5}$ speciation network as infrastructure elements from which more intensive data (e.g., NARSTO Northeast) could be collected.....

3.0 Monitoring Priorities

The summary view presented in **Table 3.1** of expected monitoring priorities over the next six years is presented to provide context for subsequent discussions on resource allocations, investments and divestments. Obviously, there are several "Yes" answers in this matrix; a fact which highlights the need for an integrated national monitoring strategy.

Table 3.1 Future Monitoring Program Needs

Program	FY99	FY00	FY01	FY02	FY03	FY04	FY05
Maintain O_3 Monitoring Levels	Yes	Yes	Yes		Yes	Yes	Yes
Maintain PAMS Networks	Yes				Yes	Yes	Yes
Downsize/Maintain PAMS		Yes	Yes	Yes			
Initiate/Maintain $PM_{2.5}$	Yes	Yes	Yes	Yes			
Downsize/Maintain $PM_{2.5}$					Yes	Yes	Yes
Initiate/Maintain Other PM Indicator(s)				Yes	Yes	Yes	Yes
Downsize Other Criteria Pollutant Monitoring Programs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initiate/Maintain Air Toxics Monitoring		Yes	Yes	Yes	Yes	Yes	Yes
Analyze Data and Perform Program Assessments		Yes	Yes	Yes	Yes	Yes	Yes
Maintain and Develop Real (Near) Time Public Distribution Capacity	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**

4.0 Overview of Existing Networks and Budgets

A summary of the current networks by pollutant/program and funding category provided in **Table 4.1** serves as an inventory to assist in assessing the various monitoring program strengths and weaknesses. These data are based largely on the 1999 Information Collection Request (ICR) developed by EPA. Historically, funding for these programs was provided by Clean Air Act §105 Grants to State and Local agencies. For all criteria pollutants except $PM_{2.5}$, these Grants covered an array of activities including (but not limited to) program planning, enforcement, compliance assurance, air quality modeling, emissions inventory development and ambient air monitoring. Consequently, an explicit breakdown of §105 Grants allocated by monitoring category is not available. In addition, a varying percentage of State and Local agency funds are applied to most monitoring programs to "match[3]" the §105 Grants. More recently, explicit grant resources have been allocated to new programs starting with the PAMS program in the early 1990s; continuing with the allocation of fully Federal funded §103[4] Grants for $PM_{2.5}$ starting in 1997; and explicit §105 Grant allocations for toxics monitoring starting in 1999. Several monitoring programs are funded through agency Science and Technology (S&T) or other resource pools and managed entirely by EPA. These programs include, among others, the National Performance Audit Program (NPAP), the Clean Air Status and Trends Network (CASTNet), and the $PM_{2.5}$ Supersites program.

[3] EPA assumes that Federal §105 Grants cover approximately 60% of program costs and the remaining costs are covered by State and Local agency budgets. However, the State/Local contribution often is variable and can be more than 40%, especially on a program-by-program basis.

[4] EPA assumes that §103 Grants cover all costs associated with the $PM_{2.5}$ monitoring program. An unknown amount of State and Local agency specific resources supplement the §103 Grants for special purpose tasks beyond the normal scope of the monitoring program. Note that §103 Grants do not require the minimum 60% Federal-40% State/Local sharing of the costs as in §105.

Table 4.1 Estimated Costs for Ambient Monitoring Programs in FY-1999

Program	Funding and Support (millions of dollars)						Parameter		
	§103 Grants	105 Grants[5]		S&T	EPM	Total	Est. No. Sites & Samplers	No. of Non-attainment Areas	No. of Sites at <60% NAAQS
		Federal	StateMatch						
$PM_{2.5}$ (Mass & Speciation)	33.56	---	---	---	---	33.56	1400[6]		
$PM_{2.5}$ (Regional Haze & IMPROVE)	2.12	1.25	0.0	---	---	3.37	100[2]		
$PM_{2.5}$ (Supersites)	---	---		15	---	15.	2-7		
PAMS	---	12.1	9.4	---	---	21.5	82		
PM_{10}	---	9.38	6.25	---	---	15.6	1274		
Ozone	---	9.66[7]	6.45	---	---	16.1	1044		
SO_2	---	6.18	4.12	---	---	10.3	551		
NO_2	---	3.78	2.52	---	---	6.3	414		
Pb	---	1.49	1.0	---	---	2.49	248		
CO	---	6.08	4.05	---	---	10.1	526		
NPAP - QA	---	---	---	0.75	0.35	1.1			
CASTNet	---	---	---	3.9	---	3.9	40		
Toxics	---	3.0[8]	---	---	---	3.			
EMPACT	---	---	---	2.5	---	2.5			
Total (FY1999)	35.68	52.92	33.79	22.2	0.35	144.9			

[5] The State share of §105 Grants is assumed to be approximately 40% of the total. Note that the Clean Air Act requires that the State and Local Agencies supply 40% of the funding for these programs (State/Local match) at a minimum.

[6] Includes the expected deployment of a full network into 2000.

[7] Based on the 1999 Information Collection Request (ICR) (estimates only; no explicit program tracking of monitoring costs exists).

[8] Based on the current program budget.

5.0 Anticipated Network Modifications And Budget Needs For Fy2001

Near term changes in the monitoring program that EPA feels should be incorporated in FY2001 budget and associated Grant guidance include enhancements or specific attention to the following programs:

- $PM_{2.5}$ Monitoring.
- Nitrogen Species Monitoring
- Air Toxics Monitoring
- Program Assessment and Data Analysis
- EPA Technical Support

Assumptions:

- Program funding remains level with certain exceptions.
- Recent §105 programs with specific allocations (PAMS and air toxics) should be considered as the total resource pool to fund PAMS (including nitrogen species monitoring and air toxics).
- Program assessment and data analysis activities should be funded from divestments in criteria pollutant monitoring and PAMS.
- New programs or initiatives requiring EPA Science and Technology (S&T) or Environmental Program and Management (EPM) funds will not be funded from a reduction in Federal §105 or §103 Grants.

5.1 PM2.5 Monitoring

Recommendation:

Provide resources for two funding initiatives:

- Continue to provide the $42 million FY2000 base §103 Grants through FY2010.
- Continue to provide the $5 million FY2000 Supersites program as S&T funds through FY2004.

Discussion:

- Section 103 Grants - During FY-2001 the $PM_{2.5}$ network will be fully deployed and the operation of the network is expected to cost nearly $42 million annually in §103 funds. This estimate reflects more recent cost information for speciation and federal reference method/equivalent method (FRM/FEM) samplers, speciation analyses, fully deployed IMPROVE (Interagency Monitoring of Protected Visual Environments) operations, additional maintenance needs based on initial network operations, and modifications resulting from discussions with the National Academy of Sciences and Clean Air Scientific Advisory Committee (CASAC), e.g., increased speciation sampling. Most important is the extension of the §103 Grant program through 2010 to provide needed stability to State and Local agencies. This continued funding would ensure that the infrastructure established during the 1998-2000 time frame can address the compliance and control strategy development

needs of the current standard as well as any future modifications resulting from the 2002 review of the particulate matter standards. Accordingly, EPA should consider converting §105 Grants which support PM_{10} monitoring into the §103 program and merge all phases of the particulate matter monitoring program. That action would add approximately $7 million[9] to the $42 million request for a §103 Grant total of $49 million for particulate matter monitoring.

- *Supersites* - In addition, the *Supersites* program[10] requires continuation of the $5 million S&T base funds to insure the integrity of the program into 2004 and beyond. The *Supersites* will have been fully deployed in 2001 and a program assessment will recommend key infrastructure components to be maintained. The *Supersites* are a critically important program integration tool that merges interests from various scientific, regulatory and organizational elements. Although the *Supersites* program is managed cooperatively with the Office of Research and Development (ORD), the Office of Air and Radiation (OAR) must maintain a funding base to ensure program relevancy and responsiveness. Furthermore, the agency has promoted the Supersites program as a key integration element during negotiations with the NAS, CASAC and the General Accounting Office (GAO).

5.2 Nitrogen Monitoring for NO_x Reductions Accountability.

Recommendation:

Upgrade capability of PAMS and CASTNet networks to measure atmospheric nitrogen species to track the effects of implementing the oxides of nitrogen ($NO_{x)}$ emissions reductions program. Funding would be derived from a restructuring each program, assuming level funding.

Discussion:

An initial cost of $2 million is required to upgrade the nitrogen species monitoring capability of the PAMS and CASTNet networks to track the progress of the NO_x reduction programs and meet basic accountability objectives. These activities will allow EPA to ensure that the NO_x reductions are being implemented and working as originally designed; and if not, will provide a data base to support mid-course corrections. The funds will be used to purchase and install and operate NO_y[11] monitors at nearly 90 sites covering a cross section of urbanized and regional/rural locations in the eastern United States. Resources for these initiatives would emerge from internal program adjustments in PAMS and CASTNet, supplying the necessary $1 million in capital costs plus annual operating costs of $250,000 in each network(PAMS and CASTNet). More details on the NO_x monitoring initiative are provided in **Attachment 2**.

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[9] Note: **Attachment 1** indicates that approximately $9 million is spent on PM_{10} monitoring during FY-1999. The $7 million estimate assumes continued reduction in PM_{10} sampling to 2001 and beyond.

[10] The Supersites program is a set of special studies extending beyond the national regulatory networks for particulate matter to identify source-receptor relationships, clarify atmospheric processes, accelerate the testing of new sampling technologies, foster collaborative partnerships, provide data suitable for health assessments, and otherwise support the crafting of SIP strategies by the State and Local air pollution control agencies.

[11] NO_y refers to the total reactive oxides of nitrogen including such compounds as nitric acid, PAN (peroxyacetylnitrate), etc.

Although this initiative addresses the need to enhance our measurement capability to confirm NO_x reductions, monitoring for other nitrogen compounds such as ammonia and nitric acid are strongly encouraged to support $PM_{2.5}$ deposition and ozone mitigation programs.

5.3 Air Toxics

Recommendations:

Combine resources from PAMS ($14.1million in FY2000) and air toxics ($3 million) to optimally address objectives of both the toxics and PAMS programs (including nitrogen species monitoring upgrades). Continue the program assessment of PAMS[12] that is jointly underway by EPA and STAPPA/ALAPCO and add an additional specific objective to combine these two monitoring programs.

Discussion:

The air toxics budget is expected to remain at approximately $3 million (§105 Grants allocated to State and Local agencies) through FY-2001. While these resources may be adequate to initiate certain core data collection activities during 2000, they will not provide support to specific local objectives valued by State/Local agencies. Such activities might include microscale sampling across different communities using "movable" platforms, or focusing on specific compounds of concern. Flexibility that allows State and Local agencies the ability to tailor programs to their needs is an essential element that must be accommodated, recognizing both the value of local knowledge and judgement and the geographic variation in air pollution problems. Assuming level funding across all programs, the PAMS program shares certain logistical facets (high populated urban centers, similar measurement techniques) with toxics monitoring so that both programs could be combined for greater efficiency. This approach implies that a reduction in current PAMS monitoring can be realized to shift resources to targeted toxics objectives. The assessment activities described above will provide direction for programmatic shifts. For example, the PAMS program may focus on a primary objective of tracking trends of VOC (volatile organic compounds) and NO_x reductions with a reduced emphasis on air quality model evaluation. Conceptually, such an approach would emphasize PAMS #2 Sites with a reduction in upwind and downwind ozone precursor monitoring at PAMS #1, #3, and #4 Sites..

[12] A joint EPA/NOAA(National Oceanic and Atmospheric Administration)/State/Local agency workgroup is reviewing the PAMS program to evaluate its ability to meet established data quality objectives (DQOs) and to access the quality of the collected data. A recent STAPPA/ALAPCO Monitoring Committee initiative has allocated resources to broaden this assessment to include the evaluation of strategies to address toxics monitoring objectives by modifying the PAMS requirements. The State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials or STAPPA/ALAPCO is a consortium of State and Local air pollution agency directors.

5.4 Program Assessment and Data Analysis

Recommendation:

Allocate approximately $6 million annually to perform regular assessments of the nation's monitoring programs, based on the results of data analysis and interpretation activities. These activities should be considered a fundamental component of monitoring, not to be compromised in the interest of collecting more data. If necessary, funding for such assessments could come from a reduction in data collection at PAMS and criteria pollutant monitoring sites.

Discussion:

EPA has not performed effective periodic assessments of the monitoring programs that revisit original data quality objectives, determine data error, identify measurement redundancies and gaps, and review capability of sampling methods in light of recent developments. The recent NARSTO Assessment included a critical review paper on monitoring networks (Demerjian, 1998) that strongly criticized EPA for not conducting an adequate assessment of PAMS. Consider the previous discussion on toxics monitoring. An assessment of program needs, strengths and weaknesses is critical to develop an objective basis for decision-making. All monitoring programs need periodic assessments. The particulate matter monitoring program will require that special attention be given to new monitoring techniques and recent health effects and exposure research. Data from these studies may indicate that some of the design principles on which the current program was formed are outdated and consideration should be given to monitoring for a PM coarse fraction (PM_{10} - $PM_{2.5}$). These assessments need to be managed jointly by EPA, State, and Local agencies and will require resources estimated to be approximately $500,000 per year. These funds will provide for State and Local agency staff time plus extramural support for continuing tracking, review and assessment across all program elements. Consideration should be given to developing a joint EPA/STAPPA/ALAPCO/Academic oversight committee that manages these funds and provides direction, focus and leadership to ensure that program assessments become a permanent component of the monitoring program. Questions remain concerning who performs these assessments, how often and who pays for them. As a first assumption, EPA, State and Local agencies should perform these assessments both independently and collaboratively. For example, EPA could focus on the ability of programs to meet national objectives while State and Local agencies concentrate on local objectives. Since objectives and gathered data often overlap, it is prudent for these agencies to collaborate on the program assessments. Resources could come from shifts in current programs, including possible reduction in data collection requirements to free resources for better utilization of the available data. These assessments could be contained in annual data analysis reports submitted by State agencies and should be supported with succinct, unambiguous objectives to ensure success.

Data Analysis and Interpretation. Specific funding for data analysis activities must be earmarked for EPA headquarters, Regional Offices and State and Local agencies. Experience with the PAMS program suggests an inefficient use of the aerometric data, despite attempts to direct §105 funding for data analysis activities. Resources of approximately $5 million per year should be earmarked for

this activity with approximately $4 million distributed to State and Local agencies and $1 million to EPA Headquarters and Regional Offices. The $4 million would be addressed in annual guidance for the §105 Grants and provide for both staff time and extramural support. The extramural support could promote access to University groups fostering partnerships across the regulatory and research communities. Data analysis efforts should provide the basis which for the aforementioned program assessments. These activities should be afforded high priority and visibility within State and EPA organizations. For example, within EPA headquarters this task should be considered as critical as the preparation of the annual ***National Air Quality and Emissions Trends Report*** and perhaps be integrated with this report to provide an annual summary of both the state of ambient air and the underlying ambient monitoring programs. Within State and Local organizations, such assessments should be a fully integrated with air program planning groups and elevated to an appropriate high level priority. Resources for this effort must be coordinated across EPA headquarters, Regional offices and State/Local organizations.

5.5 EPA Technical Support

Recommendation:

Allocate resources to Office of Air and Radiation laboratories [Office of Radiation and Indoor Air (ORIA) and OAQPS] to develop and maintain the technical capability to support the ambient air monitoring programs. This effort will require funding for approximately 7 new FTE's (full-time equivalents or person-years) and $1 million in EPM/S&T funds.

Discussion:

The divestment by EPA's ORD in routine program support has spurred a separate planning effort across OAR, EPA Regional Office Laboratories and ORD to develop the technical capability to support a wide range of emerging and existing ambient monitoring activities. Examples include the development of chemical analysis capability and quality assurance (QA) support for the $PM_{2.5}$ speciation program, National Performance Audit Program (NPAP), monitoring methods testing, and training. A separate strategy focusing on technical support activities that integrates EPA laboratories across ORIA, OAQPS and Regional RS&T laboratories was initiated in late 1998; details of this strategy are provided in **Attachment 3.** Investments needed in EPA technical support for FY-2001are outlined in **Table 5.1**.

Table 5.1 Near-Term Needed Investments

Operating Unit	Needs	Estimated Cost
OAQPS Labs and Field Programs	Equipment	$315,000
ORIA - Montgomery and Las Vegas	7 FTEs plus Equipment	$700,000
Total	---	$1,015,000

5.6 Resource Summary

Table 5.1 incorporates the assumptions discussed throughout Section 5 and is intended to indicate essentially stable funding from FY2000 within the §103 and §105 Grant programs, with internal resource shifts to air toxics, nitrogen species monitoring and program assessment activities. The PM_{10} resource pool is expected provide continued support for particle sampling (which may include other components beyond traditional PM_{10} measurements depending on new developments in policy and science).

Table 5.1 Estimated Costs for Ambient Monitoring Programs in FY-2001

Program	Funding and Support (millions of dollars)						Parameter
	§103 Grants	105 Grants[13]		S&T	EPM	Total	Est. No. Sites & Samplers
		Federal	State Match				
$PM_{2.5}$ (Mass & Speciation)	39	---	---	---	---	39	1400
$PM_{2.5}$ (Regional Haze & IMPROVE)	2.92	1.25	0.0	---	---	4.17	100
$PM_{2.5}$ (Supersites)	---	---	---	5	---	5	7
PAMS (Plus NO_x Reduction Program, Air Toxics, & Assessment Activities)[14]	---	17.1	9.4	---	---	26.5	82
PM_{10} Plus Other Coarse Indicator(s)	---	9.38	6.25	---	---	15.6	600
Ozone	---	9.66[15]	6.45	---	---	16.1	1044
SO_2, NO_2, CO, Pb (Plus Assessment & Analysis)[16]	---	17.53	11.69	---	---	29.22	551
NPAP - QA	---	---	---	0.75	0.35	1.1	
CASTNet	---	---	---	3.9	---	3.9	40
Toxics	---	---	---	---	---	0	
EMPACT	---	---	---	---	2.5	2.5	
Initiatives							
ORIA Labs	---	---	---	---	.7[17]	.7	
OAQPS Labs	---	---	---	---	.315	.315	
NO_x Reduction Programs[18]	---	---	---	---	---	---	
Program Assessment	---	---	---	---	---	0	
Data Analysis	---	---	---	---	---	0	
Total (FY1999)	41.9	54.9	33.8	9.7	3.9	144.1	

[13] The State share of §105 Grants is assumed to be approximately 40% of the total. Note that the Clean Air Act requires that the State and Local Agencies supply 40% of the funding for these programs (State/Local match) at a minimum.

[14] PAMS ($14.1 million) and toxics ($3 million) are pooled.

[15] Based on the 1999 ICR (estimates only; no explicit program tracking of monitoring costs exists).

[16] FY-1999 levels are carried with the assumption that analysis costs are derived from criteria pollutant divestments.

[17] Includes FTEs and capital costs.

[18] Cost for NO_x reduction assessment/analysis derived from PAMS and other criteria program divestments.

6.0 Near Term Divestment Areas

6.1 Criteria Pollutant Programs Other than Ozone and $PM_{2.5}$

Despite significant abatement of atmospheric pollution [which has lead to significant reductions in the number of nonattainment areas for PM_{10}, lead, carbon monoxide (CO), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2)], substantial FY-1999 resources of approximately $45 million (Table 4.1) continue to be poured into those areas. Relatively speaking, the nation is dominated by two criteria pollutants: ozone and $PM_{2.5}$. The combined $PM_{2.5}$ and ozone (including PAMS) budgets are approximately $90 million. Overall, this distribution is inconsistent with the relative number of nonattainment areas and the attendant threat to public health and welfare from these pollutants. Relative to ozone and $PM_{2.5}$, an excess amount of resources is allocated for the other criteria pollutants. Strong technical rationale exists for reducing those criteria networks measuring CO, NO_2 and SO_2:

- The relative exposure to adverse levels is minimal, and the associated cost incurred-to-value received for these measurements from a risk perspective is very high;
- Many of the emission reductions targeted for ozone and $PM_{2.5}$ will have collateral benefits for carbon monoxide, nitrogen dioxide and sulfur dioxide (all of which are precursor gases for either ozone, $PM_{2.5}$ or both); therefore their levels are expected to continue to decline as a result of implemented control strategies;
- The primary objectives for measuring CO, NO_2, and SO_2 should be redirected to defining their roles as precursors for ozone and PM, as well as tracking their levels as part of an overall accountability assessment for the progress of implemented emission control strategies. A core of monitoring sites that capture these pollutants for precursor purposes should be adequate for the continued tracking of trends. One might argue that the trend of pollutant measurements from an area representative of overall air quality is more meaningful, nationally, than the trend of a monitor sited in a “hot-spot” location; and,
- Much of the technology in place that measures these criteria gases is not state-of-the-art and is perhaps not suited to current environmental conditions where lower detectable limits and greater resolution is required. In particular, the networks probably are not capable of characterizing regional levels of CO, NO_2, and SO_2 in the low and sub-ppb (below part-per-billion) concentration range. In addition, it has been well known that the current NO_2 measurements include artifacts associated with related nitrogen compounds. From a compliance perspective, this effect is not problematic as the instruments slightly overestimate NO_2; and yet virtually the entire nation is designated attainment for NO_2.

Despite the apparent divestment opportunities available from criteria pollutant monitoring programs, agencies should not assume that a linear relationship exists between the number of samplers eliminated and any savings in resources. Instead, agencies should exercise caution when estimating the savings due to monitoring divestments. Most existing platforms bundle several gas analyzers together which operate continuously; have time tested operational procedures; and require minimal attention on an instrument by instrument basis. Divestments in PM_{10} sampling, for example, may have little real impact on resource savings. Although not fully captured in Table 4.1 above, there have been significant reductions in PM_{10} sampling in the eastern United States. In the western United States, the need for PM_{10} sampling is

greater given that the particulate mass distribution typically is skewed more toward the coarse fraction, relative to the eastern U.S. aerosols. Consequently, the potential exists for more localized PM_{10} problems in western communities. Moreover, the meteorological conditions found in many mountainous western areas further exacerbate air pollutant concentrations.

6.2 The $PM_{2.5}$ Network

Starting in 2002, consideration should be given to downsizing certain parts of the $PM_{2.5}$ network. At that time, the nation should have an adequate data base for attainment/nonattainment designations; subsequent reviews of the networks to identify areas of redundancy and sites which measure low levels may allow for reductions in the number of monitors. Furthermore, the availability of currently operating $PM_{2.5}$ instruments provides a low cost technology solution (e.g., retrofit inlets and impactors) that positions agencies to measure different size fractions, e.g., PM_1 or coarse PM (PM_{10}- $PM_{2.5}$). Such a need may arise from the promulgation of new standards or specific research needs.

6.3 The Photochemical Assessment Monitoring Stations (PAMS) Program

The PAMS program has been identified as a logical funding source for integrating air toxics monitoring and conducting program assessments. The rationale for this recommendation is based on several factors:

- The technology and expertise required to operate PAMS instrumentation are similar to that required for air toxics measurements (this fact should not be interpreted as meaning that all PAMS locations are optimal for air toxics monitoring);
- The PAMS program has been criticized for not conducting needed program assessments based on data utilization and collecting data not specifically linked to agreed upon objectives and analyses;
- The constraint of level resources for new initiatives (e.g., air toxics) demands an available resource pool for which PAMS is a candidate, because
- Air toxics measurements are needed in highly populated cities; areas where existing State and Local agency staff receive funding for and support PAMS. Other program areas such as PM_{10} are not logical resource candidates because the technical and logistical connections with air toxics are not strong. Also, there is little certainty that the divestment in established criteria pollutant monitoring programs will “free up” resources for use elsewhere.

7.0 Moving Beyond 2001: Long Term Approach and Operating Principles for Ambient Air Monitoring Programs

The previous discussion which focused on activities for FY-2001, alluded to certain long-term changes, but did not provide the vision for a program that fundamentally relies on a long-term measurements to detect trends. While it is possible to develop a prospective picture of monitoring networks, the probability of major unforeseen influences demands that the following basic principles be established to effect change within the monitoring program:

7.1 Programs Must Accommodate Both National and Local Monitoring Objectives by Incorporating and Honoring Prescriptive and Flexible Program Components

Although national and local objectives often are identical (e.g., characterization of regional air quality), geographic, climatic and demographic differences across the country result in significant variations in airshed characteristics and consequently different monitoring approaches. Moreover, State and Local agencies generally have the best insight and capability for determining the objectives and monitoring design necessary for a particular area. However, the strong regional and interregional (e.g., transport) aspects of air pollution clearly demand partnering across local and national organizations. Over the past decade, the tendency has been to assume that regionality is dominant, based on the nation's experience with ozone. The relative importance of local versus national issues is both program and time dependent. However, neither perspective by itself provides the bases for the design of an ambient air monitoring network; programs must embody more than just a "national" perspective. From a planning view, existing and emerging programs must have reasonable objectives that are not unduly weighted toward a national design approach. The vast majority of resources for the PAMS program were in great part dedicated to realizing a "national" design perspective, which often has been revisited to accommodate more realistic "national" objectives balanced with "local" objectives such as the monitoring of air toxics[19]. Emerging programs like the $PM_{2.5}$ speciation program and air toxics must respect both national and local needs. A recent draft toxics monitoring concept plan overemphasized "national" objectives and provided little opportunity for local refinements. The approach is now being revised based on input received from State and Local agencies and from a May 1999 workshop which solicited additional input on EPA's draft strategy. The earliest stages of the $PM_{2.5}$ speciation program included substantial flexibility for State and Local agencies (i.e., planning estimates for 50 trends sites and 250 State/Local sites). However, the expected level of State/Local agency discretion in the speciation program has decreased in light of more refined budget estimates and comments from the research community which have emphasized the "trends" component of the network.

[19] Such an approach was proposed by the California Air Resources Board under the PAMS alternative plan provisions and approved by EPA in 1993.

7.2 Program Assessments Based on Data Analysis and Interpretation Activities Must Become a Fully Integrated Program Component That Demonstrates Data Value (Or Lack Thereof)

The need for program assessments was discussed at length in **Section 5.0**. In very simple terms, a mechanism to evaluate the value and relevancy of a monitoring program must be an integral part of the program itself. Otherwise, the program runs the risk of becoming obsolete with an attendant reduction in value. A subtle but important change is implied when a demonstration of the value of the collected data is a requisite for continued program support. To a certain extent, monitoring programs receive immunity to change, based perhaps on fears that public health will not be protected or a disruption to long terms trends will occur. These valid concerns need to addressed in any program revision. The adoption of a value driven approach must recognize the need for patience as it may take several years to demonstrate value of any particular monitoring program. For example, the true value of PAMS may not be realized for another decade or more as decreases in emissions result in significant changes in ambient ozone precursor concentrations. Without an objective program assessment, we are reduced to a largely subjective process of speculating on program value; this situation should be considered unacceptable.

7.3 Program Changes Must Be Accommodated to Minimize Disruptions on Workforces

Consider the hypothetical scenario where EPA might determine that air toxics are the nation's highest air priority and PM_{10} is no longer an indicator of concern. Associated with this determination might be a resource shift from western U.S. mountain states to urbanized high population centers resulting in a localized reduction of staff and programs. Programs are operated by people; programmatic adjustments must consider the underlying impact on local resources, including staffing implications. Avoiding political and personal concerns would result in a disingenuous discussion on change, where an honest discourse would be impeded by these complicating factors which are as important as the technical issues. While programs should be allowed a reasonable period to be implemented in new areas or be scaled down, hiring decisions should consider the potential for program change and the ability of an agency to adapt.

7.4 A More Dynamic Growth, Maintenance and Scale-down Cycle for Monitoring Programs Should Be Adopted

In the past, programs have tended to be "ramped-up" and maintained with little thought for eventual program termination, or substantial downsizing. When beginning new initiatives, it would be practical to implement a large scale program quickly to address serious information gaps as has been done with the current $PM_{2.5}$ monitoring program. What happens after several years when the $PM_{2.5}$ problem has been defined? Should the data collection effort be as intense as during an period of uncertainty? If not, what planning should be developed to scale down the network? Again, using the $PM_{2.5}$ program as an example, little planning has gone into eventual program scale-down. The reasons for this are (1) the consuming nature of current program deployment and (2) the fact that program scale-down is associated with resource shifts and staff impacts, fairly difficult issues to address prospectively. However, anticipating natural program growth and decay cycles from the onset should facilitate more effective transitions with less disruption rather than ignoring the cyclical nature of ambient monitoring programs.

7.5 Regulatory Monitoring Programs Must Facilitate and Accommodate Scientific and Technological Advances

Monitoring technology is rapidly undergoing modifications brought about by advances in an array of physical and chemical sampling techniques. Continued pressure is placed on the regulatory networks to respond to research oriented objectives. Any view that the "regulatory" monitoring program is not directly relevant to research, inaccurately describes the current (or expected future) relationship between research activities and monitoring. The black and white model where the research community develops new methods, field tests the methods and then "hands" over those methods to the regulatory monitoring community has many shades of gray (especially in light of the PAMS and $PM_{2.5}$ speciation programs which drive the development, incorporate and test new techniques). California and other States have been leaders in sponsoring methods development and field test programs. Typically, regulatory needs are similar to research monitoring needs, though the driving influence may differ. State and Local agencies are demanding continuous particulate matter monitors to better characterize air quality, reduce operational burden, and provide responsive information to the public. Researchers seek continuous data to provide more robust input to a range of models and studies. The regulatory programs should consider reducing imbedded obstacles (e.g., the use of design rather than performance criteria in methods designations, and the reliance on historical and existing methods to maintain consistent air quality trends information) to technological advances. Partnerships such as the California Regional Particulate Air Quality Study (CRPAQS) and PM *Supersites* between research and regulatory groups should continue to be fostered. As a component of "flexibility", State and Local agencies and EPA regulatory offices (OAQPS and Regional laboratories) should be encouraged to include methods testing/evaluation as a program objective, and continue and maintain partnerships with academic institutions.

8.0 Accommodating Scientific and Technological Changes

This section is intended to provide more specific guidance and dialogue on the subject text, and will be expanded, eliminated or merged into other sections in the next draft].

9.0 Building Program Assessment and Analysis into Monitoring Programs

This section is intended to provide more specific guidance and dialogue on the subject text, and will be expanded, eliminated or merged into other sections on the next draft.

10.0 Integrating State/Local Agency Programs with Other Monitoring Programs Sponsored by Federal Agencies and Industry

This section is intended to provide more specific guidance and dialogue on the subject text, and will be expanded, eliminated or merged into other sections on the next draft.

11.0 Steps for Implementing Monitoring Program Adjustments

Network modifications, including enhancements and divestments, will require a systematic review of the existing networks that merges very broad top-down perspectives (captured in this document) with more realistic bottom-up reviews and recommendations from those more closely associated with conducting monitoring operations (State and Local agencies). Networks constantly undergo review by EPA Regional Offices. However, those reviews are focused on assuring that specific regulatory and quality assurance requirements are maintained; a more comprehensive assessment generally is not undertaken . The discussions throughout this document on integrating program assessments and technological advancements address conceptually the need for such approaches, but provide little insight on the steps required for implementation. This section is intended to move away from the brainstorming and conceptualization emphasis throughout the document and provide more specific steps on effecting strategic change in the regulatory monitoring programs. The following are specific recommendations:

- *Planning* - Develop a concept plan (this document) that provides recommendations for FY2001 and longer-term operating principles. The value of this document is found in the discussion it provokes, and the fact that it solicits advice from the monitoring and planning communities of government agencies.
- *Surveys* - Implement a STAPPA/ALAPCO survey for State and Local agencies to solicit input on the future directions for the various monitoring programs. The survey should be completed by August 15, 1999???? so that the concept plan can incorporate its results.
- *Oversight* - Utilize the Standing Air Monitoring Work Group (SAMWG) as a committee to oversee the implementation of monitoring policy. SAMWG has played an important role in facilitating communications across EPA and State and Local agencies, and providing a “sounding board” for emerging EPA initiatives. SAMWG should play a more proactive role in the development of recommendations for monitoring policy (i.e., strategic planning), assume responsibility to ensure that policy is communicated, and assist in the implementation of policy as appropriate.
- *Regulatory Revisions* - Revise existing monitoring regulations to reduce the burden imposed on State and Local agencies by eliminating any outdated requirements for criteria pollutant monitoring.
- *Guidance* - Develop more specific guidance for §105 and §103 Grants that emphasizes the roles of data analysis and program assessments as important products from State and Local agencies.
- *Oversight* - Revisit the oversight roles of EPA Headquarters and Regional Offices in facilitating periodic program assessments which integrate planning and monitoring activities.
- *Coordination* - Continue the PAMS program assessment underway and conduct a joint STAPPA/ALAPCO-EPA workshop to further define the structure of PAMS and air toxics.
- *Ground Rules* - Establish ground rules for allocating resources; options might include:
  - maintain funding levels for all programs and provide new funding for new needs (highly unlikely).
  - maintain current funding for all existing and new monitoring programs (highly likely) by:
    - reducing the level of effort for existing programs to accommodate new programs (assumed approach in the strategy)

  - -- modify EPA Region/State allocations, as necessary, to reflect changing priorities (impossible to avoid...see discussion in **Section 7.3**??).
  - -- retain current allocations (very large constraint to change; politically unpalatable).
- maintaining existing programs; implementing new programs only if outside (private) funding available (unlikely, given inherent governmental needs/functions).
- maintaining separation between EPA programs/initiatives and State Grants, i.e. do not fund EPA investments (e.g., lab capability) through a reduction in §105 Grants

- *Optimization* - Develop guidance on network optimization and divestment approaches.
- *Other items* - Please add your input here!