EPA #

United States Environmental Protection Agency

FINAL DRAFT

The National Ambient Air Monitoring Strategy

Office of Air Quality Planning and Standards
Research Triangle Park, NC
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Table Of Contents

Table Of Contents

Table Of Contents

LIST OF ACRONYMS AND TERMS

AIRMON – Atmospheric IntegratedResearch Monitoring Network

ALAPCO – Association of Local Air Pollution Control Officials

AMTIC – Air Monitoring Technology Information Center

APTI – Air Pollution Training Institute

AQI – Air Quality Index

AQS – Air Quality (data) System

BAM – Beta Attenuation Monitor

CAA – (Federal) Clean Air Act

CAC – Correlating Acceptable Continuous (monitor)

CASAC – Clean Air Science Advisory Committee

CASTNET – Clean Air Status and Trends Network

CBSA – Core Based Statistical Area

CENR – Committee for Environment and Natural Resources

CEU – Continuing Education Unit

CFR – Code of Federal Regulations

CMAQ – Community Model Air Quality (system)

CO – Carbon Monoxide

CRPAQS – Central Valley (California) Regional Particulate Air Quality Study

CSI – Clear Skies Initiative

CV – Coefficient of Variance

CY – Calendar Year

DC – Direct Current

DMC – Data Management Center

DOE – Department of Energy

DQA – Data Quality Assessment

DQI – Data Quality Indicator

DQO – Data Quality Objective

EC – Elemental Carbon

EPA – Environmental Protection Agency

ESAT – Environmental Services Assistance Team

FEM – Federal Equivalent Method

FLM – Federal Land Managers

FRM – Federal Reference Method

FY – Fiscal Year

GAO – General Accounting Office

GC – Gas Chromatograph

GIS – Geographical Information System

HAPS – Hazardous Air Pollutants

HEI – Health Effects Institute

IACET – International Association for Continuing Education and Training

IADN – Interagency Deposition Network

IC – Ion Chromatography

IMPROVE – Interagency Monitoring of Protected Visual Environments

ITEP – Institute of Tribal Environmental Professionals

ITT – Information Transfer Technology

K – thousand

M – million

LIST OF ACRONYMS AND TERMS

MANE-VU – Mid-Atlantic/Northeast Visibility Union

MDN – Mercury Deposition Network

NAAQS – National Ambient Air Quality Standards

NAMS – National Air Monitoring Stations

NAPAP – National Acid Precipitation Assessment Program

NARSTO – North American Research Strategy for Tropospheric Ozone

NAS – National Academy of Science

NASA – National Aeronautics and Space Agency

NATTS – National Air Toxics Trends Sites

NAU – Northern Arizona University

NCore – The National Core Monitoring Network

NMHC – Non-Methane Hydrocarbons

NMSC – National Monitoring Strategy (or Steering) Committee

NO – Nitric Oxide

NO_2 – Nitrogen Dioxide

NOAA – National Oceanic and Atmospheric Administration

NOx – Oxides of Nitrogen

NOy – Reactive Nitrogen Compounds

NPEP – National Performance Evaluation Program

NPS – National Parks Service

NTN – National Trends Network

O_3 – Ozone

OAP – Office of Atmospheric Programs

OAQPS – Office of Air Quality Planning and Standards

OC – Organic Carbon

ORD – Office of Research and Development

ORIA – Office of Radiation and Indoor Air

PAMS – Photochemical Assessment Measurement Stations

Pb – Lead

PBMS – Performance Based Measurement System

PE – Performance Evaluation

PEP – Performance Evaluation Program

PM – Particulate Matter

PM_{10} – Particulate Matter with aerodynamic diameter less than 10 micrometers

$PM_{2.5}$ – Particulate Matter with aerodynamic diameter less than 2.5 micrometers

PM_c or PM_{coarse} – PM_{10} minus $PM_{2.5}$

ppb – parts per billion

QA – Quality Assurance

QAPP – Quality Assurance Program Plan

QC – Quality Control

QMP – Quality Management Plan

RADM – Regional Acid Deposition Model

REM – Regional Equivalent Monitor

RO – EPA Regional Office

ROM – Regional Oxidant Model

RPO – Regional Planning Organization

RTP – Research Triangle Park (North Carolina)

S & T – Science and Technology

SAMWG – Standing Air Monitoring Working Group

LIST OF ACRONYMS AND TERMS

SIP – State Implementation Plan

SLAMS – State and Local Air Monitoring Stations

SLTs – State and Local Agencies and Tribes

SO_2 – Sulfur Dioxide

SOP – Standard Operating Procedure

SPM – Special Purpose Monitor

SRP – Standard Reference Photometer

SS – Supersite

STAG – State and Tribal Air Grant

STAPPA – State and Territorial Air Pollution Program Administrators

Strategy – The National Air Monitoring Strategy

SVOC – Semi-Volatile Organic Compound

TAMS – Tribal Air Monitoring Support (Center)

TAR – Tribal Authority Rule

TBD – To Be Determined

TEOM – Tapered Element Oscillation Monitor

TNMOC – Total Non-Methane Organic Compound

TSA – Technical Systems Audits

TSP – Total Suspended Particulates

USB – Universal Serial Bus

VOC – Volatile Organic Compound

XML – Extensible Markup Language

Preface

This document is the final report for the National Ambient Air Monitoring Strategy (Strategy), and replaces the draft version, dated September 2002. (That version, available at http://www.epa.gov/ttn/amtic included a summary document and a more comprehensive document.) This final report is written largely as an extended summary, intended to address comments received from the Clean Air Scientific Advisory Committee (CASAC) review (December, 2003), and from state and local agencies, tribes, and the public. It is further intended to outline an implementation strategy for network change.

Although this document contains 12 sections, it can be considered as three different parts. The first part (Sections 1-3) contains background material and specifies the objectives for the Strategy. The second part (Sections 4-9) contains each of the six components of the Strategy: NCore, network assessments, needed technology, quality assurance, regulation changes, and communications and outreach. The third part (Sections 10-12) contains important follow-on considerations, including tribal participation, the all-important implementation plan, and some still-outstanding issues.

It is intended that this Final Strategy Document will serve as the guide for implementing the Strategy, beginning in 2004, and continuing over the next several years. It is envisioned that supplements to this document may be developed over time as conditions evolve through the implementation process.

Section 1. Background and Objectives

1.1 Rationale for a Strategy.

Ambient monitoring systems are a critical part of the Nation's air program infrastructure. Data from these systems are used to characterize "air quality" and associated health and ecosystem impacts, develop emission strategies to reduce adverse impacts, and account for progress over time. The United States spends well over $200 million annually on routine ambient air monitoring programs, a figure dwarfed by the billions associated with emission reduction strategies. Ambient data provide a basis for accounting of air program progress thereby determining the value of those investments. Obviously, the investment in and role played by our networks demand periodic strategic planning.

Dramatic and mostly positive changes in air quality have been observed over the last two decades, despite increasing population, vehicle usage, and productivity. Most criteria pollutant measurements read well below national standards (Figure 1-1). While the more obvious

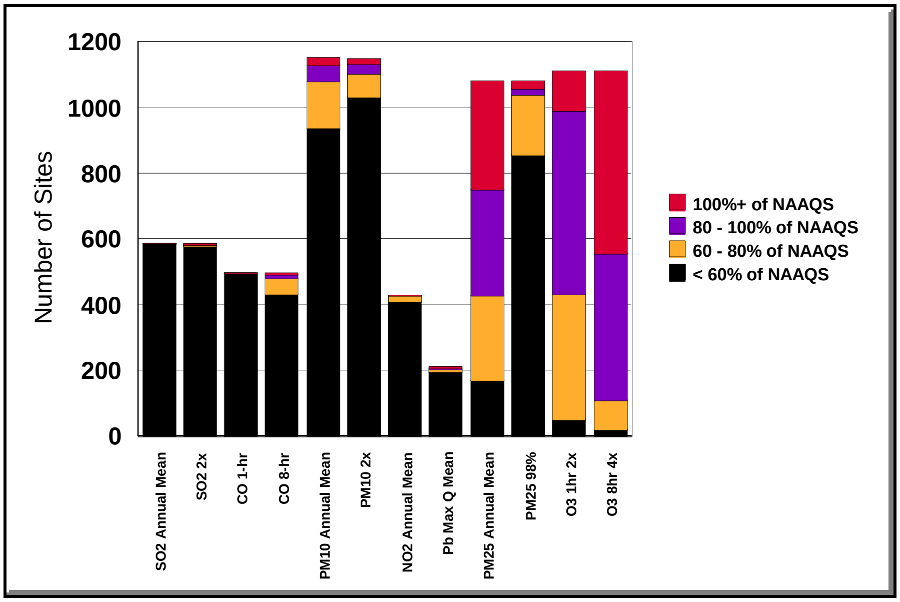

Figure 1-1. Number of monitors measuring values relative to the National Ambient Air Quality Standards based on AIRS data through 1999. Great progress has been made in reducing ambient concentrations of most criteria measurements. Ozone and $PM_{2.5}$ dominate the nonattainment picture on a national scale.

problems of widespread elevated lead and gaseous criteria pollutant problems largely have been solved, current and future problems in particulate matter, ozone, and air toxics challenge air programs. These challenges reside in very complex air pollution behavior (e.g., nonlinear relationships between emission sources and atmospheric concentrations) with increasing knowledge that very low, and difficult to measure, air pollution levels are associated with adverse environmental and human welfare effects. New directions in air monitoring are needed to reflect the successful progress in reducing air pollution and incorporate new scientific findings and technologies.

Ambient air measurements produced by State and Local agencies and Tribes (SLTs) are high quality, credible environmental data that service a broad spectrum of clients. The challenge is to maintain and improve upon a valued product. Monitoring programs are subject to continual changes in SLT, Federal and research priorities. New and revised national ambient air quality standards (NAAQS), changing air quality (e.g., significantly reduced concentrations of criteria pollutants) and an influx of scientific findings and technological advancements challenge the response capability of the Nation's networks. The single-pollutant measurement approach, commonly administered in networks, is not an optimal design for integrated air quality management approaches that can be optimized by accounting for numerous programmatic and technical linkages across ozone, fine particulate matter, regional haze, air toxics, and related multi-media interactions (e.g., atmospheric deposition). Indeed, the current design of the Nation's networks is based largely on the existing monitoring regulations (Code of Federal Regulations [CFR], Parts 53 and 58) that were developed in the late 1970's. Complicating a desire to implement change is the need to retain stability in ambient air networks for the detection of long term air pollution trends.

1.2 Goal and Objectives

Given this backdrop, ***the overarching goal of this air monitoring strategy is to improve the scientific and technical competency of the nation's air monitoring networks while increasing our ability to protect public and environmental welfare; and to accomplish this in flexible ways that accommodate future needs in an optimized resource constrained environment***. The following monitoring **strategy**[1] objectives provide the framework for achieving this broad based goal:

- To manage the Nation's air monitoring networks in a dynamic manner that addresses the most pressing public health issues, optimizes efficiency, and accommodates future needs, and continually challenges the value of networks.

- To establish a new air monitoring approach, coupling a minimum level of required national monitoring with flexible SLT air monitoring networks in order to efficiently and effectively meet both national and SLT needs.

- To provide a greater degree of timely (e.g., real-time) public air quality information, including the mapping of air pollution data and air quality forecasts.

[1] More specific monitoring data objectives are described under NCore, Section 4.

- To improve network efficiencies and cross network consistency through:

    - periodic network assessments
    - re-evaluation and modification of monitoring regulations
    - revision of quality assurance procedures
    - aggressive coordination across network operations

- To foster the utilization of new measurement method technologies.

- To encourage multi-pollutant measurements, where appropriate, for better air quality management and scientific/health-based data sets.

- To provide a base air monitoring structure which, in conjunction with special studies (not part of this Strategy), could be used to support certain regulatory needs, e.g., State Implementation Plan (SIP) development, source apportionment, operational model evaluation, and tracking progress of emissions reduction strategies.

- To develop and implement a major public information and outreach program as an important cornerstone toward network changes.

- To seek input from the scientific community as to the merit/value of proposed changes.

- To provide air monitoring platforms and data bases which can be used for other environmental purposes, such as area-based ecosystem assessments, global issues, diagnostic research, and biological sensing.

- To assess, periodically, funding levels needed to maintain support for this monitoring strategy, and incorporate recommendations into the budget planning process.

1.3 Scope of Participants and Key Operating Principles

A National Monitoring Steering Committee (NMSC), with representatives from EPA (Environmental Protection Agency) OAQPS (Office of Air Quality Planning and Standards), EPA ORD (Office of Research and Development), EPA Regional Offices (ROs), and SLTs, was developed to provide oversight and guidance. This NMSC structure reflects both the partnership across EPA and its major grantees as well as an intent to limit participation initially to focus on a manageable subset of clients and increase probability for progress. Clearly, the scope of this effort must expand to other entities as numerous leveraging and common interest opportunities exist with industry, other Federal agencies, and the international community. This expansion has started through discussions with NARSTO, the Committee for Environment and Natural Resources (CENR), PM Health and Supersite Principal Investigators, and initiation of Scientific

Advisory Board review. This current effort should be perceived as the foundation for the strategy.

The following operating principles reflect this important partnership across EPA and its grantee organizations as well as embracing the goal and objectives of the strategy:

- **Partnership**. Consensus building is used to corroborate strategic planning elements among EPA and SLTs.

- **Flexibility by Balancing National and Local Needs**. Network design, divestment and investment decisions must achieve a balance between prescription (consistency) and flexibility to accommodate national and local monitoring objectives. Although localized issues are "national" issues, and nationally consistent data bases serve local (SLT agency) interests, allowances must be made for differing needs arising from both perspectives.

- **Effective Interfacing with "Science."** An emphasis should be placed on more active engagement with the scientific community, recognizing the important role science plays in network design and technology and the role of networks in assisting scientific research. The perspective that a clear demarcation exists between science-oriented and Agency- based monitoring is counterproductive to the larger goal of improving air monitoring.

- **Zero Sum Resource Assumptions**. This Strategy is not a vehicle to add significant resources for air measurements. Relatively stable but flat spending is projected for air monitoring activities. This level resource assumption requires a reduction in current efforts to accommodate new monitoring needs. The Strategy includes very modest resource proposals (i.e., an insignificant fraction of current monitoring resources) required to catalyze certain technology elements of the Strategy. Furthermore, the Strategy intends to retain the basic infrastructure and operational stability of existing agencies. Reallocation implies shifts to different pollutant measurements and technologies, and not significant resource shifts across geographical regimes.

- **Data Analysis and Interpretation**. Too often, large data collection programs sacrifice data analysis tasks due to a lack of protected or dedicated analysis resources, available guidance and expertise, or declining project interest (which often peaks at program start up). The Photochemical Assessment Measurement Stations PAMS program suffered from these effects, which were compounded by a lack of patience associated with a desire for short term results from a program designed to address long term trends. A good example has been established by the emerging air toxics program which has set aside significant resources for analysis of historical and new pilot city data prior to large scale network deployment. Networks will operate more efficiently when periodic active analyses are performed that identify strengths and weaknesses and provide more dynamic direction for modifications.

1.4 Recommendations

In proposing this Strategy, the NMSC is recommending several key changes to the way air monitoring is conducted. These changes will allow for more efficient collection and universal use of air quality data, and greater flexibility in air monitoring to meet the challenges of the 21st Century in ways that meet both national and local monitoring needs. The key recommendations are:

- The networks need to produce more insightful data by:

  - including a greater level of multi-pollutant monitoring sites in representative urban and rural areas across the Nation
  - expanding use of advanced continuously operating instruments and new information transfer technologies
  - integrating emerging hazardous air pollutant (HAPs) measurements into mainstream monitoring networks
  - supporting advanced research level stations

- A new national monitoring network design (called NCore) should accommodate these recommendations and the major demands of air monitoring networks, such as:

  - trend determinations
  - reporting to the public
  - assessing the effectiveness of emission reduction strategies
  - providing data for health assessments and NAAQS review
  - determinations of attainment and nonattainment status.

- ***Flexibility*** must be maintained and even increased for SLT's to address local and area-specific issues including, for example, environmental justice concerns, episodic PM and ozone events, and "local" or hot spot air toxics concerns.

- Periodic ***assessments*** of air monitoring networks must be performed to determine if the existing network structure is optimally meeting national and local objectives. The current national review of the networks indicate that many criteria pollutant measurements (e.g., nitrogen and sulfur dioxides, carbon monoxide, PM_{10}) are providing only limited value which present opportunities to realign air monitoring resources in more relevant areas. Such assessments and network decisions are best addressed through regional level evaluations.

- The network modifications, including NCore, should be conducted within current resource allocations used to support monitoring (e.g., with respect to staffing). However, there needs to be modest investments in new equipment to upgrade monitoring systems to meet new priorities and accommodate advanced technologies.

- Recommendations for network changes should engage the public. A strong public communications program is advocated, both at the national and local levels.

- Existing monitoring regulations require modification and promulgation by EPA to accommodate recommended network changes.

This document describes these recommendations in more detail and provides a framework to implement them.

Section 2 - Major Components of the Strategy

This section defines the key components of the Strategy, and explains the Strategy document structure which is organized on a component basis, but briefly summarized here.

2.1 The NCore Monitoring Network [Section 4]

The new national network, NCore, basically is an extension of the current air monitoring networks, but with an opportunity to address new directions in air monitoring, and to begin filling measurement and technological gaps that have accumulated over the years. Emphasis is placed on a backbone of multi-pollutant sites, continuous monitoring methods, and important pollutants over and above the criteria pollutants, for example, ammonia, and reactive nitrogen compounds (NOy). When completed, NCore will meet a number of important needs: improved data flow and timely reporting to the public; NAAQS compliance determinations; supporting development of emissions strategies; assuring accountability for control programs; and supporting scientific and health-based studies.

Structurally, in place of the current National Air Monitoring Station (NAMS)/State and Local Air Monitoring Station (SLAMS) programs, NCore will establish three levels of monitoring sites:

- **Level 1 –** a more research-oriented platform accommodating the greatest level of instrumentation with specific targeted objectives, reasonably analogous to the current PM Supersite program;

- **Level 2 –** the backbone network of approximately 75 nationwide multi-pollutant sites, encompassing both urban (about 55 sites) and rural (about 20 sites) locations;

- **Level 3 –** additional sites, reasonably analogous to today's SLAMS sites, focusing primarily on those pollutants of greatest concern.

It is estimated that over 1,000 Level 3 sites will be part of NCore. While each of the three levels have specific objectives, it should be recognized that there is more or less a continuum among these. Level 2 sites, for example, may meet the minimum level of multi-pollutant measurements, but may also be augmented as necessary with other measurements so that the most heavily equipped sites are approaching Level 1 in scope. Similarly, Level 3 sites may be single pollutant sites, but as necessary, may be augmented by other monitors so that it approaches Level 2 site criteria. It is envisioned that a number of Level 3 sites may be close to requirements for a minimum Level 2 site. These variations will be dictated by the needs of the particular area or agency responsible for air monitoring programs.

In moving toward the NCore design, it is expected that leveraging of existing networks can be accomplished where most feasible. With regard more specifically to the Level 2 sites, it is appropriate, for example, to include air toxic trend site monitoring; $PM_{2.5}$ speciation monitoring; and PAMS monitoring where such linkages make the most sense and meet the objectives of each program. By combining these monitoring programs at a single location, we maximize the information about the multi-pollutant nature of the air to which the public is exposed. This greatly enhances the foundation for future health studies and NAAQS revisions. This leveraging of monitoring resources could also be effective at Level 3 sites, if such leveraging is not appropriate at a Level 2 site.

2.2 Network Assessments [Section 5]

As part of the Strategy, a holistic review of our air monitoring networks is warranted. State and local agencies typically conduct an annual network review, and recommend changes to their networks. As a result, the networks are ever-changing to meet more current needs. However, there has not been a concerted effort to take a critical look at our monitoring sites and determine if there are redundancies and inefficiencies in current designs. Furthermore, our networks have traditionally been laid out in overlapping fashion, i.e., an ozone network, a carbon monoxide network, and a PM_{10} and $PM_{2.5}$ network, etc.

In 2000, EPA commissioned a national assessment of our monitoring networks, with considerations for population, pollutant concentrations, pollutant deviations from the NAAQS, pollutant estimation uncertainty, and the area represented by each site. Based on this national assessment, it was determined that substantial reductions in monitors could be made for pollutants which are no longer violating national air standards on a widespread basis, namely lead, sulfur dioxide, nitrogen dioxide, and PM_{10}, with the caveat that the measurement of some pollutants, such as sulfur dioxide, may be useful as source tracers even though ambient levels may be low. Even for those pollutants of greatest national concern, ozone and $PM_{2.5}$, sufficient redundancy was found to suggest reductions of 5 to 20% of our monitors without seriously compromising the information from our monitors.

With this as a backdrop, each of the 10 EPA Regional Offices was charged with conducting regional assessments of the air monitoring networks. This process began in early 2001 and is expected to be completed in 2004. However, the procedures by which regional assessments were conducted were not standardized. It is recognized that differences in air quality, population, monitoring density, among others, necessitate varying approaches in evaluating networks. However, without some generalized guidelines, the potential for regional inconsistencies exists. A Subcommittee of CASAC (Clean Air Science Advisory Committee) met in July 2003 and recommended that regional assessment guidelines be developed, and in response, definitive guidelines will be in place for subsequent regional assessments, targeted to be done every five years.

The network assessment process, too, is a collaborative effort between EPA and the SLTs. While some factors for network changes may be developed from statistical evaluations, there are also local considerations, e.g., political, which have bearing on local decisions to change monitors. Ultimately, the combined efforts among national, regional, and local perspectives and needs will result in an optimized realignment of air monitoring networks which will be more efficient, yet more responsive to the many objectives of the Strategy.

2.3 Technology [Section 6]

The explosion of computer and communications technologies over the past 15 years can be extended to air quality monitoring as well. The potential for improving monitoring methods; monitoring support capabilities such as computer controlled instrument calibrations and quality assurance functions; and information transfer (i.e., getting data quickly to the public) is greater now that at any time in the past. Yet, some components of our monitoring networks are still functioning under more manual and time consuming regimes.

EPA, working with its State and local partners, has established a Technology Working Group to examine the prospects for incorporating new technologies and making recommendations as to the best ways to embrace these. The focus is in three key areas:

- moving toward continuous PM monitors in place of the more cumbersome, labor intensive filter-based methods
- encouraging the utilization of new technologies to measure a more robust suite of pollutants, such as reactive nitrogen compounds (NOy)
- fostering the utilization of advanced information transfer technologies (e.g., replacing antiquated phone communication telemetry systems with internet-based, radio and satellite communications media).

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There are several recognized impediments in moving forward in these areas:

- regulations which support the “old” way of doing things need to be revised to reflect the current technological environment;
- special funding needs to be identified to invest in the equipment capital costs to replace older monitors and data transfer systems
- investments in staff training are needed to assure Agency staff will be able to operate and maintain the new equipment. In addressing these impediments, regulation changes are in progress as part of this Strategy, and funding/training issues will be addressed as part of the implementation plan, of which a framework is presented in Section 11 of this document.

2.4 Quality Assurance (QA) [Section 7]

Quality assurance is a major component of the air monitoring programs and it is intended to assure that only high quality data are produced, and therefore the investments in air monitoring produce the most beneficial results. As the air monitoring networks are reevaluated under the Strategy, so too, the quality assurance programs need to be reassessed. To accomplish this task, a Quality Assurance Work Group was established between EPA and State and local agencies. The objective was to develop a quality system, its elements and activities, for an ambient air monitoring program. A quality system can be defined as a structured and documented system describing the policies, objectives, principles, organizational authority, responsibilities, and implementation plan of an organization for assuring quality in its work, processes, products, and services. This provides a framework for work performed by an organization and carrying out its required quality assurance and quality control. This process is essential to assure confidence in the data collected.

The Work Group developed several key recommendations:

- move toward a performance-based measurement process with specified data quality objectives;
- minimize start-up problems with a phased implementation approach;
- provide a reasonable estimate of the costs associated with QA programs;
- develop certification and/or accreditation programs;
- develop generic quality assurance program plans (QAPPs);
- accelerate data review and certification programs for quicker data access into the national air quality data system (AQS);
- eliminate redundancies in performance evaluation programs;
- develop appropriate data quality assessment tools (e.g., software); and
- streamline regulations, and more specifically identify those actions which should be mandated through regulation and which should be recommended through guidance.

It is expected that both regulation changes and necessary guidance will be developed as separate actions to accommodate the implementation of the Strategy.

Additional actions which will be necessary include:

- the development of standard operating procedures (SOPs) to accompany the employment of new instrumentation; and

- appropriate requirements for the infrastructure necessary to accommodate NCore sites (e.g., so that sufficient space, power, access, etc, are included in site designs.)

These elements will need to be developed as part of the implementation plan.

2.5 Monitoring Regulations [Section 8]

Monitoring regulation revisions are needed to remove potential obstacles in implementing the Strategy and to foster technically creative instrument approaches and measurement systems. The monitoring regulations remain the most authoritative guide for air agencies and will ultimately serve as the principal communications tool to convey products of the Strategy, ultimately establishing NCore as the umbrella for federally mandated air monitoring. The specific topics targeted for regulation changes are:

- insertion of NCore as the replacement for the traditional NAMS/SLAMS monitoring components (40 CFR Part 58)

- establishment of new minimum requirements in criteria pollutant monitoring to enable action on results from the network assessments and the continuous PM monitoring implementation plan (40 CFR Part 58)

- introduction of new provisions for $PM_{2.5}$ monitoring, including regional equivalency (40 CFR Parts 53 and 58), and broader correlating acceptable continuous (CAC) monitoring applications (40 CFR Part 58)

- revised PAMS monitoring requirements emphasizing accountability as a primary objective and a reduction in non-type-2 sites (40 CFR Part 58)

- restructuring of quality assurance (40 CFR Part 58)

- revised national equivalency specification for $PM_{2.5}$ and expected PM_{coarse} that will be based on updated data quality objectives and structured to accommodate continuous technologies (40 CFR Part 53)

The specifics of these changes cannot be included in this document, as the regulatory process will govern these details. It is expected that a notice of proposed regulation amendments will be issued by EPA in 2004, with final changes to become effective in 2005.

These five components constitute the major implementation and action steps that in turn effect network change as conceived in Figure 2-1.

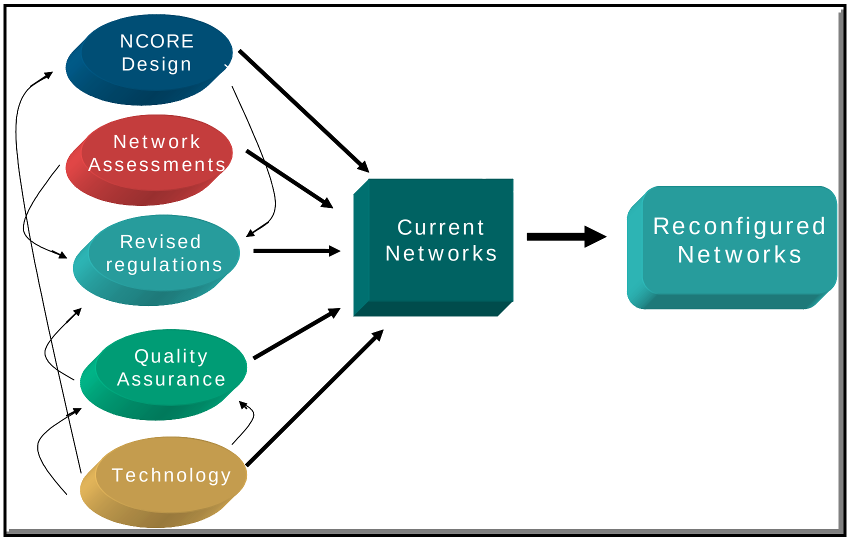

Figure 2-1 . Information flow across monitoring strategy components.

In addition to these major components which impact overall network design, the Strategy document includes the following sections which support implementation.

2.6. Communications and Outreach [Section 9]

The success of implementing a new approach in air monitoring requires a comprehensive public outreach and communications process. Without proper public interaction and dialog, there could be public misconceptions about the overall benefits of the Strategy. One of the key elements for public outreach is a publicly-oriented brochure. Working with State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) and a public relations contractor, EPA has put together a tri-panel brochure which can either be distributed (in limited quantities) to SLTs, or can be provided electronically to agencies so that each agency can imprint local contact information for the public. It is expected, too, that the SLTs will engage the public as appropriate, for example, through public meetings, workshops, use of websites, etc, so as to keep the public apprised of network changes and to solicit public input as well.

There are other communications products which are primarily intended for the SLT staff. These include a fact sheet explaining the technical need for a revised air monitoring strategy; and a quarterly newsletter to provide updates on the status of the Strategy as it moves from the development to the implementation phases. These two products are available on EPA's AMTIC website, www.epa.gov/ttn/amtic .

Section 3 - Overview of the Existing Air Monitoring Networks

This overview section is provided as context and reference which will facilitate understanding of the recommended network modifications discussed through the remainder of this report. The major routinely operating ambient air monitoring networks in the United States include a collection of programs primarily operated by the SLT's:

3.1 State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS)

SLAMS and NAMS represent the majority of all criteria pollutant (SO_2, NO_2, CO, O_3, Pb, $PM_{2.5}$, PM_{10}) monitoring across the nation with over 5,000 monitors at approximately 3,000 sites. These stations use Federal reference or equivalent methods (FRM/FEM) for direct comparison to the NAAQS. Design and measurement requirements for these networks are codified in 40 CFR Part 58 (design and quality assurance), Part 53 (equivalent methods), and Part 50 (reference methods). NAMS are a subset of SLAMS that are designated as national trends sites. The NAMS and SLAMS were developed in the 1970's with a major addition of $PM_{2.5}$ monitors starting in 1999 associated with promulgation of the 1997 PM NAAQS. These networks experienced accelerated growth throughout the 1970's with most components exhibiting declines in the number of sites with the exception of ozone and $PM_{2.5}$ (Figure 3-1 and also Table 3-1). Rethinking the design of SLAMS/NAMS is a central topic of this strategy.

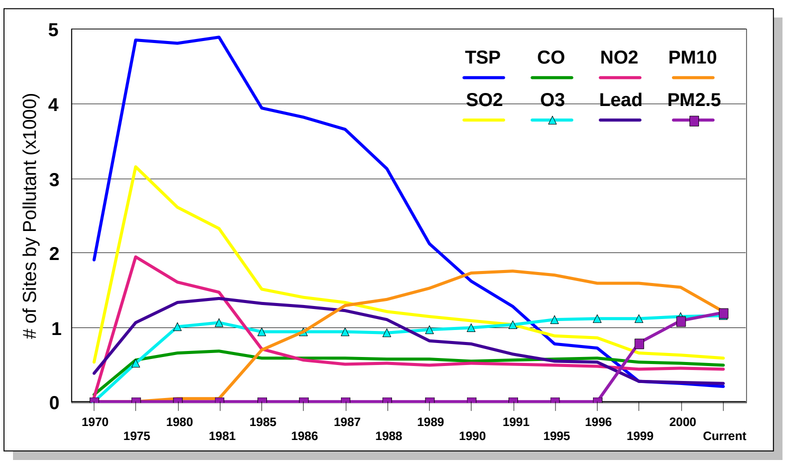

Figure 3-1. Growth and decline of criteria pollutant networks.

3.1.1 $PM_{2.5}$ Networks

The $PM_{2.5}$ networks include three major components (Figure 3-2):

- **mass only measurements** through nearly 1,100 FRM filter based mass sites [Figure 3-3] that measure 24-hour averaged concentrations through gravimetry, and approximately 200 continuously operating mass sites using a range of technologies;

- **chemical speciation measurements** that consists of approximately 54 trend, 175 State Implementation Plan (SIP), and 150 IMPROVE sites (Figure 3-4), respectively. The vast majority of these sites collect aerosol samples over 24 hours every third day on filters that are analyzed for trace elements, major ions (sulfates, nitrates, and ammonium) and organic and elemental carbon fractions. Most of the IMPROVE sites are operated by personnel from the Federal Land Management (FLM) and Forest and National Park Services. Over the last five years, these networks have been subject to reviews by the National Academy of Sciences (NAS), EPA's CASAC, the General Accounting Office (GAO), and the Inspector General's Office. The CASAC review by the particle monitoring subcommittee has been engaged with EPA since 1999. Many of the recommendations related to the introduction of new methodology, particularly increased continuous particle monitoring and the corresponding need to redirect resources from FRM filter methods to continuous and speciation sampling have been addressed in detail through the CASAC Subcommittee on Particulate Matter Monitoring; and

- **eight supersites** executed as cooperative agreements with universities and EPA that operate over various periods spanning 1999 to 2005 and conduct a wealth of standard and research grade measurements. Supersites are designed to address the extremely complicated sampling issues associated with fine aerosols and constitute an ambitious technology transfer and liaison effort across research level and routine network operations.

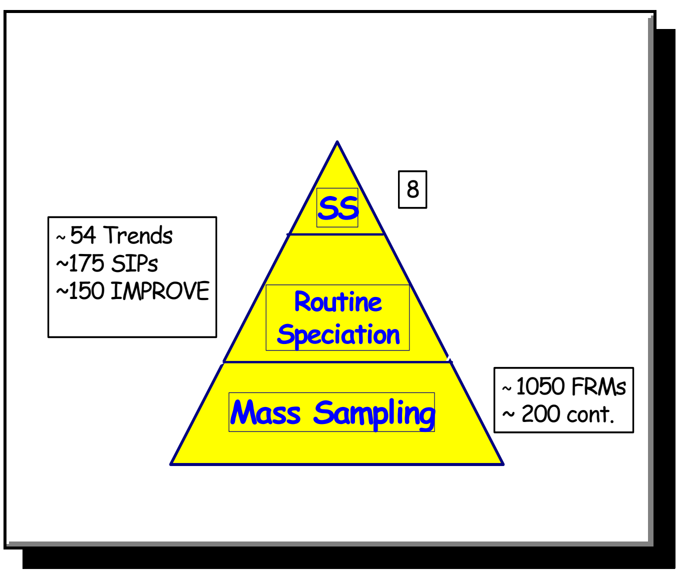

Figure 3-2. $PM_{2.5}$ Monitoring Network Elements.

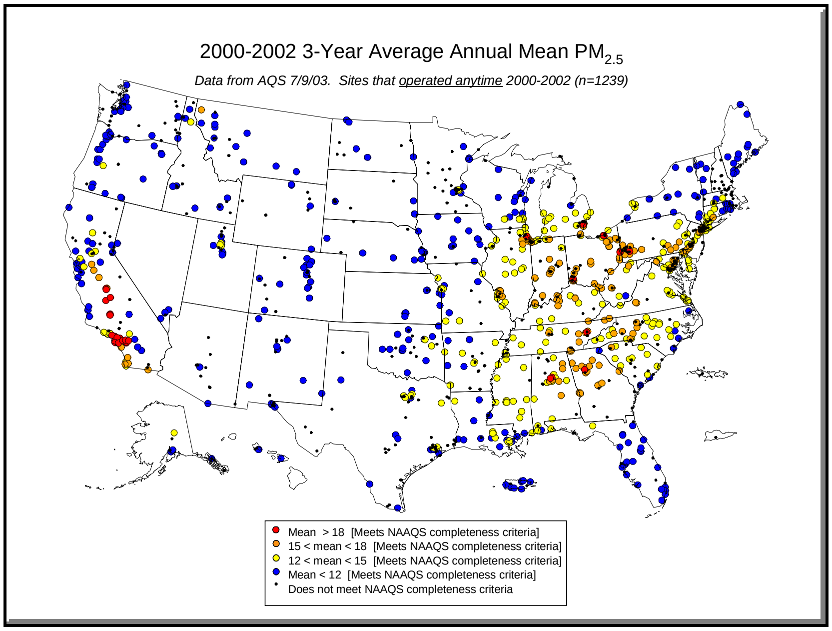

Figure 3-3. $PM_{2.5}$ FRM monitoring sites.

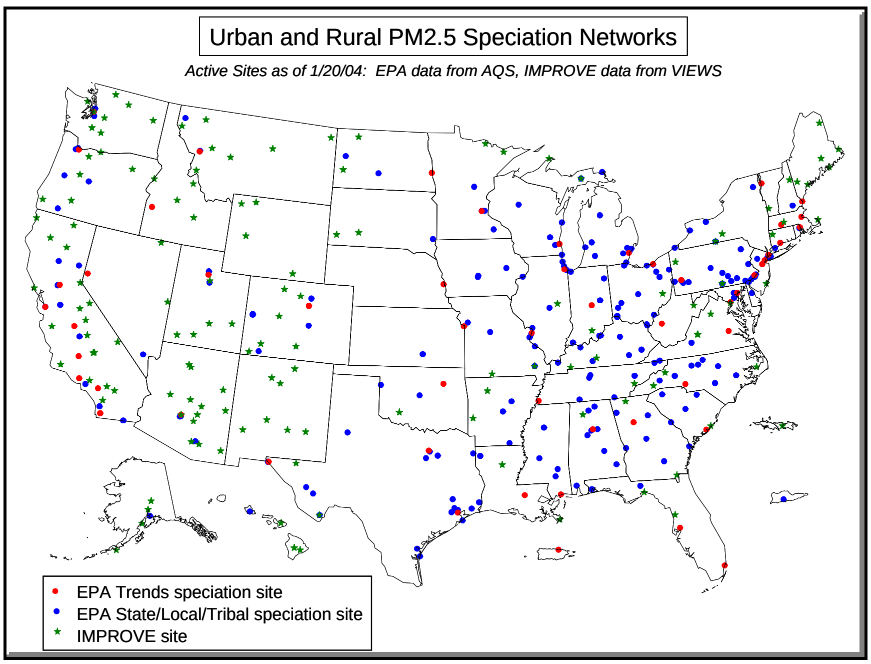

Figure 3-4. $PM_{2.5}$ Chemical Speciation Sites.

3.2 Clean Air Status and Trends Network (CASTNET)

CASTNET originally was designed to account for progress of strategies targeting major electrical generating utilities throughout the Midwest which release acid rain precursor emissions, sulfur, and nitrogen oxides. Network operations are contracted out to private firms funded through Science and Technology (S&T) funds and managed by EPA's Office of Air and Radiation. CASTNET consists of approximately 70 sites located predominantly throughout the East with greatest site densities in States along the Ohio River Valley and central Appalachian Mountains (Figure 3-5). Aggregate two week samples are collected by filter packs and analyzed for major sulfur and nitrogen oxide transformation compounds (e.g., end products such as sulfate and nitrate ions). CASTNET was deployed in the 1980's as part of EPA's National Acid Precipitation Assessment Program (NAPAP). A network assessment in the mid-1990's lead to a more optimized and less extensive network.

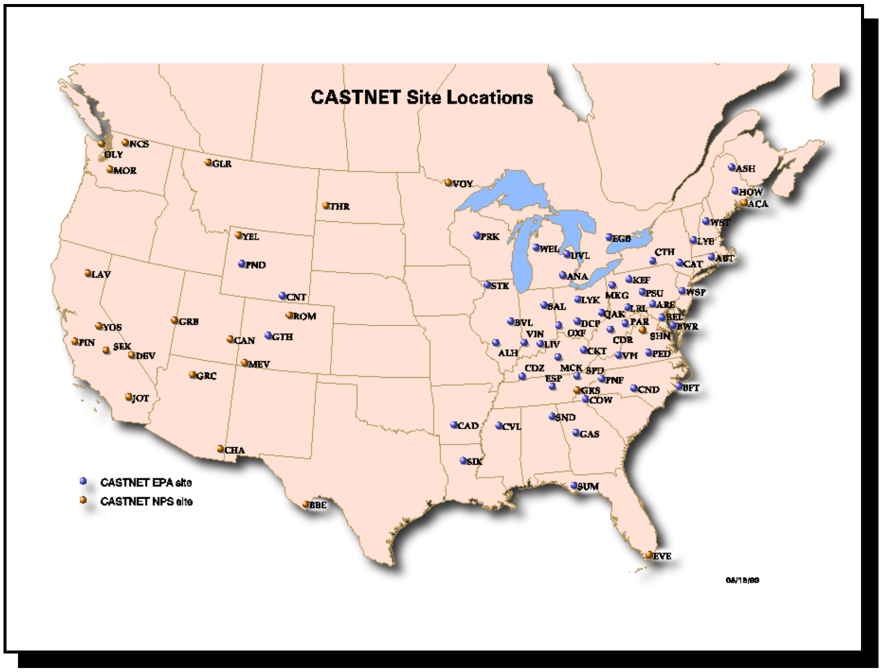

Figure 3-5. Clean Air Status and Trends Network (CASTNET).

3.3 PAMS

PAMS measures ozone precursors (i.e., volatile organic compounds (VOC) and nitrogen oxides (NO_x) which react to form ozone) at 75 sites in 25 metropolitan areas that were classified as serious ozone nonattainment coincident with release of the 1990 Clean Air Act (CAA) amendments (Figure 3-6). The addition of PAMS in the early to mid-1990's was a major addition to the national networks, introducing near research grade measurement technologies to produce continuous data for over 50 VOC compounds during summer ozone seasons. PAMS has been subject to numerous concerns regarding data quality and lack data analysis applications. More recent efforts have explored stronger linkage to air toxics monitoring as well as identification of more streamlined PAMS requirements.

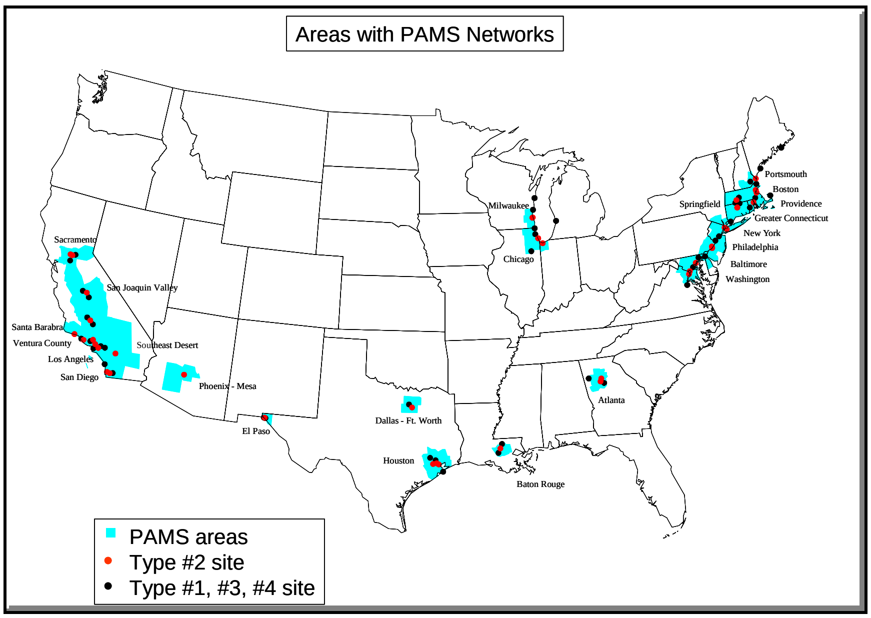

Figure 3-6. Locations of Photochemical Assessment Measurements Stations (PAMS).

3.4 Air Toxics Monitoring Network

Nearly 250 air toxics sites have been operated by State and local agencies largely through their own initiatives and funding as there are no Federal requirements for air toxics monitoring, and only recently have Federal Grant funds been earmarked for such monitoring. A Steering Committee consisting of EPA, State, and local agency members has been developing a National Air Toxics monitoring program. The program design effort is starting with a detailed analysis of data from existing sites and recently deployed pilot studies (measuring 18 species) at four major urban locations (Providence, RI; Tampa, FL; Detroit, MI; Seattle, WA) and six small city/rural locations (Puerto Rico; Keeney Knob, WV; Cedar Rapids, IA; Grand Junction, CO: Rio Rancho, NM; San Jacinto, CA). While air toxics clearly is a problem of national scope, the problems are highly variable and dependent on location conditions (i.e., emissions mix, topography, meteorology). A majority of resources should be under the discretion of SLTs to accommodate the variable and localized nature of air toxics across the Nation. A fraction of the program will support a national trends network that measures a limited number of species at perhaps 20-30 locations. Pilot city studies were initiated in 2001 to develop a consistent data base to support a national network design. The Steering Committee has recommended an initial 10- 20 urban and rural sites to start this network (Figure 3-7) .

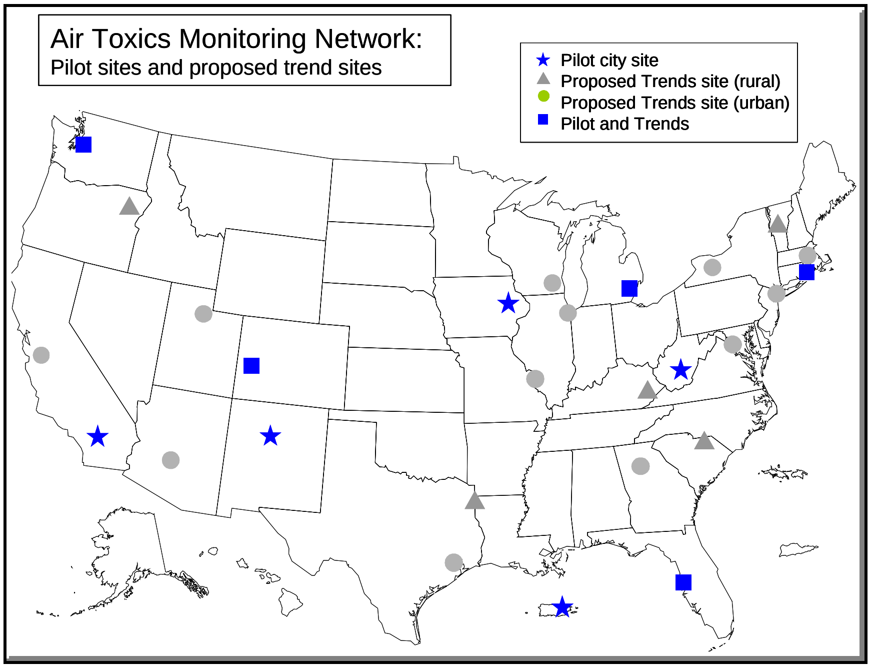

Figure 3-7. National Air Toxics Monitoring Network.

3.5 Tribal Monitoring

Tribal land monitoring (Figure 3-8) continues to increase in the number of tribes that operate monitors and the number of parameters that are measured. As of August 2002, approximately 46 sites exist for which some data are reported to EPA's AQS. This number reached approximately 50 by the end of 2002. Included in this number are 6 ozone monitoring sites; 24 PM_{10} and $PM_{2.5}$ fine mass sites; and 2 $PM_{2.5}$ chemical speciation sites. The sites also include a large number of accompanying meteorological measurements and several monitor for VOC and/or toxic chemicals. There are 2 existing IMPROVE fine mass speciation sites for regional haze measurements and 11 more sites should be added within the next year.

3.6 Summary

The preceding discussions help to set the existing air monitoring framework from which the Strategy is developed. Accordingly, the elements of the Strategy are detailed in the next six sections.

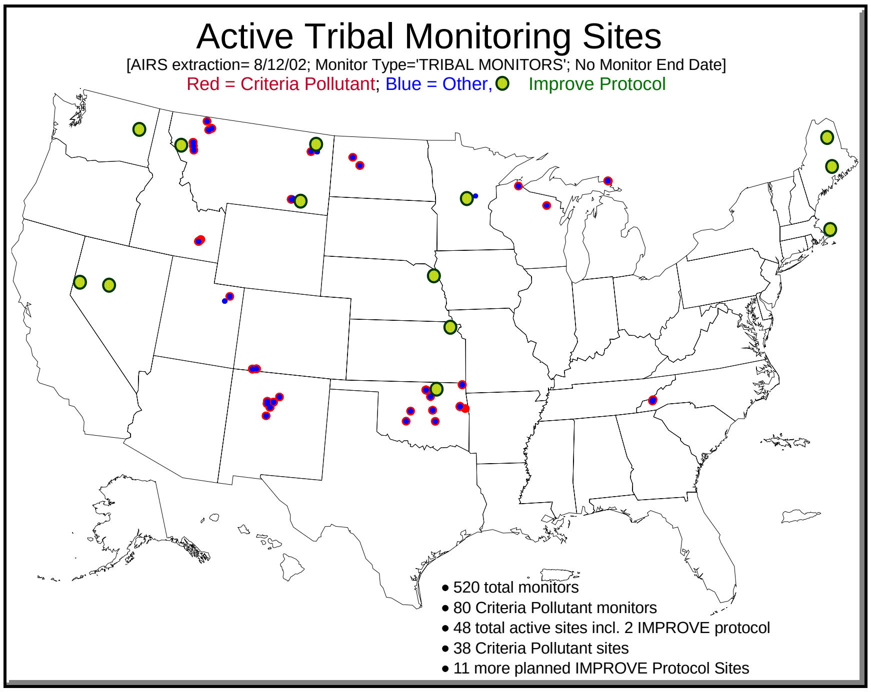

Figure 3-8. Tribal Monitoring Sites.

Table 3-1. Summary table of national ambient air monitoring networks.

SLAMS/ NAMS	Approximate Current Number of Sites	% Measuring > 60% NAAQS	Historical High # Sites	Sampling Reporting Freq. (Year Found Unless Noted)	Notes
Ozone	1167	> 80 (8 hr)	1167 (2002)	hourly (May - September)	
$PM_{2.5}$	1200	> 75	1200 (2002)	24-hr average; mix of daily, every third day and every sixth day	
PM_{10}	1214	< 25	1763 (1991)	mix of 24-hr. Avg., every sixth day; and hourly	
SO_2	592	< 5	3158 (1975)	hourly	
NO_2	437	< 5	1944 (1975)	hourly	
CO	498	< 5	684 (1981)	hourly	
Pb	247	< 5	1393 (1981)	24-hr. Avg., every sixth day	
TSP	215	NA	4894 (1981)	24-hr. Avg., every sixth day	
$PM_{2.5}$					
FRM mass	(1200)				as above
Continuous mass	200	NA		hourly	
Speciation	54 trends; 175 SIP, 150 IMPROVE	NA		mostly 24-hr. Avg.; every third day	major ions (sulfate, nitrate, ammonium); carbon fractions (organic and elemental); trace metals
PAMS	75 sites in 25 MSA's	NA		mix of hourly, 3-hr. Avg. and 24-hr. Average (56 VOC's, TNMOC and carbonyls throughout ozone season	ozone and NO_2 include in SLAMS/ NAMS
Toxics	250 (22 National Trend sites)	NA		broad range of metals, VOC's, SVOC's; Pilots: 18 species (metals, VOC's, aldehydes); 24-hr. Avg., every sixth or twelfth day	
CASTNET	70	NA		total nitrate, sulfate, ammonium 2-week avg. samples collected continuously	ozone and IMPROVE measurements included above

Section 4 - NCore Network

4.1 Introduction and Objectives

The NCore network is both a repackaging and enhancement of existing networks. The emphasis on the term "Core" reflects a multi-faceted role of national networks that can be complemented by more specific applications, such as intensive field campaigns to understand atmospheric process dynamics, or personal and indoor measurements to assess human exposure. The NCore term basically replaces the more common NAMS/SLAMS terminology and attempts to more effectively leverage all of the major existing networks to produce a more integrated multiple pollutant approach to air monitoring. Additional new measurements are proposed that foster a multiple pollutant measurement approach intended to address current and future data needs. Such measurements would replace existing ones that either do not have the measurement sensitivity attendant with current atmospheric concentrations, or have reached a point of strongly diminished value.

The overall structure of NCore is described in some detail below and is based on a tiered system of measurements referred to as Levels 1, 2, and 3, ranging from most complex near research grade sites (Level 1) to sites more typical of the existing NAMS/SLAMS network with as few as one measurement parameter. The NCore Level 2 sites represent a new network element which specifically requires the co-location of multiple air pollution measurements at 75 or more sites nationwide.

NCore provides an opportunity to address new directions in monitoring and begin to fill measurement and technological gaps that have accumulated in the networks. The Strategy recognizes that there are both nationally and locally oriented objectives in monitoring that require different design approaches despite our best attempts at leveraging resources and maximizing versatility of monitoring stations. NCore takes a more proactive approach at addressing national level needs that often had to make the most of available data sources, regardless of their design basis. NCore addresses the following objectives:

- **Timely reporting of data to public** by supporting AIRNow, air quality forecasting and other public reporting mechanisms

- **Support for development of emission strategies** through air quality model evaluation and other observational methods

- **Accountability of emission strategy progress** through tracking long term trends of criteria and non-criteria pollutants and their precursors

- **Support for long-term health assessments** that contribute to ongoing reviews of the NAAQS

- **Compliance** through establishing nonattainment/attainment areas through comparison with the NAAQS

- **Support to scientific studies** ranging across technological, health, and atmospheric process disciplines

- **Support to ecosystem assessments** recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed to address ecosystem analyses.

All of these objectives are equally valued, a departure from a historical emphasis on compliance where the NAMS/SLAMS networks was viewed principally as a “NAAQS comparison” network. That is not to imply that NCore is a research grade network, as the measurements generally are produced through routine operations conducted by most monitoring organizations. The underlying philosophy adopted in NCore is that regulatory assessments are strengthened through a more comprehensive measurement approach that is well integrated with scientific applications and, in turn, science and research efforts become more focused and effective from taking on a program relevancy perspective.

NCore should be viewed as a core structure or network backbone that provides a basic group of data that are needed to support a broad spectrum of objectives and analyses (Table 4-1). It is important to point out that, by itself, NCore cannot meet all of the data requirements for most assessments. There always will be necessary additions to flesh out the specific spatial, temporal and compositional parameters suited for a particular analysis. Accordingly, it is appropriate to view NCore as a main trunk of information, upon which the necessary branching of specific monitoring needs can be added. The NCore design assumes that pollutant measurements inherently serve multiple data needs and, therefore, network efficiencies are enhanced through collocating measurements. Relatedly, a tension exists between designing for a specific data objective versus taking a more holistic design approach that risks a dilution of attention toward a specific need. Such caution must be acknowledged in communicating the limitations of a nationally designed network, and recognizing the equal importance of local and other program specific monitoring efforts that build off of a core design.

Table 4-1. Relationships Across NCore Measurement Levels and Data Objectives.		
Objective	**NCcore Level (Primary/Secondary purpose)**	**Example Analyses/Rationale**
Public Reporting	3/2 (continuous PM and ozone)	direct reporting through AIRnow
Emission strategy development	2/2 (trace gases, $PM_{2.5}$ spec., VOCs)	model evaluation, source apportionment and other observational models
Assessing effectiveness of emission reductions and AQ trends	2/3 (trace gases, $PM_{2.5}$ speciation, VOCs)	time series comparisons to emssions projections
Support health assessments and NAAQS reviews	2/3,1 (trace gases, O_3, PM (mass and species)	ambient input to exposure models; direct association analyses
Compliance (NAAQS comparisons)	3/2 $PM_{2.5}$, $PM_{(10-2.5)}$, ozone	point and spatial field comparions to NAAQS
Science support	1/2 (all)	methods evaluation, size distribution analyses, diagnostic analysis (model processes, particle formation)
Ecosystem assessment	2 (NOy, HNO_3, NH_3, O_3)	mass balance analysis, deposition calculations

4.2 NCore Design Attributes.

Much of this discussion addresses NCore Level 2 multiple pollutant sites that are a new addition to the nation's networks. The NCore Level 2 data objectives lead to a handful of very basic design attributes:

- **Collocated multiple pollutant measurements**. Air pollution phenomena across ozone, particulate matter, other criteria pollutants and air toxics are more integrated than the existing single pollutant program infrastructure suggests. From an emissions source perspective, multiple pollutants or their precursors are released simultaneously (e.g., combustion plume with nitrogen, carbon, hydrocarbon, mercury, sulfur gases, and particulate matter). Meteorological processes that shape pollutant movement, atmospheric transformations and removal act on all pollutants. Numerous chemical/physical interactions exist underlying the dynamics of particle and ozone formation and the adherence of air toxics on surfaces of particles. The overwhelming programmatic and scientific interactions across pollutants demand a movement toward integrated air quality management. Collocated air monitoring will benefit health assessments, emission strategy development, and monitoring. Health studies with access to multiple pollutant data will be better positioned to tease out confounding effects of different pollutants, particularly when a variety of concentration, composition and population types are included. The tools for strategy development (e.g., air quality models and source attribution methods) benefit by performing more robust evaluations (i.e., by checking performance on several variables to ensure the model produces results for correct reasons and not through compensating errors). Just as emission sources are characterized by a multiplicity of pollutant releases, related source apportionment models yield more conclusive results from use of multiple measurements. Multiple measurements streamline monitoring operations and offer increased diagnostic capabilities to improve instrument performance. In addition, as we move aggressively to integrate continuous PM (e.g., both mass and speciation) monitors in the network, it is important to retain a number of collocated filter and continuous instruments as the relationships between these methods now are subject to future changes brought on by modifications of aerosol composition (e.g., as nitrate replaces sulfate, assuming proportionally greater sulfur reductions, as the major inorganic component, aerosol sampling losses due to volatility may increase at different rates dependent on instrument type). Given that we cannot measure everything everywhere within a constrained resource environment, a natural conflict arises between the relative value of spatial richness versus multiple parameters at fewer locations. This Strategy assumes that there is a geometric increase in value attained from combining measurements at a single location, as opposed to spreading out single measurements in a very rich spatial context.

- **Emphasis on continuously operating instruments**. Continuous systems allow for immediate data delivery through state-of-the art telemetry transfer and support reporting mechanisms such as AIRNow, and critical support for a variety of public health and monitoring agencies charged with informing public on air quality. Continuous data add considerable insight to health assessments that address a variety of averaging times, source apportionment studies that relate impacts to direct emission sources, and air quality models that need to perform adequately over a variety of time scales to increase confidence in projected emissions control scenarios.

- **Diversity of "representative" locations,** across urban (large and medium size cities) and rural (characterize background and transport corridors) areas. National level health assessments and air quality model evaluations require data representative of broad urban (e.g., 5 to 40 km) and regional/rural (> 50 km) spatial scales. Long term epidemiological studies that support review of national ambient air quality standards benefit from a variety of airshed characteristics across different population regimes. The NCore sites should be perceived as developing a representative report card on air quality across the nation, capable of delineating differences among geographic and climatological regions. While "high" concentration levels will characterize many urban areas in NCore, it is important to include cities that also experience less elevated pollution levels or differing mixtures of pollutants for more statistically robust assessments. It also is important to characterize rural/regional environments to understand background conditions, transport corridors, regional-urban dynamics, and influences of global transport. Air quality modeling domains continue to increase. Throughout the 1970's and 80's localized source oriented dispersion modeling evolved into broader urban scale modeling (e.g., Urban Airshed Modeling for ozone) to regional approaches in the 1980's and 1990's (e.g., Regional Oxidant (ROM) and Acid Deposition (RADM) Models to current national scale approaches (Models 3- CMAQ) and eventually to routine applications of continental/global scale models. The movement toward broader spatial scale models coincides with increased importance of the regional/rural/transport environment on urban conditions. As peak urban air pollution levels decline, slowly increasing background levels impart greater relative influence on air quality. Models need to capture these rural attributes to be successful in providing accurate urban concentrations.

These design attributes differ from historical approaches that emphasized maximum concentration locations, often dependent on a particular pollutant. Those perspectives remain valid from a local perspective and need to be addressed through elements of NCore Level 3 measurements as well as through the more discretionary monitoring conducted outside the scope of NCore.

4.3 NCore Measurement Levels.

NCore would be structured as a three tiered site classification (Levels 1-3, Figure 4-1) based on measurement complexity, ranging from most (Level 1) to least (Level 3) complex site classification. A range of 3 - 6 Level 1 “master” sites would serve a strong science and technology transfer role for the network. Approximately 75 Level 2 sites would add a new multiple pollutant component to the networks with a minimum set of continuously operating instruments that in many areas would benefit from placement at existing PM speciation, PAMS and air toxics trends sites. Level 3 sites are largely single pollutant sites, emphasizing the need for spatially rich network in the most ubiquitous criteria pollutants (i.e., $PM_{2.5}$ and ozone) and addressing an assortment of compliance related needs. Note that the pyramid depiction reflects a continuum of gradient site complexities. The levels only establish minimum monitoring expectations. Realistically, there will exist a diversity of site complexities that do not fit conveniently into a 3-level scheme. Across the board, agencies are encouraged to enhance the number of measurement parameters at all stations, including Level 3, which has a minimum requirement of a single pollutant measurement.

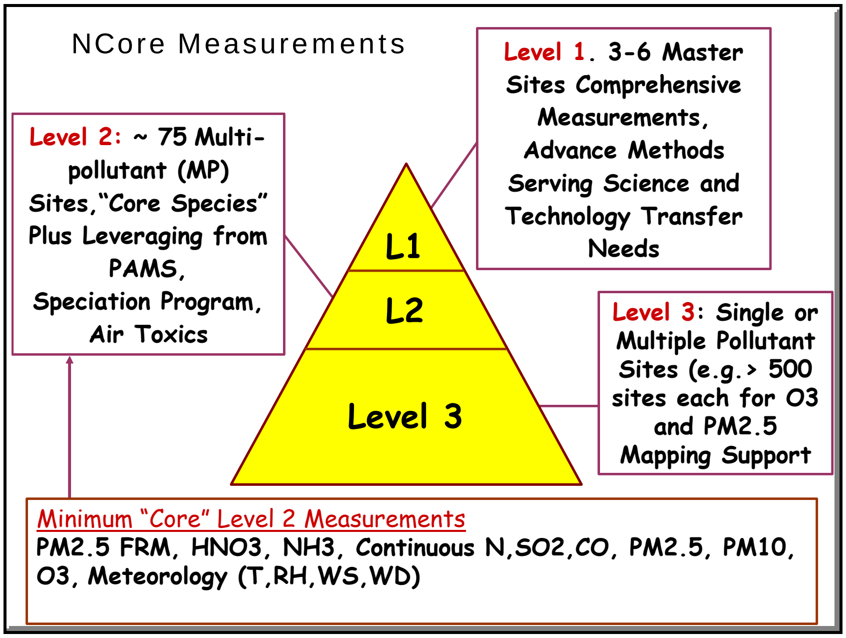

Figure 4-1. Components of NCore

4.3.1 Level 1. A small number (3-6) of Level 1 (master) sites would include the most comprehensive list of routine measurements (i.e., the most complete Level 2 site with PAMS, PM speciation and air toxics trends), research level measurements with potential for routine application (e.g., PM size distribution, continuous nitric acid and ammonia, true NO_2), and additional measurements dependent on area specific priorities, available expertise, and resources. These sites would serve three needs: (1) a comprehensive suite of measurements providing the most insightful of all routine air monitoring networks; (2) a technology transfer mechanism to test emerging methods at a few locations with disparate conditions that eventually would find more mainstream application;[1] and (3) addressing a specific monitoring objective, such as providing a continental U.S. background site, international trans-boundary transport site, or support ambient methods testing. Consideration should be given to establishing three sites initially that focus on methods/technology transfer in different regions of the nation and in locations that serve a critical spatial need such as characterizing inflow or outflow of transcontinental transport, a true background location within the continental United States or a major intra-continental transport location (note that the NCore Level 2 sites may be more appropriate in addressing transport).

The Level 1 sites need not be considered as only fixed sites operating indefinitely like the NCore Level 2 sites which have a trends and program accountability objective. As a program, Level 1 should be instituted as a base component with stable funding for an indefinite period

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[1]True nitrogen dioxide measurements should be part of routine operations; however, field testing and demonstration efforts must precede application in routine networks. Consideration for routine applications should be given to other measurements such as continuous ammonia, nitric acid, and particle size distributions.

recognizing the importance of the dynamic interaction between research grade and routine monitoring networks.   However, it may be more prudent to view Level 1 sites as having a short term or even a mobile role where, for example, dedicated, intensive measurements are conducted for a 1-3 year period in a particular location and perhaps rotated to another location with a built-in period assessment prior to each new deployment. Such an approach would be compatible with the joint NOAA-EPA proposed urban collaboration studies that seeks to conduct intensive studies linking sources to human welfare effects.

These Level 1 sites are an exception to the earlier analogy where NCore replaces the NAMS/SLAMS nomenclature. A more appropriate association places Level 1 sites as a replacement for the current $PM_{2.5}$ Supersites program. Administratively, resources for Level 1 sites would not be derived from existing STAG program that supports most routine monitoring. Separate, and as yet unidentified, dedicated internal EPA funding needs to support the Level 1 sites, as in the Supersites program.

There is a clear need for a dedicated testing program. Over the last ten years, EPA's ORD has decreased its level of methods development and testing to a point where it no longer is considered a leader in this field. Methods testing now is conducted through a rather loose collection of State sponsored trials (especially California's Air Resources Board), vendor sponsored initiatives, miscellaneous research grants and agreements to universities (e.g., PM Supersites and health centers) combined with a skeleton level effort of internal EPA testing. The Supersites program does fulfill some of the needed technology transfer needs, but is of short duration and mostly focused on broad array of particle characterization issues in addition to technology testing. Level 1 sites would be one component addressing this national level weakness that needs attention. State agencies cannot continue to be burdened with being "trial" testers of new methods. More importantly, we can not afford to lose the opportunities in greatly enhanced data value that emerging technologies present. Where it is appropriate to do so, Level 1 sites may be situated at a cooperative Level 2 site. In such situations, the Level 2 site responsibilities would be operated by a host agency, and the augmented monitoring to comprise a Level 1 stature would be operated by the entity (e.g., EPA contractor) responsible for that specific monitoring. Clearly, for such an arrangement to occur, there would need to be ample space, power, and security to accommodate both monitoring functions.

4.3.2 Level 2. Level 2 measurements represent the mainstream multiple pollutant sites in the network and best reflect the design attributes discussed above. The approximate total number of sites (75) as well as proposed measurements are modest recommendations that attempt to balance total network growth while introducing a manageable realignment in the networks. Site locations will be based on design criteria that also balance technical needs with practical considerations, such as leveraging established sites, maintaining geographic equity.

The minimum recommended measurements (Table 4-1), mostly through near continuous monitors reporting at 1-hr intervals or less, include gaseous sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxide and total reactive nitrogen (NO and NOy)[2], ozone (O_3); and particles with size cuts less than 2.5, between 2.5 and 10 µ, ($PM_{2.5}$) and ($PM_{10-2.5}$), respectively. Additional parameters include filter based $PM_{2.5}$ (with FRMs) and basic meteorological parameters, including temperature, relative humidity, wind speed and direction. In addition, integrated nitric acid and ammonia samples will be collected through denuders for subsequent laboratory analysis. While these parameters include most criteria pollutants except nitrogen dioxide [NO_2], and lead [Pb], they are not chosen for compliance purposes. They represent a robust set of indicators that support multiple objectives, including accountability, health assessments, and emissions strategy development (e.g., air quality model evaluation, source apportionment and numerous observational model applications). In most cases, these minimum measurements will be accompanied with existing measurements. For example, aerosol sulfate from the speciation program combined with gaseous SO_2 provides valuable insight into air mass aging and transformation dynamics.

The continuous PM measurements are not expected to use FRM monitors, recognizing that currently, no $PM_{2.5}$ continuous monitor has equivalency status. The reason for specifying continuous methods for PM has been addressed at length. $PM_{10-2.5}$ measurements have been included in anticipation that EPA will promulgate a new PM NAAQS that include requirements for measuring $PM_{10-2.5}$. In addition, the inclusion of $PM_{10-2.5}$ as part of a suite multiple pollutant measurements supports health studies and emission strategy development. As a peripheral benefit, the presence of co-located integrated and in-situ continuous aerosol methods will provide a continuing reference check for the performance of continuous instruments and address some of the network collocation requirements to meet Regional Equivalency (Section 6). Collocation with FRMs is an important component of the $PM_{2.5}$ continuous implementation strategy as the relationship between FRMs and continuous monitors drives the integration of these systems. These relationships will vary in place and time as a function of aerosol composition (e.g., gradual evolution of a more volatile aerosol in the East as carbon and nitrate fractions increase relative to more stable sulfate fraction). Continuous PM measurements have the potential to produce measurements more representative of true environmental conditions, relative to filter based FRM. As the aggressive deployment of continuous PM monitors advances, the "reference" network that underlies future health effects studies will reflect the shift to continuous monitors.

4.3.3 NCore Level 2 Measurement Issues. The philosophy for the Level 2 measurements is to use commercially available, reasonably priced continuous instruments that are not considered research grade or laboratory bench operations. Admittedly, the list of new measurements include trace gases which pose challenges which may not be viewed as classic

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[2] NO and NOy are chosen as they provide indicators for relatively fresh (NO) and aged (NOy) emissions. They serve as a critical tool in accounting for progress in large scale nitrogen emission reduction programs (e.g., Nox SIP calls and Clear Sky Initiative, CSI), provide input for a variety of observational based and source apportionment models, and assist evaluation of air quality models. True nitrogen dioxide, NO_2, should be added as a core measurement. However, the lack of affordable and routinely operational instrumentation prevents such a recommendation at this time.

research level operations yet, nevertheless, require a level of attention not typically associated with routine monitoring. With respect to the trace gas measurements, they are of such national importance that they simply need to be adequately characterized in the ambient atmosphere. The expectation that the efficiencies gained from locating multiple instruments and enhancing the Information Transfer Technology capabilities, such as frequent zero baseline adjustments, at monitoring platforms will somewhat offset the operational burden. The introduction of ammonia and nitric acid through denuder extractions is not expected to significantly increase operator burden or capital expenses. The approach will be to start the NCore Level 2 sites with fairly simple denuder systems that include acid and base denuders operating under low flow for a monthly averaging period. Consequently, the total cost per site amounts to 12 laboratory extractions and associated analysis costs which will be roughly an order of magnitude less cost relative to other pollutant measurements, with minimal operator burden relegated to monthly cartridge replacement and associated mailing to a central laboratory. The NCore Level 2 network is to be phased over 3 years with 2005 considered as a pilot to work out many unanticpated problems and take appropriate corrective actions. Additional discussion on methods issues is covered in Section 6, quality assurance and training in Section 7, and related implementation and funding issues in Section 11.

Table 4-1. NCore Level 2 Core Parameter List.

Measurements	**Comments**
$PM_{2.5}$ speciation	OC/EC fractions, major ions and trace metals (24 hour average; every 3rd day)
$PM_{2.5}$ FRM mass	typically 24 hr. average every 3rd day
continuous PM2.5 mass	1 hour reporting interval for all cont. species
continuous $PM_{(10\text{-}2.5)}$ mass	in anticipation of $PM_{(10\text{-}2.5)}$ standard
ozone (O_3)	all gases through cont. monitors (except HNO_3 and NH_3)
carbon monoxide (CO)	capable of trace levels (low ppb and below) where needed
sulfur dioxide (SO_2)	capable of trace levels (low ppb and below) where needed
nitrogen oxide (NO)	capable of trace levels (low ppb and below) where needed
total reactive nitrogen (NOy)	capable of trace levels (low ppb and below) where needed
ammonia (NH_3)	through denuders; 12 samples per year @monthly average
nitric acid (HNO_3)	through denuders; 12 samples per year @monthly average
surface meteorology	wind speed and direction, temperature, pressure, RH

4.3.4 Future NCore Level 2 Measurements. The minimum recommended NCore Level 2 measurements reflect a balance across a constrained resource pool, available monitoring technologies, and desired measurements. Consideration should be given to introducing additional Level 2 measurements at selected sites in the future. Examples of nationally important measurements that support multiple objectives include true nitrogen dioxide, continuous nitric acid and ammonia gases and particle size distributions. Consideration also should be given to routine particle size distribution measurements at selected locations. As multiple pollutant stations, NCore sites should over-design for space and power consumption with the expectation of additional future measurements. Such over-design will encourage collaboration between research scientists and government agencies as NCore Level 2 sites should accommodate periodic visits from health and atmospheric scientists that may conduct specialized intensive sampling.

4.3.5 Level 3. The Level-3 sites are the most numerous of the three tiers, but are focused generally on the more important criteria pollutants. These augment the Level-2 site network, and are sometimes referred to as "adjunct sites." Primarily dedicated to defining needed information for nonattainment areas, many of the Level-3 sites will still be single-pollutant, and mainly targeted to PM and ozone. Such sites will help define the nonattainment areas and boundaries, monitor in areas with the highest concentrations, the greatest population exposure, provide information in new growth areas, meet SIP needs, and evaluate local background conditions. It is expected that over 1,000 such monitoring sites will be part of the Level-3 network, many of them already functioning as part of the current air monitoring program. Although Level 3 sites may be required to include a minimum of one pollutant measurement, co-location of measurements is strongly encouraged at these sites.

4.3.6 Local, Flexible Component. In addition to the three NCore Levels, there is also a local, flexible component to the Strategy. This part recognizes that there are specific local needs which need to be addressed with air monitoring. Local considerations include such things as addressing environmental justice concerns, air toxics "hot spots," community concerns, local source impacts, political considerations, and a host of other elements which can be important on a local level. By incorporating this flexible part of the overall monitoring structure, both national and local needs can be addressed. In many situations, monitoring conducted for local needs can also be of value from a national perspective. Thus, SLT's are encouraged to utilize available monitoring funding, after Level 2 and 3 requirements have been met, toward local needs.

4.4 NCore Siting

The siting goal for Level 2 NCore sites is to produce a sample of representative measurement stations to service multiple objectives. Siting criteria include:

- **Collectively**
  - approximately 75 locations predominantly urban with 10-20 rural/regional sites
  - *urban:* a cross section of urban cities, emphasizing major areas with a population greater than 1 million; but also including mix of large (0.5 to 1.0 million) and medium (0.25 to 0.5 million) cities with geographically and pollutant diverse locations suitable as reference sites for long term epidemiological studies

- *rural:* capturing important transport corridors, including national, continental, and intercontinental scales, and regionally representative background conditions. In addition, some sites should allow for characterizing urban-regional coupling (e.g., how much additional aerosol does the urban environment add to a larger regional mix).

- **Individual site basis**

  - "representative" locations not impacted by local sources (urban sites, 5-40 km; rural sites, greater than 50 km)

  - leverage with existing sites where practical, such as the speciation, air toxics, PAMS, and CASTNET trends sites.

  - consistency with collective criteria..(i.e., does the selected site add holistic network value)

  - other factors (e.g., resource allocation, Tribal representation).

4.4.1. Guidance for Site Selection and Site Allocation Proposal.

a. Broad-based technical guidance. Level 2 network design is initiated by considering a cross-section of urban locations to support long term epidemiological studies, with subsequent addition of rural/regional locations to support national air quality modeling evaluation and emissions strategy accountability assessments, followed by a practical mapping of these general locations with existing sites, and an equitable/objective allocation scheme. This sequential approach is captured in Figure 4-2. Nearly 80 "representative" air quality regions that group populations based on statistical and geographic factors form a cross-section of desired areas for long term epidemiological studies. An additional 24 rural locations are identified to support evaluation of the national Community Modeling Air Quality System (CMAQ). These locations can be compared with available site candidates from existing networks (e.g., PM speciation, PAMS type 2 and CASTNET) that were designed with "representative" siting conditions commensurate with NCore Level 2 criteria. This procedure provides a modest objective based reference to judge the adequacy of the site allocation process (see below).

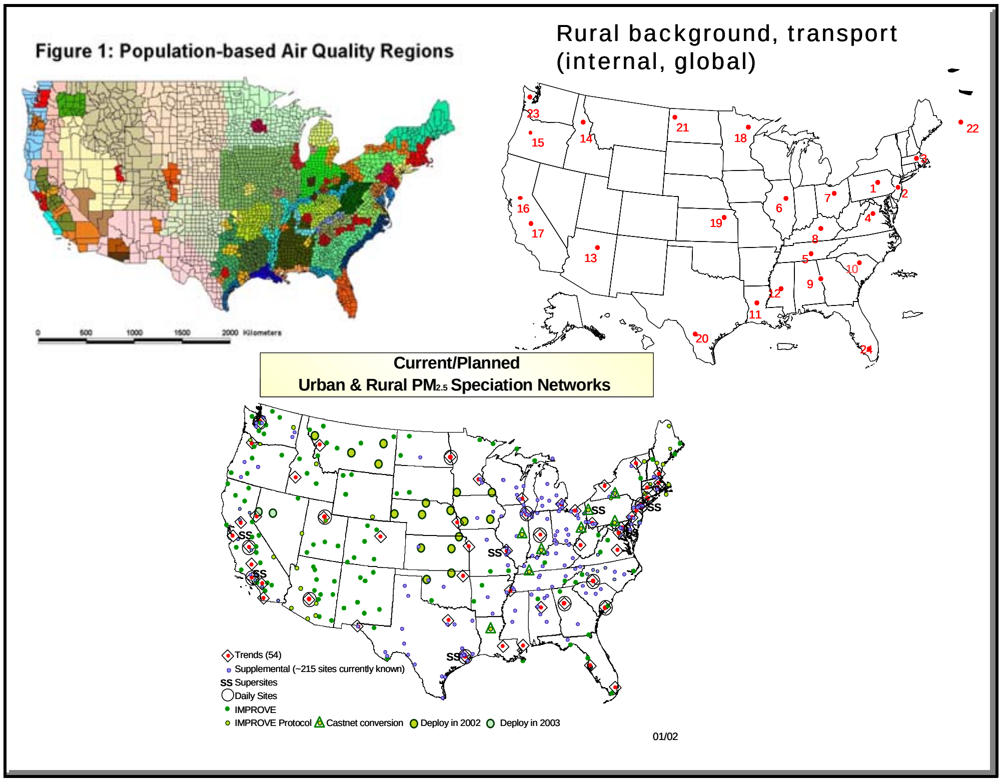


Figure 4-2. National maps providing initial broad scale siting guidance for NCore level 2 sites. The maps include recommendations based on supporting long term health assessments (top left) that emphasize an aggregate of representative cities and air quality mode evaluations that rely on rural background and transport locations (top right). Existing site locations in most cases will be used as NCore siting infrastructure (bottom).

b. Site allocation process. The allocation scheme (summarized in Table 4-2) is based largely on historical and political considerations (e.g.,one Level 2 site per state) that distributes monitoring resources based on a combination of population and geography, which in broad terms is consistent with several technical design aspects. Technical guidance sets a framework for assessing the development of NCore, while the allocation scheme provides a process for facilitating implementation. This allocation scheme provides a sweeping range of metropolitan areas. Clearly, the allocation must be flexible enough to ensure that sites add meaningful value and avoid redundancies. Suspected shortcomings in the proposed allocation scheme that need to be reconciled include, for example, a lack of rural locations in CA, lightly populated Western states that may not provide a meaningful rural location, multiple Florida locations with generally moderate air quality due to marine influences, and possible redundant locations along the East Coast and Midwest. Level 2 sites will require approval by the EPA Administrator (or delegate), a means to insure that the collective national siting criteria are adhered to. An NCore design committee will be constituted to site locations and facilitate site selection approval.

Table 4-2. Proposed NCore Level 2 Site Allocations.					
	Total	**Major Cities > 1.0 M**	**Large Cities 0.5 - 1.0 M**	**Medium Cities 0.25 - 0.5 M**	**Rural**
1 per State minimum	50	TBD	TBD	TBD	TBD
added 2 in most populated states (NY, CA, TX, Fl)	8	TBD	TBD	TBD	TBD
added 1 in each second tier populated States(OH, IL, PA, MI, NC)	5	TBD	TBD	TBD	TBD
additional rural sites	12	TBD	TBD	TBD	TBD
total	***75***	***32***	***13***	***10***	***20***
Note: allocation does not cover every major, large, medium sized city in United States; states lacking cities greater than 250,000 population can provide rural coverage					

c. Process for input into specific site locations. The number of sites and their distribution portrayed in Table 2 is only a first approximation that requires added input and consideration to reach decisions on actual site locations optimized to meet the NCore objectives. Site locations will be influenced by a combination of logistics associated with SLT capabilities and existing infrastructures, and input from SLTs and the health effects/exposure, atmospheric sciences and ecosystem assessment communities. OAQPS and the Regional Offices will serve largeley as facilitators for this siting effort. EPA Regional Offices will work with their States (including local agencies and Tribes) and RPOs to provide initial suggestions based on logistics and design considerations for which the States and Regional Offices are most familiar with. EPA OAQPS will solicit input from the research community through a combination of existing committee and organization structures and workshops and meetings as discussed in Section 11. There likely will be some iteration and negotiation involved in this outreach effort. The three year phased approach (Section 11) for implementation will allow for the necessary outreach and adjustments to start NCore Level 2 on the right track. Realistically, a set of NCore Level 2 site locations should be developed by April 2005.

d. Inter- and intra-continental transport sites. A subset of the rural NCore sites should be dedicated to characterizing inflow and outflow of a range of pollutants across United States borders. There is some difficulty in having SLTs assume operational responsibility for rural sites due to logistics associated with travel time and site access and the fact that rural sites tend to be more focused on serving a national or regional objective thus compromising some interest a local perspective. Some of these perspectives have been changed through RPO efforts. However, there likely will be a need to establish a dedicated pool of funding for international transport sites that may be operated by existing research or private institutions with the option for transfer to SLT organizations. Such sites should be viewed as a key component of the overall network changes and should not be compromised due incommensurabilities in existing funding arrangements.

e. Design concerns. Inevitably, there will be spatial coverage gaps given the limited number (75) of NCore Level 2 sites. This concern is balanced by the expectation that Level 2 sites are only minimum recommendations that serve as models for additional network modifications, not unlike the $PM_{2.5}$ speciation program where the majority of State SIP sites operate similarly to the National trend sites. While the proposed allocation scheme is based largely on population and existing EPA regions, the intention is to set the basic design goal and allow for regional flexibility to choose the most appropriate and practical locations. There are more overlaps in siting needs for the multiple objectives. For example, long term epidemiological studies are served by a cross-section of different cities with varying climates, source configurations, and air quality characteristics. Air quality model evaluations require similar locations, as well as proportionately more information on rural and background locations, along with vertical characterization of the atmosphere which is beyond the scope for NCore. Siting for accountability purposes benefits from "representative" locations but requires as much information in rural locations as urban locations, given the difficulty of separating source signals in urban environments (e.g., nitrogen in urban locations is dominated by mobile sources, whereas in selected rural locations, such as CASTNET sites, the emission signals from major utility sources are less effected by area wide sources).

f. Accurate site characterization data. There is an increased need to provide improved characterization of the spatial representativeness of monitoring sites. The importance of characterizing spatial representativeness is elevated as we try to promote spatial analysis techniques that attempt to resolve spatial gradients based on point measurements. The NCore Level 2 sites are being promoted as representing relatively broad spatial scales. Accordingly, these sites will require a dedicated effort to characterize their spatial representativeness. A key element of future network assessments should be a technically sound analysis through modeling or other means that establishes the average as well as some indication of variance as driven by topography and meteorology of spatial representation of a monitoring site.

4.4.2. Level 1 and 3 Siting

NCore Level 1 sites are an important bridge for technology transfer and corroboration between research and regulatory oriented organizations. Unfortunately, resource prospects for supporting these sites appear slim as they are not part of mainstream routine networks (like Levels 2 and 3) or research programs. These sites should include a range of representative locations across the nation. Candidate locations include existing supersites and other well developed platforms capable of accommodating large footprint for instruments with adequate power and security, such as co-location at an agency-operated Level 2 site. Consideration should be given to developing a rural-based master site, to ensure that technologies tested today can meet future conditions as concentration levels continue to decline.

Level 3 sites retain several NAMS/SLAMS attributes and require Regional Administrator approval. The subtle change incorporated in Level 3 is the recognition that mapping (e.g., AIRNow) and the production of pollutant concentration contours is a national level resource. Where possible, Level 3 sites should be optimized for multi-pollutant purposes, though not to the degree as required for a Level 2 site. For example, there may be opportunities to co-locate ozone and PM monitors without degrading the network information derived from having separate ozone and PM locations.

4.5 Relationship Between NCore and Existing Networks.

Excluding CASTNET and IMPROVE, the existing networks[3] largely consist of NAMS/SLAMS and special purpose/supplemental monitoring for criteria pollutants, PAMS, non FRM portions of $PM_{2.5}$ network (e.g., speciation, supersites and continuous mass) and air toxics. Most of these networks include a combination of prescriptive and less prescriptive monitoring based on relatively direct language in 40 CFR Part 58 of the monitoring regulations, or through specific guidance in the Federal 103/105 Grants. The more prescriptive aspects include NAMS (all criteria pollutants), $PM_{2.5}$ SLAMS, PAMS, speciation trends and the emerging air toxics national trends sites. Less prescriptive elements not included in the monitoring regulations (i.e., "local-flexible" component) include special purpose/supplemental monitoring, SLAMS (other than $PM_{2.5}$ mass), $PM_{2.5}$ speciation beyond trends, and a variety of air toxics sampling. Note that the estimated local fraction of resources for a particular program element is greatest for air toxics followed by $PM_{2.5}$ speciation (Table 4-3). While much of the SLAMS monitoring for criteria pollutants is not required in 40 CFR Part 58, over time the monitoring has taken on a "required" context associated with various Clean Air Act requirements (e.g., design value sites, maintenance plan provisions, new source review, miscellaneous arbitration).

A rough comparison of NCore with existing networks suggests:

Level 1- - PM supersites:

- Level 2 - - criteria pollutant NAMS, speciation trends, air toxics trends, PAMS site 2;
- Level 3 - - SLAMS criteria pollutants.

Several qualifying remarks are appropriate:

- The Supersites program is temporary and funding to transition into Level 1 master sites is not identified.
- Level 1 sites should be an integral long term network component, and operate with greater intersite consistency than the current Supersites.
- The minimum requirements determining criteria pollutant trends (analogous to NAMS) in most cases would be accomplished through Level 2 sites.
- It is expected that the majority of speciation trend sites will be selected as Level 2 sites.

[3] not including CASTNET and IMPROVE; networks referred to are limited to those driven by Federal 103 and 105 Grants and operated by State/local agencies and Tribes that are more directly impacted by 40 CFR Part 58.

- The emerging national air toxics trend sites (NATTS) are being collocated at existing speciation sites (mostly trend sites) which in turn should emerge as formal NCore Level 2 sites.

- Note that major fractions of air toxics and PM speciation are not part of NCore and should be viewed as part of the "local" network.

- Approximately 50% of the remaining PAMS type 2 sites also serve as likely candidates for NCore Level 2, many of these already are collocated with speciation trend sites.

Table 4-3. Relationship Between Existing Networks and NCore

	NCore Level 1	NCore Level 2	NCore Level 3	Local	Other	Notes
PM Supersites	✓					lacking future funds
NAMS (CO, NO_2, O_3, SO_2, PM_{10}, $PM_{2.5}$)		✓				specified Level 2 $PM_{2.5}$, PM_{10}, NO/NOy do not use equivalent methods (assume each site has $PM_{2.5}$ FRM; cont. PM_{10} and $PM_{2.5}$ evolve into equivalent PMc)
SLAMS			✓			
PM speciation trends		✓			✓	assumes most (not all) trend sites are Level 2 locations
PM speciation (SIP)				✓		
Air toxic trends		✓				
Air toxics				✓		
PAMS type 2		✓		✓		unknown number of PAMS sites for Level 2
other PAMS				✓		

4.6 Utilizing NCore to Enhance Network Integration.

Initial reviews of the monitoring strategy suggest the need for greater integration into areas that extend beyond the traditional roles of routine networks operated by SLT's. More specifically, greater attention to ecosystem assessment support, coordination with intensive process oriented field campaigns, consideration of sites dedicated to inter-continental pollutant transport, and a linkage to a wealth of satellite data has been advocated by CASAC and the CENR. Initial steps taken to enhance such integration include adding ecosystem assessment support as a seventh NCore objective, and initiating a pilot study to to test new monitoring technologies in CASTNET with the goal of using CASTNET to fill certain rural NCore Level 2 spatial gaps and build on the established CASTNET connection to ecosystem oriented networks such as those under the umbrella of the National Atmospheric Deposition Program (NADP). Similarly, the recent addition of ammonia and nitric acid as NCore Level 2 measurements increases our ability to characterize nitrogen cycling which is relevant to watershed eutrophication and acidification assessments. The inclusion of Level 1 sites is an explicit attempt to foster partnerships with the research community. In addition to these small steps, more aggressive integration attempts should be pursued as NCore has the potential to provide a synergistic value much larger than the discrete measurements provided.

4.6.1 Sentinel Sites for International Transport. Strong consideration should be given to developing a close association with NOAA and other workgroups that address the technical issues with an international perspective to assist in the design and support of routinely operating “sentinel” stations. The primary objectives of these sites would be characterizing fluxes of key pollutants into and out of the United States. The NCore Level 2 parameter list would serve as a subset, or at least exhibit considerable overlap, of desired measurements from a transcontinental (and intra-continental) needs perspective.

4.6.2 Dedicated Emission Inventory Evaluations Sites. Over the last two decades there have been periodic efforts to evaluate components of emission inventories through well structured ambient data sets. Such efforts typically have included tunnel studies to evaluate the most recent Mobile source emission model or optical path approaches to capture the near tail pipe emissions from specific vehicles in real world conditions. Generally, there is no formal or routine program that allows for periodic evaluation of emissions through a linkage with ambient observations. While such a component may not fit neatly into the NCore model, it certainly merits consideration as part of an overall network re-engineering effort.

Mechanisms for addressing larger integration needs are discussed in the implementation plan (Section 11).

Section 5 - Network Assessments

Periodic network assessments are needed to establish and maintain optimum air monitoring networks. Simply stated, a network assessment is a structured evaluation of a monitoring network to determine if the goals and objectives for that network are being met in the most efficient way, accounting for budget, staffing, public information, technical, political and other factors. The following paragraphs describe the overall strategy for conducting network assessments as well as findings from the most recent national and regional assessments.

5.1 Network Assessment Overview

Network assessment is not a new process. State and local agencies historically have conducted annual network evaluations, and changes to monitoring networks have been undertaken and reported as part of this process. However, periodically, it is necessary to take a more holistic review on a multi-level basis: national, regional, and local agencies. As part of the Strategy it is recommended that a multi-level network assessment be conducted every five years.

The primary objectives of the network assessments are to ensure that the right parameters are being measured in the right locations, and that network costs are kept at a minimum. Some of the related secondary objectives include the following:

- Identify new data needs and associated technologies,
- Increase multi-pollutant sites vs. single pollutant sites,
- Increase network coverage,
- Reduce network redundancy,
- Preserve important trends sites, and
- Reduce manual methods in favor of continuous methods.

5.1.1 Role of National Assessments. The national assessments are intended to provide broad directional recommendations for information about potential network changes. The national assessments identify current and future data needs, and make recommendations for the implementation of new technologies. The national assessments also evaluate the existing networks in order to identify universal opportunities to reduce or eliminate existing monitoring activities and associated costs. The recommendations that come from the national assessment are intended to guide the more site specific regional assessments.

5.1.2 Role of Regional Assessments. Regional assessments are intended to identify site specific network changes to be made based on the broad recommendations from the national assessment. Detailed analyses should be made to identify where new monitors should be located, and to identify low value monitors that should be eliminated. After reviewing their recommendations with OAQPS, and State and local agencies, the Regional Office should include a list of specific network changes that are to be implemented in their final regional assessment.

See the preliminary guidance on conducting regional assessments at the end of this section for additional information.

5.1.3 Role of Local Assessments. As stated above, State and local agencies regularly conduct network evaluations. As a part of their regular network evaluations, SLTs would be asked to review and comment on the recommended network changes that would affect their monitoring activities. State and local agencies should carefully review each of the changes suggested by the RO. Ultimately, local agencies will be responsible for implementing the RO's final recommendation for network changes.

5.2 FY 2000 National Assessment

An example national assessment of the criteria pollutant networks was conducted in 2000 to catalyze subsequent regional level assessments. This assessment considered concentration level, site representation of area and population, and error uncertainty created by site removal as weighting parameters used to determine relative "value" of individual sites. The most widely applied factor inherent in most assessment approaches is related to site redundancy and can be estimated in a variety of ways. The national assessment calculated error uncertainty by modeling (i.e., interpolating between measurement sites) surface concentrations with and without a specific monitor with the difference reflecting uncertainty (Figure 5-1). Areas of low uncertainty (e.g., less than 5 ppb error difference for ozone) suggest that removal of a monitor would not compromise the ability to estimate air quality in the region of that monitor as nearby stations would provide adequate acceptable predictions.

The assessment approach was expanded to include additional weighting factors beyond error. Typical outputs for ozone networks (Figure 5-2) suggest that ozone sites clustered in urban areas yield less powerful information than sites located in sparsely monitored areas, especially in high growth regions like the southeast. However, this conclusion is more applicable to urban areas with more homogeneous conditions. This methodology was applied to all criteria pollutants with a variety of weighting schemes to provide a resource for more detailed regionalized assessments.

The key findings of the national network assessment are as follows:

- **Investment Needs:** New monitoring efforts are needed to support new air quality challenges, including monitoring for air toxics and new technology for criteria pollutants and precursor species. Air toxics have emerged as a top public health concern in many parts of the country, and a national air toxics monitoring network is currently under development under special funding for air toxics monitoring. New technology, especially continuous measurement methods for pollutants, such as fine particles, are needed to provide more complete, reliable, and timely air quality information, and to relieve the burden of manual sampling. Resources and guidance are needed for this activity.

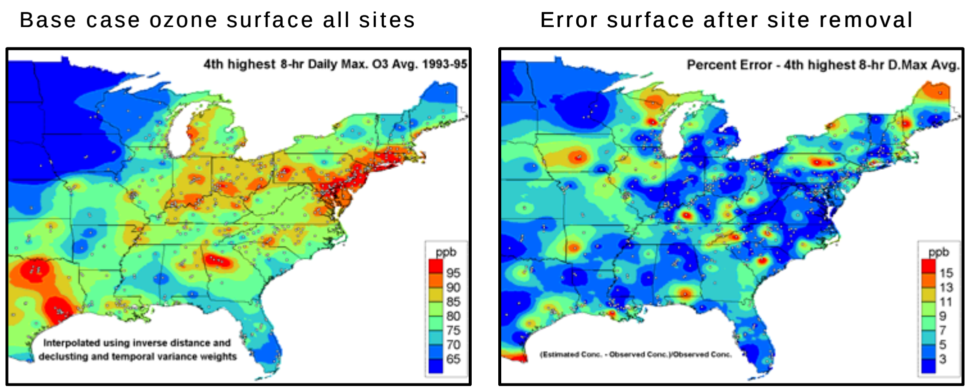


Figure 5-1. Surface depiction of estimated absolute errors (right) in ozone concentrations produced by removing existing monitors on a site by site basis, relative to base case (left). Areas showing low errors (<5 ppb) suggest neighboring monitors could accurately predict ozone in area of a removed site. Areas of high error suggest necessity to retain existing monitors and perhaps increase monitoring.

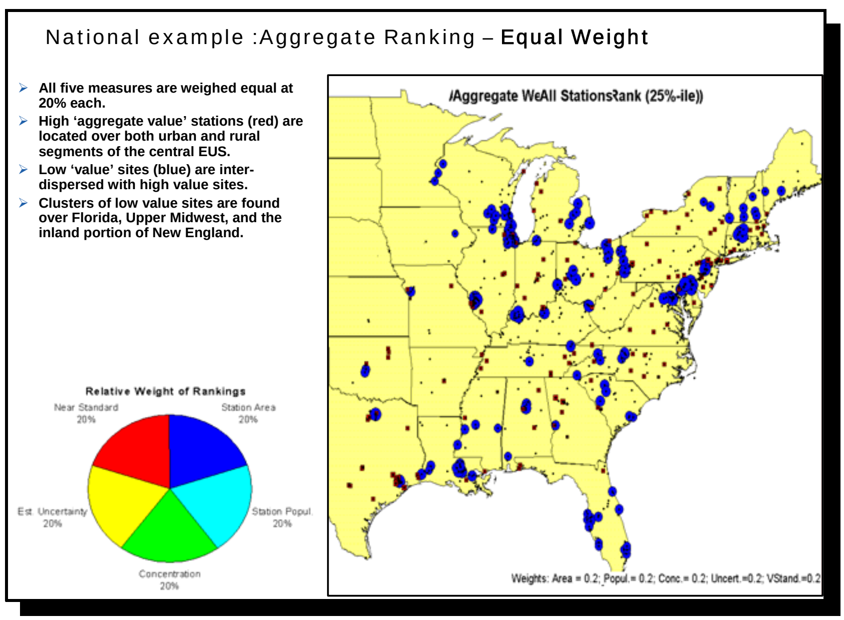


Figure 5-2. Aggregate assessment of 5 evenly weighted factors. Blue circles and red squares indicate the lowest and highest valued sites, respectively.

- **Divestment Opportunities:** To make more efficient use of existing monitoring resources and to help pay for (and justify additional resources) the new monitoring initiatives noted above, opportunities exist to reduce existing monitors. Two areas of potential divestment are suggested. First, many historical criteria pollutant monitoring networks have achieved their objective and demonstrate that there are no national (and, in most cases, regional) air quality problems for certain pollutants, including PM_{10}, SO_2, NO_2, CO and Pb. A substantial reduction in the number of monitors for these pollutants should be considered. (However, considerations need to be made to retain a certain number of trace level monitors especially for SO_2 and CO because of their utility as tracers for certain sources of emissions.) As part of this adjustment, it may be desirable to relocate some of these sites to rural areas to provide regional air quality data. Second, there are many monitoring sites with only one (or a few) pollutants. To the extent possible, sites should be combined to form multi-pollutant monitoring stations. Any resource savings from such divestments must remain in the monitoring program for identified investment needs. A reasonable period of time is required to smoothly transition from established to new monitoring activities.

It should be noted that removal or relocation of monitors with historical regulatory applications creates a challenging intersection of policy and technical applications. Network assessments produce recommendations on removing or relocating samplers based largely on technical merit. In some instances, these recommendations may be in conflict with existing policy or other needs. For example, a recommendation that an ozone monitor be discontinued in a "nonattainment" county due to redundancy of neighboring sampling sites raises interesting policy/technical issues. These and other issues require attention in concert with technical recommendations developed through assessments. It should not be assumed that policy should override a technical recommendation, nor should technical approach override existing policy. Rather, reasonable solutions can be achieved on a case-by-case basis. To that end, the intersection between policy and network optimization, issues are being identified. The total perspective of such implications is currently under evaluation.

- **Importance of Regional Input:** The national analyses are intended to provide broad directional information about potential network changes. Regional/local analyses are a critical complement to the national analyses, and are necessary to develop specific monitoring site recommendations. To this end, EPA must allow States and regional organizations sufficient time (e.g., at least 6 months) to conduct adequate regional/local analyses.

A copy of the FY 2000 national assessment can be found on the web at: www.epa.gov/ttn/amtic/netamap.

5.3 FY 2003 Regional Assessments

Each of the 10 EPA ROs was tasked with performing a regional network assessment in conjunction with its SLT partners. Although a framework was suggested, each RO undertook the assessment process differently, ranging from complex statistical functions to subjective site-by-site considerations. Some RO's have gone through the process of approving SLT network changes, while other RO's are awaiting finalization of the network assessment process before approving changes. This lack of consistency points strongly to the need for network assessment guidance. Such guidance was deemed to be important by the CASAC Subcommittee on Monitoring at its July 2003 meeting. Because the regional assessment process is so far along at this point, there will not be a guidance structure in place for this initial round of assessments; however, a guidance document is now being developed which will help provide national consistency for subsequent assessments.

Though not yet final, the following summary of recommended network changes is intended to show the progress made by each of the Regional Offices:

Region 1: Reductions in PM_{10} FRM monitors; CO; and SO_2;
Additions for $PM_{2.5}$ continuous monitors; air toxic monitoring;
Modifications for $PM_{2.5}$ FRM's to support PM-coarse monitoring;
Approach: Site-by-site situational analysis.

Region 2: Reductions in PM_{10} and CO monitors;
Additions for $PM_{2.5}$ continuous monitors;
Approach: Site-by-site situational analysis.

Region 3: Reductions in SO_2, NO_2, CO, Pb, PM_{10}
Additions: Yet to be determined
Approach: optimum network design function using 6 design considerations

Region 4: Reductions in CO, PM_{10}, NO_2, lead, and SO_2 monitors;
Additions: Yet to be determined;
Approach: Statistical spatial analyses with considerations for population exposure, areal extent of violations, and sensitivity analyses.

Region 5: Reductions in ozone, CO, PM_{10}, $PM_{2.5}$, lead, CO, SO_2, and NO_2;
Additions: Yet to be determined;
Approach: Statistical analyses for identifying high/low value sites; use of positive matrix factorization.

Region 6: Reductions in PM_{10}, $PM_{2.5}$, CO, SO_2, NO_x, lead, ozone;
Additions in continuous $PM_{2.5}$, NOy, ozone;
Relocations for $PM_{2.5}$ FRM, SO_2, PM_{10} FRM sites;
Approach: State-by-state changes in consultation with each state.

Region 7: Reductions in Pb, PM_{10}, CO, and $PM_{2.5}$ monitors;
Additions of 8 hour ozone sites, further additions considered;
Relocations of 1 hour ozone sites;
Approach: Statistical approach and consultation with State/Local agencies.

Region 8: Reductions: Yet to be determined;
Additions: Yet to be determined;
Approach: Paired correlation rankings; comparisons to NAAQS; input and feedback from individual states.

Region 9: Reductions: Yet to be determined;
Additions: Yet to be determined;
Approach: Statistical process similar to national assessment.

Region 10: Reductions: PM_{10} and $PM_{2.5}$ FRM monitors; CO; NO_2;
Additions: Continuous $PM_{2.5}$ monitors;
Approach: Correlation analyses; NAAQS comparisons; NCore design criteria.

It should be noted that the above summary represents work-in-progress, but is intended to provide a sense of the progress and types of approaches being taken by the various regions.

5.4 Guidance for Future Regional Network Assessments

Guidance and training materials are needed for future network assessments to provide more structure to the assessment process. The guidance must promote greater national consistency while allowing for flexibility due to the substantial differences among the regions. OAQPS is currently preparing a Regional Assessment Guideline Document which will be complete by the beginning of the next round of network assessments. With the next assessment due at the end of 2008, the regional assessments should begin no later than mid-2006. EPA is expecting to have a draft guidance document available for review by September 2004. Allowing 6-12 months thereafter for comments and document revisions, the guidance should be completed in mid 2005. This is in sufficient time prior to the start of the next round of network assessments.

It is with this in mind that the following steps are provided as a preliminary guide for the regional network assessments, recognizing that further elaboration is forthcoming in the guideline document currently under preparation:

- **Step 1: Description**
  Each assessment should contain some basic descriptive material of the region, to include topography, climate, population and trends, and general air quality conditions. This section should be considered more of a boilerplate section, needing updating as appropriate for each subsequent assessment.

- **Step 2: Network History**
  A description of the network evolution over at least the previous 10 years is important in helping to establish a sense of changes that have already been made in response to changing network needs. At a minimum, this description should

depict the total number of monitors in the region by pollutant and by year, either in graphical or tabular format. At best, this should be accompanied by a detailed table showing the history of each monitoring site. Then each successive five-year assessment simply appends the most recent five-year history to the previous summary, maintaining a continuous record of the monitoring networks.

- **Step 3: Statistical Analyses**
  Each assessment should include some level of statistical analysis. At a minimum, site intercorrelations would help identify redundant sites. Also, some comparisons to the NAAQS and trend analyses would help determine sites which are well below the NAAQS and are not trending upward. Such sites, from a purely statistical standpoint, could be candidates for divestment. Analyses can be more complex, at the discretion of the Region. Examples include spatial analyses, factor analyses, as well as innovative approaches using weighting schemes such as those used in the National Assessment. The more detailed analyses can be used as important tools for determining the adequacy of existing monitoring sites. Examples of the types of statistical analyses that should be conducted can be found at - http://www.epa.gov/ttn/amtic/netamap.html

- **Step 4: Situational Analyses**
  Apart from the statistics, there are a myriad of other factors which have bearing on network changes. These include, but are not limited to:

  - Value of maintaining long-term trends
  - Closeness to the NAAQS
  - Population changes (e.g., new areas of growth)
  - Existing maintenance plan and SIP requirements
  - Sparseness of the existing network
  - Special local circumstances (e.g., political factors)
  - Needs of the scientific and health communities

  These factors can be considered subjectively, or more objectively by first identifying the important factors and developing weighting schemes for each factor. The approach would be at the discretion of the Region.

- **Step 5: Suggested Changes**
  Based on both the statistical and situational analyses, each Regional Office should prepare a recommended list of network changes, by pollutant and site, applicable to each state. Regional Office staff should engage in one or more workshops/meetings with State and local agencies for the purpose of sharing the results of the initial analyses and explaining the rationale for any suggested changes.

- **Step 6: Interactive Discussions**
  State and local agencies should careful review each of the changes suggested by the Regional Office. Deviations from the initially recommended changes are expected, but state and local agencies should present cogent rationale for the basis of any deviation. It is expected that state and local agencies will provide back to the Regional Offices their list of network changes including those which agree with the Regional Office recommendations, and those which differ. There may need to be one or more meetings between Regional Office staff and state and local agency staff to refine the changes which must ultimately be approved by the Regional Office.

- **Step 7: Final Recommendations**
  Each Regional Office will provide a listing of the final changes to the air monitoring network within its jurisdiction. These are to be provided to OAQPS. The final listing should contain the following information:

  - Parameter changes (additions/removals/relocations)
  - Site changes (additions/removals/relocations)
  - A justification statement explaining (briefly) the rationale for the change
  - A timeline for implementation for each change.

5.5 Summary

The network assessment process is an integral part of the Strategy in that a more formalized, periodic network review will assure that the Nation's air monitoring networks adjust to meet the most pressing public, regulatory, and scientific needs.

Section 6 - Technology

6.1 Introduction

This section of the Strategy focuses on the technologies the EPA and its SLT partners will use to deliver timely ambient air monitoring data from the NCore network.

During the planning stages of the Strategy, the Technology workgroup, with input from the Quality Assurance and Regulatory Review workgroups, NMSC, CASAC, and SAMWG, identified three overall needs for technology investments for the NCore networks. In addition to the new investments, the existing infrastructure for programs such as the ozone network will continue to be employed. Other technologies such as routine CO, SO_2, and NO_2 monitoring may be reduced depending on network assessments that take into account the new investments. While other technology investments will likely be made during implementation of the Strategy, most of those technologies will be supporting one of the three major technology needs:

- Timely reporting of high quality, highly time-resolved ambient monitoring data;
- Collocated characterization of trace levels of CO, SO_2, NO and NOy; and
- Highly time resolved, spatially rich $PM_{2.5}$ data.

The timely reporting of high quality, highly time-resolved ambient monitoring data will require a coordinated effort to ensure data management systems are meeting desired performance needs. These data management systems will need to provide validated data, to the extent possible, in near real time to multiple clients within minutes from the end of a sample period. For NCore to realize its full potential as the Nation's ambient air monitoring network, the data management systems used will need to not only provide efficient processing and validation of data, but also provide appropriate communication of that data in a format appropriate and available for multiple users. The main driver for improved data management systems is providing near real-time, high quality hourly data from all NCore Level 2 continuous monitors as well as ozone, trace level CO, NO, NOy, SO_2 and $PM_{2.5}$ continuous data from all other NCore sites. By having an emphasis on availability of data in near real-time, NCore will better serve its clients by having data available as episodes are occurring. This will allow technical and policy staff to better understand the exposure and interactions of air pollutants in the atmosphere of most interest - today. The characterization of trace levels gases and $PM_{2.5}$ in near real time are part of the monitoring technologies being emphasized in NCore. The use of monitoring technologies in the NCore networks is generally limited to reference and equivalent methods for gaseous criteria pollutants. However, for trace gas analyzers of CO, SO_2 and NO_2, instrument manufacturers are expected to be utilizing their base reference or equivalent methods with modifications to improve their detection limit and therefore performance at low concentrations relative to NAAQS levels. For PM criteria pollutants, EPA is moving toward a base network of reference or equivalent methods with a larger network of *approved* continuous PM monitors that meet appropriate data quality objectives.

While one or more agencies may already be operating with some of the technologies listed in this section, the challenge for implementation will be to produce a framework that encourages widespread adoption of these technologies. Requiring specific technologies will be avoided in most instances; however, the measurement of select parameters will be required at NCore Level 2 sites, as appropriate. The concern on requiring specific technologies is that over time new technologies will be become commercially available that make existing technologies obsolete. One of the main tenets of the Strategy is adopting Performance Based Measurement Systems (PBMS). By adopting PBMS for each parameter of interest in the NCore network, future technologies may be able to enter the market place and become accepted over existing technologies when the data demonstrates they are a better solution for the network. This is part of the Strategy's emphasis on utilizing a PBMS for inclusion of methods that can achieve multiple monitoring objectives. For parameters of interest that do not have reference methods, the strategy will be to use PBMS through a DQO process to identify both a relative standard approach to the method and acceptable error rates.

6.2 Timely Reporting of High Quality, Highly Time Resolved Ambient Air Monitoring Data

Over the last several years one of the most important emerging uses of ambient monitoring data has been public reporting of the AQI. This effort has expanded on EPA's AIRNow web site from regional based near real-time ozone mapping products color coded to the AQI to a national multi-pollutant mapping, forecasting, and data handling system of real-time data. Since ozone and $PM_{2.5}$ drive the highest reporting of the AQI in most areas, these two pollutants are the only two parameters currently reported from AIRNow. While other pollutants such as CO, SO_2, and NO_2, and PM_{10} may not drive the AQI, they are still important for forecasters and other data users to understand for model evaluation and tracking of air pollution episodes. Therefore, this Strategy seeks the following goals for sharing of NCore data in near real time:

- Share all continuous O3, $PM_{2.5}$ and PM_{10} data, where available, across the nation;
- For NCore Level 2 sites, share all gaseous CO, SO_2, NO and NOy data across the nation; and
- For NCore Level 2 sites, share all base meteorological measurements across the nation.

6.2.1 Reporting Interval of Shared Ambient Monitoring Data

The NCore networks serve multiple monitoring objectives such as support for health effects studies, AQI reporting, trends, NAAQS attainment decisions, and accountability of control strategies. For most of these objectives the current minimum 1-hour sampling period for continuous instrumentation is adequate to fulfill the needs of the data. However, there is a need from time to time to evaluate data at a higher time resolution. Examples for this include, but may not be limited to: tracking air pollution episodes, providing data for exposure studies, model evaluation, and evaluating shorter averaging periods for potential changes to the NAAQS.

Gaseous pollutant monitors are generally capable of highly time resolved data such as 5 minute averages, while only select PM instrumentation are capable of sub-hourly measurements. The hardware and software necessary in data management systems to log and report shorter averaging periods are generally already available within the agencies system. However, due to conventional telephone modem polling, many agencies may not be able to handle the timely reporting of shorter averaging periods. One widely available solution to this would be the use of internet connectivity, especially when individual monitoring sites push their data to a central server rather than being polled.

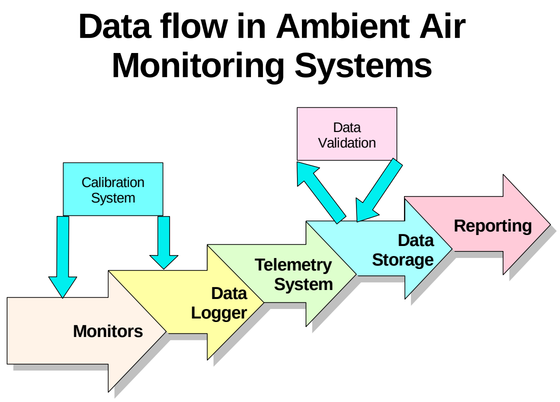
One consequence to collecting sub-hourly data is a potential increased need for validation resources. This is believed to be largely associated with the perceived need to manually validate all criteria pollutant measurements. Since validation of data generally takes place at the reporting interval of the standard, the ambient monitoring network is at a point analogous to a catch-22. That is, there is not enough motivation to move to lower averaging periods, since data need to be validated and certified at intervals that correspond to the NAAQS, yet without a robust dataset of short term data for health and exposure purposes, EPA may not have the information necessary to move toward NAAQS with shorter averaging periods, if necessary. However, sub-hourly data could still be reported with data aggregated and validated at the reporting interval of the NAAQS. Another concern is that the standard 1-hour reporting interval serves data reporting purposes for most agencies almost all the time and it is only the occasional episode where shorter term exposure data is most useful. Yet it is these very episodes that may be dictating why a monitor has been located in the area of interest. To provide a nationally consistent approach for the reporting interval of data, the NCore Level 2 and 3 networks will take a tiered approach to data reporting. At the top tier hourly data intervals will remain the standard for data reporting. Long term, the NCore networks will be capable of providing at least 5 minute intervals for those methods that have acceptable data quality at those averaging periods. For QA/QC purposes such as utilizing calibration gases, agencies should be capable on assessing data on at least a 1-minute interval.

6.2.2 Reporting Frequency and Lag Time for Reporting Data

Continuous monitoring data that are being shared in near real-time from NCore monitoring stations are to be reported each hour. Data should be reported as soon as practical after the end of each hour. For the near term, the goal is to report data within twenty minutes past the end of each hour. This will provide enough time for data processing and additional validation at the Data Management Center (DMC); generation of reports and maps; distribution of those products to a variety of stakeholders and web sites; and still allow enough time for staff review before the end of the hour. This is an important goal to support reporting of air pollution episodes on news media programs by the top of the hour. The long term goal is to report all data within five minutes after the end of an hour. This will further enhance NCore’s ability to deliver timely data within a reasonable time period that takes advantage of existing commercially available technology.

6.2.3 Information Technology Components

The areas of information technology currently run in most State and local agencies may be the most ripe for new investment. This is largely due to both the need for a national network of air monitoring that can be available in real-time to support public information needs of the data and the substantial areas of improvements that have been made in information technology since most air monitoring stations were implemented. Although commercially available information technologies may be substantially more efficient than what are currently being used by many State and local agencies, there are a number of issues to consider such as: making the best choice for investment - as today's technology may be outdated soon, costs of technical support, and how easy would it be to move to another generation of this technology once the current generation is outdated. This section identifies some of the key issues with each area of information technology supporting an ambient air monitoring program as well as desired performance capabilities of an information transfer system to serve Level 2 and 3 NCore sites.



a. Instrument to Datalogger. Most continuous monitors have the ability to output data at least two ways. For realtime or near realtime monitors, analog outputs usually have a DC voltage corresponding to a range of the concentrations. For example, in an ozone monitor, a 0 to 5 volt output might correspond to a 0 to 500 part per billion range. The analog output is fed into a data logger that has been programmed to receive the DC voltage and interpret it as a concentration of ozone. An RS232 or other digital output may also be employed. These outputs can carry a substantial amount of information beyond the concentration value. For instance: operating temperature; light intensity, if applicable; and concentration range may all be carried in addition to the actual concentration. Despite the wealth of information that can be carried across an RS232 connection, these connections are rarely used. The primary reasons for using DC voltage outputs over RS232 connections are the simplicity of receiving the concentration data by DC voltage and the lack of standard formats for the fields among vendors for the RS232 connections. Despite not using these other data available via the RS232 connection, some of the information may actually be very useful for validating data and remote troubleshooting of instruments. With the cost of storing data becoming cheaper, having an archive of these data may be an effective way to improve validation of the monitoring data. Therefore, a strong recommendation is made to utilize digital connectivity from the back of the instrument to the datalogger. Although there are several digital connectivity options that are commercially available such as RS232, ethernet, USB and Firewire, most ambient monitoring instrumentation only have RS232 available. Since the commercial world is migrating to Firewire, due to its increased speed and functionality over other options, there will be a long term goal in NCore to do the same. However, any of the digital connectivity solutions are acceptable so long as they allow for two way communication with the instrument. Note in some cases it is possible to report data directly from a monitor to a database without the use of a station datalogger. This solution is acceptable so long as the monitor is capable of data storage for periods when telemetry on off-line.

b. Datalogger to Database. Once data are on the datalogger at the ambient air monitoring station, they need to be sent to servers where they can be summarized and disseminated to data users. In most cases this will occur by using a server at the office of the SLT agency. The conventional way to get data from the monitoring stations has been to poll each of the stations individually. With more widespread availability of the internet, pushing data from monitoring sites on a regular basis will be especially effective in mapping and public reporting of data.

c. Reporting. The need to provide data to a number of users will require multiple reports of the information. For example, the public may need a near real time simple message that the air is clean or moderate. A health researcher or modeler may want a very detailed accounting of the available data in the shortest time intervals possible. Atmospheric scientists typically desire data in a relatively unprocessed yet comprehensive form with adequate descriptions (meta data) to allow for further processing for comparability to other data sets. Regulatory users generally want the data in the form that they can be compared to the NAAQS.

(i) Public Reporting and AIRNow. The area of public reporting for air monitoring data may provide the largest number of users of data. This area has been growing rapidly in the last few years as a result of the increased availability of air quality reporting, especially for ozone and $PM_{2.5}$. For public reporting of the AQI, the AIRNow web site will remain the EPA's primary medium for distribution of air monitoring data. The additional continuous monitoring parameters collected from NCore will also be reported to AIRNow. These parameters are expected to be made publicly available for sharing throughout technical user communities. However, they are not expected to be widely distributed through AIRNow as products for public consumption.

(ii) AQS Reporting. Air monitoring data from NCore level 2 and 3 are to be supplied to AQS after validation by the SLT Agency. In early 2002, EPA implemented its new AQS system. The new system has much more functionality than the previous main-frame system. However, while AQS is fully functional, there remains a perception that data access is difficult.

As a first step to better integrate the AIRNow and AQS datasets, a common format will be sought that will allow for reporting to both databases in the same format. By moving to a common format, data analysis tools that are developed for one system should be able to be applied to both systems. This should help alleviate perceptions about AQS access as these tools will allow users to access and interface with AQS. The format is expected to be in XML. Use of XML as a data format is consistent with EPA and Federal guidelines towards better data integration and sharing.

d. Summary of Desired Performance for Information Transfer Systems to Support National Core Network of Ambient Air Monitoring Stations. Currently, most agencies are using the same information technology systems to record and move data from ambient monitoring stations that were implemented in the 1980's. Due to incredible improvements in processing speed and storage capacity as well as the throughput capabilities to move data, some information technology systems currently in use may be antiquated. If one considers future needs of NCore network stations such as automated low level validation and national near-real time delivery of multi-pollutant data, very few systems as currently run can meet these needs. However, in some cases systems may be adaptable to desired performance capabilities simply by upgrading the telemetry or adding additional features to existing systems. Other systems may need to be replaced entirely to meet the needs of NCore. This section summarizes the desired performance capabilities of an information transfer system to serve NCore Level 2 and 3 sites.

(i) Information Technology Performance Criteria. To define the needed performance criteria of a state-of-the art information technology system, a table of needs has been developed. This table provides performance needs for an optimal information technology system, but is not intended to address what the individual components should look like. For instance, once low level validated data for a specific time period were ready to leave the monitoring station a number of telemetry systems may actually accomplish moving those data. By identifying the needed performance criteria of moving data rather than the actual system to move it monitoring agencies may be free to identify the most optimal system for their network. Table 6-1 summarizes the performance elements of the Data Management Systems used to log, transfer, validate, and report data from NCore ambient air monitoring stations.

Table 6-1.National Core Network (Level 2 and 3) Information Technology Performance Needs		
Performance Element	**Performance Criteria**	**Notes**
Sample Periods	5 minutes (long term goal), and 1 hour data (current standard)	5 minutes and 1 hour data to support exposure, mapping and modeling. 1 hour data for Air Quality Index reporting and NAAQS. Sample period may need to be higher for certain pollutant measurement systems depending on method sample period and measurement precision when averaging small time periods.
Data Delivery	Near Term goal - Within 20 minutes nationally each hour. Long term goal - Within 5 minutes nationally each hour.	As agencies migrate to new telemetry systems the goal will be to report data within 5 minutes. This should be easily obtained with broadband pushing of data to a central server.
Low Level Validation	- Last automated zero and QC check acceptable - Range check acceptable - Shelter parameters acceptable - Instrument parameters acceptable	Other validation should be applied as available: - site to site checks - rate of change - lack of change
Data Availability	- all qc data, operator notes, calibrations, and pollutant data within network - Low level validated pollutant data externally	Create log of all monitoring related activities internally. Allow only validated data to leave agency network.
Types of monitoring data to disseminate - externally	- continuous and semi-continuous pollutant data - accompanying meteorological data	- associated manual method supporting data (for instance FRM ambient Temperature) should be collected, but not reported externally
Additional data for internal tracking	- Status of ancillary equipment such as shelter temperature, power surges, zero air system, calibration system.	
Relevant site information	Latitude, longitude, altitude, land use category, scale of representativeness, pictures and map of area.	Other site information may be necessary
Remote calibration	Ability to initiate automated calibrations on regular schedule or as needed.	
Reviewing calibrations	- allow for 1 minute data as part of electronic calibration log	
Initialization of manual collection methods	Need to be able to remotely initiate these or have them set at an action level from a specific monitor	
Reporting Format	Short Term - Maintain "Obs" file format and pipe delimited formats for AIRNow and AQS reporting, respectively Near Term - XML	Need to coordinate development of XML schema with multiple stakeholders. XML is an open format that will be able to be read by most applications.

(ii) Other Performance Considerations. While some of the desired performance criteria can be identified in units such as sample period or data delivery time, others are more qualitative in nature. The following list identifies some of the other important considerations of an information transfer to support NCore:

Allow for network time synchronization of all monitoring stations:

- Have battery back-up such as a UPS to ensure no data loss during power outage;
-
- Have information transfer system be self initializing so that if power is interrupted (even with a UPS) the system will go back on-line;
-
- Graphical display of data;
- Ability to provide math operations of data;
- Automated AQS reporting after full validation.

6.3 Measurement Methods for Use within NCore

This section focuses on the measurement methods to be implemented at Level 2 and 3 sites, with a focus on the additional measurement methods for NCore Level 2 that are not currently part of the routine monitoring networks.

When possible, continuous methods should be implemented over manual methods. This is important for several reasons. The highest motivating factor for this is the need to deliver data with a high temporal resolution so that the atmosphere can be characterized on a time scale relevant to how it changes and how people are exposed. On the resource side, continuous instruments are usually much less resource intensive to operate, have a higher sample frequency, provide for greater precision due to reduced human intervention, are easier to automate with respect to data delivery, and their data are easier to validate. Realistically, there will continue to be a necessary mix of continuous and integrated (e.g., filter, canister, cartridge, denuder) sytems in the networks for three important reasons:

- Integrated samples allow for more extensive chemical and physical property analysis in the laboratory,
- Due to uneven performance characteristics exhibited by continuous methods, collocated integrated measurements enable appropriate transformations of continuous data that improve the quantification attributes of continuous data (the basis for regional approved continuos $PM_{2.5}$ methods), and
- Retention of integrated methods allows for smooth transitioning to new continuous technologies with minimal compromising on the ability to construct air quality trends analyses.

The broad longer term goal is to transition from a network that consists of nearly 80% integrated and 20% continuous methods to a near reversal where continuous methods are the dominant moniotring approach. The descriptions below provide the specific monitoring areas of investment being considered in this Strategy.

The minimum requirements for measurements at Level 2 and 3 are as follows:

- **NCore Level 2 Measurements:**
  - Continuous PM_{10} (or $PM_{(10-2.5)}$) and $PM_{2.5}$ Mass
  - Filter-based FRM $PM_{2.5}$ Mass
  - Continuous, trace level CO, SO_2
  - Ozone
  - Continuous NO and NOy
  - Monthly averaged nitric acid and ammonia through denuders
  - Surface meteorology (temperature, relative humidity, wind speed, wind direction)

- **NCore Level 3 Measurements (criteria pollutants):**
  - Mostly $PM_{2.5}$ and ozone
  - Lead, CO, SO_2, and PM_{10} only as needed

The principal pieces of the NCore Level 2 and 3 sites are summarized in the following subsections.

6.3.1 NCore Trace Gas Monitoring

One of the major areas of investment in the Strategy is the use of trace gas analyzers for the characterization of CO, SO_2, NO_2 and NOy at NCore Level 2 monitoring stations. These trace gas analyzers are basically the same instrumentation as approved reference and equivalent methods; however, modifications to improve the sensitivity of the measurement have been made. By utilizing trace gas analyzers instead of conventional gas analyzers, not only can agencies still determine compliance with the NAAQS but they can also provide valid measurements at much lower detection limits. The ability to provide data at lower detection limits will allow for better characterization of confounding factors associated with air pollution episodes since trace gas measurements at NCore Level 2 sites will be collocated. Also, improved gas monitoring data will allow for reducing uncertainties in datasets used to model air pollution episodes and enhance an array of multiple factor based source apportionment analyses. However, the true measurement objective is to characterize actual levels of these gases. In most cases, conversion to trace gas methods and associated calibration regimes will be necessary given the low levels of these pollutants in many “representative” NCore Level 2 sites. There will be locations in urban areas where the levels of these gases remain in the more conventional ranges and, therefore, not require conversion to new trace gas monitors. Clearly, these situations need to be addressed on a case- by-case basis.

The majority of ambient air gas analyzers in operation across the United States were implemented for purposes of comparing data to the NAAQS. Analysis of these data has shown that the majority of areas of the country are in attainment for the CO, SO_2, and NO_2 standards. NOy measurements are used to characterize total reactive nitrogen and there is no NAAQS for this. However, when measuring for NOy and the concentrations are below the NAAQS for NO_2, it can be assumed the monitor is demonstrating attainment of NO_2.

6.3.2 Ozone Monitoring

The ozone monitoring network is expected to remain one of the spatially rich monitoring programs implemented throughout the United States. Through network assessments their may be opportunities to relocate a small number of ozone monitoring sites from areas of high monitor density to areas of low density.

Although a large network of ozone monitors exists in the United States, there may be opportunities to make better use of the ozone network. This could potentially involve areas of technology and planning associated with ozone monitoring identified below:

- Realignment of monitors: as described in other sections there may be a large opportunity to divest of some redundant urban monitoring and relocate those monitors in areas outside the urban environment in order to detect the spatial gradient of ozone. This is expected to be largely accomplished through the assessments performed across regional areas.

- Providing enhanced ozone QA such as increased use of ozone calibrators.

- Maintaining a minimum number of ozone monitors at NCore Level 2 sites ***operating on a year round basis*** to provide a better understanding of ozone seasonal differences and interactions with other pollutants.

6.3.3 PM Continuous Mass Monitoring

A strong push for PM continuous methods is a major component of the Strategy. EPA has developed an ambitious continuous monitoring implementation plan that was borne out of requests from State and local agencies (specifically through SAMWG) and from the CASAC Subcommittee on PM monitoring. Revision two of the plan is available within Section 6 of the Monitoring Strategy Document web site at:
http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/sec6.pdf

Some of the major features of the PM continuous monitoring strategy include:

- support for a hybrid network of several hundred PM continuous monitors with a lesser number of FRM samplers;

- using performance based criteria developed in a DQO process to determine the acceptability of PM continuous monitors in the individual networks that they are used; and

- a parallel DQO approach for approval and applicability of methods on a national basis.

The goal of the PM continuous monitoring strategy is to have a PM monitoring network that can meet multiple monitoring objectives at lower cost.

6.3.4 Continuous Speciation Monitoring

Continuous or semi-continuous monitoring provides the ability for monitoring networks to deliver data with a high temporal resolution so that the atmosphere can be characterized on a time scale relevant to how it changes and how people are exposed under dynamic processes. The NCore sites are not required to operate continuous speciation samplers, with the exception of 22 National Air Toxics Trend Sites (NATTS) that include light absorbing carbon measurements through aethalometry. Nevertheless, there should be a gradual evolution of continuous sampler operations at NCore Level 2 and comparable sites. Indeed, EPA is committed to supporting a 10-site continuous speciation network, including carbon, sulfate and nitrate, that evolved from early discussions with the health effects community related to a series of recommendations forwarded by the National Academy of Sciences in the late 1990's and continued by CASAC. EPA is taking a decidedly cautious approach toward continuous speciation monitoring, based largely on findings from the Supersites and other programs indicating mixed performance across a variety of monitors.

a. Continuous Carbon, Ions and Trace Metals. Within the past two years, continuous monitors for these three species have become commercially available. Based on similar sample collection and analysis methodologies, these devices involve the impaction of atmospheric $PM_{2.5}$ aerosols on a metal strip with subsequent flash volatilization of the species, thermal/catalytic conversion, and final detection with either ultraviolet (uv) fluorescence, chemiluminescence, or infrared absorption, as appropriate. EPA and selected State agencies have been conducting a comparative assessment of these technologies collocated with conventional 24-hr filter collection speciation samplers at five STN sites across the country. Results from that work indicates operational issues with the effectiveness of the flash volatilization process and/or thermal/catalytic conversion efficiencies. Current work involves modification/adjustment of the monitors to resolve these issues after which EPA plans to expand the further use of the monitors to a minimum of 10 STN sites (Table 6-2).

New research has focused on the application of coupling ion chromatography with aerosol collection and in parallel with criteria air pollutant sampling to provide complete gaseous and aerosol species monitoring. These methods may offer the advantage of freedom from artifacts but may also present design and operational challenges with adapting liquid media-based chemical analysis to routine field monitoring use.

(i) Support for health effects studies. The 10 speciation sites with continuous speciation monitors was initiated largely in response to the National Academy of Sciences recommendation to provide a set of daily operating speciation sites to support health effects studies. Uneven performance of continuous monitors exhibited through the comparative assessment study and the $PM_{2.5}$ Supersites program has delayed implementation of this network.

Table 6-2. Current and Planned Continuous Speciation Sites (urban)

Site Location	**Current or Planned Measurements**	**Comments**
Deer Park, TX	NO_3, SO_4, C	one of first five evaluation sites
Indianapolis, IN	NO_3, SO_4, C	one of first five evaluation sites
Chicago, IL	NO_3, SO_4, C	one of first five evaluation sites
Phoenix, AZ	NO_3, SO_4, C	one of first five evaluation sites
Seattle, WA	NO_3, SO_4, C	one of first five evaluation sites
Atlanta, GA	NO_3, SO_4, C	
Salt Lake City, UT	NO_3, SO_4, C	
Fargo, ND	NO_3, SO_4, C	
Los Angeles, CA	NO_3, SO_4, C	
Fresno, CA	NO_3, SO_4, C	
NYC (Bronx), NY	NO_3, SO_4, C	
Raleigh, NC	NO_3, SO_4, C	

(ii) Regional Planning Organizations (RPO's) . RPOs formed for the purpose of assessing regional haze have initiated continuous speciation monitoring in rural locations (Table 6-3). Typical suite of measurements at these sites include:

- continuous [hourly] $PM_{2.5}$
- surface meteorology
- $PM_{2.5}$ speciation, trends or IMPROVE or "IMPROVE protocol" 3rd-day filter 24-hour average measurements for carbon, ions/elements and $PM_{2.5}/PM_{10}$
- visuals (HazeCam)
- continuous sulfate
- hourly EC/OC/OP

- light scattering [(NGN-2 (wet) "Improve-like" nephelometer]
- trace level sulfur dioxide
- ozone

Table 6-3. Regional Planning Organization (RPO) sites with a subset of continuous speciation monitors.

Location	**RPO/site type**	**Known or expected measurements beyond the standard suite**
Raleigh, NC (Milbrook)	VISTAS RPO/ suburban scale	standard suite
Look Rock, TN	VISTAS RPO/rural Great Smokey Mountains NP (Class I)	standard suite
Cape Romaine, SC (Near Charleston, SC)	VISTAS RPO/rural Cape Romain NWR (Class I area) Southeast Coastline	standard suite
Frostburg, MD	Mane-VU/MARAMA/rural Western Maryland	trace CO; NOy; Profiler
Cornwall, CT:	Mane-VU RPO/rural Mohawk Mtn	standard suite
Bar Harbor, ME:	Mane-VU RPO/rural Acadia NP/(Class I)	trace CO
Bondville, IL	Midwest RPO /suburban	continuous ammonia, nitric acid, nitrous acid, sulfur dioxide
St Louis, MO	Midwest RPO, urban (original EPA funded supersite)	Sunset Lab continuous carbon monitor

b. Nitric Acid and Ammonia Monitoring. Both nitric acid and ammonia are important precursor gases to major aerosol components nitrate and sulfate. There is an important need for these measurements to support air quality model and emission inventory evaluations, and to track the long term progress of emission reduction strategies targeting nitrogen species. Combined with the critical multi-media roles associated with watershed acidification and eutrophication, measurements of these compounds demand a place in the national networks. To initiate national level ammonia and nitric acid monitoring, the NCore Level 2 sites will include integrated samples at a one-per-month interval to limit operator burden and overall resource expenditures. The expectation is that the inclusion of integrated measurements will foster the development of continuous methods that can be used in routine network operations.

(i) Nitric acid. In the past, time-integrated systems for sampling and collection of nitric acid have been widely used. These systems use either filter packs or a combination of coated diffusion tubes followed by filter packs for sampling at the monitoring site, and the samples are then transported to a laboratory for analysis. These systems typically collect samples over a time period of several hours and are therefore limited in providing fine temporal concentration resolution. A major problem associated with nitric acid detection by point monitors is transport through the system inlet. Studies are needed to identify the best transport tubing for real-time measurements.

Thermal denuders with selective coating, such as tungstic acid, have been used for semi-continuous monitoring with data resolution of 30 minutes or less. The denuders are thermally desorbed and measured by a chemiluminescence detector. Several versions of parallel-operated denuder systems have been developed which also are coupled to chemiluminescent detectors for semi-continuous measurement of nitric acid and ammonium nitrate by difference calculations. Commercial chemiluminescence monitors for NO have been modified to design real-time nitric acid detectors using two inlets, one with only a particle filter and the second with a particle filter and a nylon filter. The difference signal is attributed to nitric acid.

Wet denuders have been developed in which nitric acid is captured in a aqueous system using diffusion scrubbers, or parallel-plate-wetted denuders followed by ion chromatographic or colorimetric analyses. Prototype instruments have been field tested which provide up to 10-minute resolution at a detection limit of 10 ppt.

Real-time measurement of nitric acid has been possible using chemical ionization mass spectrometry with detection limits of less than 15 ppt for a one-second sample interval. Systems employing tunable diode laser absorption spectroscopy and open-path, multi-pass Fourier transform infrared spectroscopy have been successfully operated for monitoring nitric acid by interpretation of IR spectra. For nitric acid, the published detection limits are 4 ppb for the diode laser and 10ppb for the Fourier transform instrument.

(ii) Ammonia Monitoring. Similar to measurement of nitric acid, ambient ammonia monitoring can be accomplished using a variety of time-integrated sampling methods and continuous, real-time, or near real-time measurements. The most prevalent time-integrated methods involve the use of acid scrubbers such as sulfuric acid, phosphoric or boric acid to collect ammonia followed by laboratory analysis using ion chromatography. Although these methods are inexpensive and relatively simple to implement, they do have the limitation that temporal resolution is dictated by the sample collection time, and the concentrations are not known until after laboratory analysis. Other time-integrated methods involve the use of gas sorbent detector tubes or passive diffusion devices or denuders of various designs (annular or honeycomb) coated with boric, oxalic, phosphorous and citric acids or sodium bisulfate.

Chemiluminescence monitors are widely used and are probably the most popular means of measuring ambient ammonia concentrations. These monitors do not actually measure ammonia directly, rather they determine the ammonia concentration by difference. In these monitors, the ammonia must be oxidized to nitric oxide by a thermal converter and the nitric oxide is then further oxidized using ozone to produce nitrogen dioxide whose luminescence is measured. By using two thermal convertors operating at temperatures which either oxidize all nitrogen species or all components excluding ammonia, a difference signal is produced to represent the ammonia concentration. However since organic nitrogen compounds and nitric acid are known interferences, ammonia specific scrubbers have been adapted to the monitors to adjust the measurements. These types of instruments can typically detect ammonia down to approximately 1 ppb.

Several optical systems have been adapted for use in real-time ammonia monitoring. These include: differential optical absorption spectroscopy (DOAS), Fourier transform infrared spectroscopy (FTIR), tunable diode laser absorption spectroscopy (TDLAS), photoacoustic spectroscopy, and ion mobility spectroscopy. Recently, several research field studies using photoacoustic spectrometers have monitored ammonia concentrations as low as 0.1ppb with good accuracy over a range from 1 ppb to 3ppm.

c. Deployment of Continuous Speciation Monitors. All of the identified monitoring technologies, whether under development or commercially-available, offer the potential for providing either real-time, or short time-averaged species data which will undoubtedly aid the health effects research and model development communities who both are in need of highly temporally-resolved monitoring data. However, given the limited practical field applications of emerging monitoring technologies, EPA strongly advises that these new systems be collocated with integrating methods for ensuring comparative assessments and eventual data transformation. Such technologies should be encouraged for use at NCore Level 2 sites where there will be both time-integrated samplers as well as continuous gaseous monitors which will offer the ideal opportunity for both comparative assessments and data integration.

(i) Aethalometers.   The SAMWG Subcommittee recommended the use of Aethalometers™ at every urban site in the NATTS. These instruments have been added to the network to measure black carbon (BC). The intent of using this instrument is to develop an indicator for diesel emissions. Technical guidance can be found in the NATTS Technical Assistance Document (TAD) found at http://www.epa.gov/ttn/amtic/airtxfil.html.

Aerosol BC is a primary emission from combustion sources. BC is ubiquitous and absorbs light. It can be found in diesel exhaust, but it is also emitted from all incomplete combustion sources together with other species such as toxic and carcinogenic organic compounds. The Aethalometer is a semi-continuous instrument that measures BC using a continuous filtration and optical transmission technique. The light attenuation through a sample spot and a blank reference are used to determine light absorption. The absorption is converted to black carbon (BC) using an absorption coefficient. The single beam Aethalometer (880 nm) is being used for the NATTS. An estimated detection limit of 0.05 $\mu g/m^3$ BC for a 5-minute average is expected. Since no BC or elemental carbon (EC) particulate standards are available for use in calibrating this monitor, only flow rate calibration using a NIST-traceable device is possible. Although the Aethalometer will not specifically measure diesel PM, it will be used in conjunction with other supportive information (e.g., meteorology, measurement of other toxic pollutants, traffic patterns) to assess the impact of diesel emissions in the NATTS.

6.4 Method Implementation Strategy

6.4.1 NCore Level 1

The Level 1 sites will have a great amount of flexibility and will serve to develop methods, perform research and transfer new technologies and information to the Level 2 network. Because of this flexibility, the actual methods to be implemented are largely unknown; however, these platforms will be structured to meet the overall Strategy method development needs.

6.4.2 NCore Level 2

The minimum measurements required at NCore Level 2 sites require the implementation of some advanced continuous and semi-continuous measurement technologies. With the exception of trace level CO, SO_2 and NOy, Level 2 measurements can be made using methods that are currently available in 40 CFR and the QA guidance provided in the QA Handbook http://www.epa.gov/ttn/amtic/qabook.html. Trace level CO, SO_2 and NOy will require the development of additional technical guidance to allow implementation at NCore. The following provides and outline of the implementation strategy by measurement type needed.

- ***Filter-based FRM $PM_{2.5}$ Mass and Ozone****:* Approved FRM and FEMs will be used to implement the procedures described in 40 CFR Part 50, Appendix D and L.

- ***Continuous PM_{10}/$PM_{10\text{-}2.5}$***: EPA anticipates a forthcoming requirement to measure $PM_{10\text{-}2.5}$ to support implementation of emerging PM NAAQS. Forthcoming guidance on $PM_{10\text{-}2.5}$ monitors will provide the basis for implementation. Clearly, $PM_{10\text{-}2.5}$ will be phased in the latter stages of NCore 2 network.

- ***Continuous $PM_{2.5}$ Mass****:* These methods will be implemented through the strategy outlined in the "Continuous Monitoring Implementation Plan. These methods may include, but are not limited to TEOMs, beta attenuation monitors (BAM), beta gauges, and nephelometers. A summary of the continuous monitoring implementation plan is provided in Section 6.5.4b, below.

- ***Basic Surface Meteorology****:* Temperature, relative humidity, wind speed, and wind direction measurements will obtained through a variety of methods described in the guidance provided in "Meteorological Monitoring Guidance for Regulatory Modeling Applications", EPA-454/R-99-005, February 2000 (http://www.epa.gov/scram001/guidance/met/mmgrma.pdf). These methods include (but are not limited to) anemometers, wind vanes, resistance temperature detectors, and hygrometers.

- ***Total Reactive Oxides of Nitrogen (NO_y):*** NO_y measurement methods will be based on the technical guidance prepared for PAMS in June of 2000. This guidance lacks calibration procedures that include difficult-to-convert organic nitrate compounds (e.g., n-propylnitrate) to provide a more stringent test of converter efficiency. Implementation of NO_y monitoring methods will require an update to the existing PAMS guidance to incorporate new calibration procedures.

- ***Continuous, trace level CO:*** Commercially available, non-dispersive infrared (NDIR) monitors that include modifications to enhance performance and offer "high-sensitivity"options to meet the requirements of monitoring non-urban air will be implemented. The principal constraints on lower detection limits of these devices are water vapor interference and background drift. These limitations can be reduced by drying the sample air and frequent chemical zeroing of the baseline and are modifications currently done manually by the user. Prior to implementation, technical guidance will be developed that includes a detailed description of the interferences and limitations and how to address them to obtain trace level measurements.

- ***Continuous trace level SO_2:*** Measurements of SO_2 suffer similar issues with sensitivity in rural areas as CO. Technical guidance will be developed prior to implementation of trace level SO_2 measurements.

- ***Direct NO_2:*** Measurement methods will be incorporated as the measurement technology advances and is commercially available. The EPA Office of Research and Development (ORD) is currently evaluating prototype instruments.

- ***Integrated nitric acid and ammonia***: Low volume denuder methods will be deployed at all Level 2 sites operating on a one sample per month frequency to minimize operator burden and laboratory anlysis costs. Sampling through denuders and subsequent extraction and analysis is considered a routine operation, and will initiate the developnment of a consistent and reliable national data base on these important precursor gases. The introduction of simple integrated measurements is expected to spur development of routine continuous monitors for eventual deployment.

6.4.3 NCore Level 3

NCore Level 3 sites will continue to implement the FRM and FEM (or Network approved methods as is expected to be developed for regional equivalency of $PM_{2.5}$ continuous methods) required for criteria pollutant monitoring and attainment/non-attainment decisions as currently described in 40 CFR, Part 50. Level 3 sites will mainly target ozone and $PM_{2.5}$ mass. No new monitoring technologies or methods will need to be developed for implementation.

6.4.4 Organic aerosol speciation (not required)

The EPA is working with technical experts in the field of molecular markers for organic carbon to develop a technical assistance document (TAD) on the use of molecular marker measurements to assess the origin of carbonaceous particulate matter. This TAD will be used to help educate, inform and guide SLTs in the use of molecular markers or tracers for source attribution. The primary focus will be on the source attribution aspects with a lesser focus on sampling and analysis. The document will provide a discussion of the current molecular markers and their sources, strategies to address unknown sources, new tracer species, the use of tracers in source apportionment modeling, strategies for atmospheric sampling, considerations for source sampling, and requirements for chemical analysis. It is expected that this document will be completed by Fall 2004.

a. Implementation Products and Deliverables. Technical method guidance documents will be prepared to guide SLT's in the proper installation and operation of NOy and the trace level CO and SO_2 instruments. This method guidance will provide information on the setup, installation, configuration, operation and calibration of these instruments. This guidance is expected to be completed by the end of 2004. In addition, SOPs that are prepared for EPA's on-site operation of these types of equipment will be shared with SLT monitoring agencies.

The implementation of NCore Level 2 and 3 measurement methods will require training. It is expected that training will be provided by the EPA, equipment manufacturers, and SLT monitoring agencies. The EPA's ambient methods training program will focus on instrument operations and procedures. The EPA uses a variety of mechanisms for both formal and informal training. These include workshops, satellite and video training, technical assistance, guidance documents and the EPA 's Ambient Monitoring Technology Information Center web site at http://www.epa.gov/ttn/amtic/. A public forum area is also available on this page which allows users to submit questions on monitoring. The overall monitoring Strategy training implementation program is discussed as part of the implementation plan outlined in Section 11.

b. PM Continuous Monitoring Implementation Plan Summary. An enlarged continuous PM monitoring network will improve public data reporting and mapping, support air pollution studies more fully by providing continuous (i.e., hourly) particulate measurements, and decrease the resource requirements of operating a large network of nearly 1000 filter-based reference particulate samplers. The continuous monitoring implementation plan provides recommended directional guidance to move forward in deploying a valued continuous PM monitoring program operated by SLT governments. A range of topics are addressed, including relationships between continuous and reference measurements, performance analyses of collocated continuous and filter based samplers, recommended performance criteria, regulatory modifications, and identification of outstanding technical issues and actions to be taken in the near future.

The plan proposes a hybrid network of filter based and continuous mass samplers. The hybrid network would include a reduced number of existing FRM samplers for direct comparison to the NAAQS and continuous samplers that meet specified performance criteria related to their ability to produce sound comparisons to FRM data. Two approaches for integrating continuous mass monitors are proposed to maximize flexibility: FEMs and an expanded use of non-designated approved methods identified as Regional Approved Methods. For FEMs, new equivalency criteria will be derived, based upon a data quality objective exercise that match the required performance criteria with the needs of the data. Regional approved methods are analogous to the Regional Equivalent Monitors (REMs) described in the continuous monitoring implementation plan. These monitors will be approved in individual SLT NCore networks where data quality meets specified criteria.

For Regional approved methods, three performance criteria are proposed to determine whether the adjusted continuous measurements are sufficiently comparable to be integrated into the $PM_{2.5}$ network. These criteria are bias (relative to a filter-based reference method) between -10% and +10%, measurement precision (data from two collocated continuous monitors) less than 10% coefficient of variance (CV), and a correlation coefficient of 0.93 (squared correlation of 0.87). The bias and precision criteria are the result of a DQO analysis that is based on data from the existing $PM_{2.5}$ network and an assumption that the annual $PM_{2.5}$ air quality standard is the principal decision driver. In a DQO analyses for the daily standard, continuous monitors, which provide what amounts to a daily sampling frequency were demonstrated to have less uncertainty around a potential decision than filter based referenced methods at lower sample frequencies, all other things being equal. Thus, use of approved continuous monitors at sites near the daily standard should be an improvement over filter based samplers with lower sample frequencies. Also, the DQO result is conservative in that the goals estimate decision error rates for the “worst case” scenarios. In cases that are not “worst,” the DQO approach allows for additional flexibility beyond the stated bias and precision goals. The correlation criteria identified was selected based on the empirical evidence of the current $PM_{2.5}$ continuous monitoring network and a DQO exercise to determine what observed correlation coefficient is acceptable for use with $PM_{2.5}$ continuous methods. These performance criteria preferably would be demonstrated by monitoring agency staff independently or in cooperation with instrument manufacturers under actual operational conditions, a departure from the very tightly controlled approach used for national equivalency demonstration. Continuous monitors would be validated periodically in recognition of changing aerosol composition and instrument performance. Performance criteria for use on a national basis for FEMs are being derived in a DQO exercise that in on-going. The major emphasis in this DQO exercise is to tie historical equivalency criteria that use Slope, intercept, and correlation with network operation DQOs that use bias and precision. The major advantage from a DQO perspective for using $PM_{2.5}$ continuous monitors over filter based FRMs is that they provide data every day. Many FRM sites operate on sample frequencies of once every third day or once very sixth day. Having a method that provides a sample every day will reduce the uncertainty of a decision with the data as compared to a method on a lower sample frequency, all other inputs being equal.

c. Use of Performance Based Approaches. A PBMS approach will be built into the Strategy for non compliance-based measurements. This approach allows for flexibility in the measurement methods used and will help to foster the development and implementation of newly-advanced, continuous measurement technologies. The PBMS concept is a process that defines data quality needs and develops data quality 'indicators' (DQIs) or criteria for which to select or accept new or revised methods. PBMS will be developed and implemented in concert with the QA strategy and DQO processes that are necessary to develop and identify specific method acceptance criteria. At this time, the PBMS process for the Strategy has not been developed. The will be a critical component of the Strategy as new technologies are ready for implementation into the routine Level 2 monitoring network. It would be expected that Level 2 sites would begin development in 2004 and the full suite of Level 2 sites would be completed by January 2007.

6.5 Issues

Despite the need to invest in many areas of the ambient air monitoring program, investing blindly may never result in an improved system. Some concerns that have been brought to the attention of the Technology workgroup from both within the group and external to it are identified below. As appropriate, some possible solutions to each of these issues are also presented:

- Making the right choice for a technology. For any one type of technology there may be several choices to consider. The most cost effective choice right now may be outdated in a year. Making the right choice needs careful consideration and even then the choice may be optimum.

- Transition from current to new technology. Need to consider things such as downtime of systems and a contingency plan if the new systems fail.

- Training of Staff. New technologies may require a higher level of expertise than the old system it was replacing. Need to adequately plan for major shifts in technology.

- Technical service. Need to consider what, if any service plan would accompany any new technology. This may affect the true cost of the technology. Also, need to consider the responsiveness of technical service.

- Use of proprietary software. Need to consider the issues regarding the use of software that is not in the public domain.

- Ability to transfer to new technologies at a future time. Agencies need to be careful to select technologies that do not prevent them from selecting a newer technology down the road.

- Identification of appropriate technical specifications to be included on purchase requests so that air monitoring agencies make the right purchase of equipment. This is especially important regarding technologies that may have similar features; however, the lower cost product is inferior and leads to substantial problems to the end user. If purchasing agents are given an appropriate amount of detail in the technical specification selection of the inferior technology may be avoided.

6.6 Implementation - Technologies to Use in NCore

The technologies used in the ambient air monitoring program cover all hardware and software used in the measurement, calibration, logging, transfer, storage, validation, and reporting of data. Many of the areas identified are already using state of the art technologies. For instance, much of the gaseous criteria pollutants are measured using continuous monitors with automated features for calibration and data output. However, other areas such as data transfer are relying on technologies that may be outdated. In some cases a technology may be somewhat antiquated; however, because it is operating smoothly and satisfying the needs of the data users, it may not be an opportune area for investment.

Table 6-4 below breaks down the major technology areas of the ambient air monitoring program into individual technology elements, summarizes the state of technology used in a typical ambient air monitoring program, provides recommendations for each technology element and provides a statement of the expected benefit of moving to this element:

Table 6-4 National Monitoring Strategy Technology Implementation Investments			
Technology Element	**State of Technologies used in typical Program**	**Recommendations**	**Expected Benefit**
Data Management Systems - recording of data from back of instrument to datalogger	Analog connection	Move to digital capture of data. Could be RS232, Ethernet, FireWire...	Allows tracking of instrument performance beyond just concentration. Allows for improved remote troubleshooting and two way communication directly to instrument.
Telemetry systems	Everything from low baud modems used on standard telephone lines to satellite, cable modem, DSL and other high speed internet systems.	Focus on performance needs of moving low interval data very quickly to support real time reporting and other data uses. Choose most optimal telemetry system depending on availability in area of monitoring.	Improves timely reporting of data. In many cases there may actually be a reduced cost for utilizing broadband over dial-up modems due to avoiding long distance charges
Data Validation	Limited range checks are used on most systems.	Move toward comprehensive automated QC systems with graphical display of data and point and click validation	Reduced manual validation. Automated QC features improves quality of real-time reported data.
Data Reporting Format	For AQS reporting, bar delimited format is used. For AIRNow reporting, “Obs” file format is used.	Move to common “XML” schema that can serve both reporting needs	XML is an open format that will be able to be read by most applications. By utilizing one format data analyses tools that are developed for one system will be compatible with both systems.
Gas pollutants - CO, SO_2, NO_2/NOy	Approved Reference and Equivalent Methods.	Trace gas analyzers that are also approved as Reference and Equivalent Methods	Allows for tracking of trends and signals that may be important. Allows for better model evaluation.
Gaseous criteria calibration systems	Mixed - Everything from fully automated to manual	Move all agencies towards fully automated systems	Improved data quality
$PM_{2.5}$ monitoring	Approximately 1000 filter based FRMs and over 300 $PM_{2.5}$ continuous monitors	Develop hybrid network of continuous and filter based monitoring to reduce dependency on filter network and optimize resources	Better spatial characterization of $PM_{2.5}$ for episodes. Improved temporal characterization. Reduced operating costs.

6.7 Recommendations

There are several recommendations to include in the Strategy. Although many of the details are described above, this section summarizes those recommendations in a concise manner:

- Reporting of all continuous data from NCore Level 2 as well as all ozone and $PM_{2.5}$ from all Level 3 sites in 1-hour intervals each hour to a real-time data base;

- Implementation of trace gas analyzers for CO, SO_2, NO_2 and NOy at NCore Level 2 monitoring stations;

- Optimization of gaseous pollutant quality assurance, including automation of routine calibrations at all sites;
- Implementation of a hybrid network of PM monitors that provides for a substantial divestment of filter based monitoring and investment in continuous monitoring.

Section 7. Ambient Air Quality Monitoring Quality System Strategy

A re-thinking of the processes of ensuring acceptable data quality must accompany the overall re-thinking of the monitoring processes. This section will address a strategy for the review and, if necessary, redevelopment of a quality system that is germane, flexible where necessary, and responsive to changes in the monitoring program. A QA Strategy Workgroup has been engaged in this process since 2000. The QA Strategy Document (www.epa.gov/ttn/amtic/geninfo.html) and its subsequent summary provide the detail of what the Workgroup considered the primary activities and goals for a three-year period. This section will provide a status of accomplishments to date, address future activities and the means to get there.

7.1 The Quality System

A quality system is defined as a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, assessing, and reporting worked performed by the organization and for carrying out required QA and quality control (QC). The primary requirements or elements for the Ambient Air Monitoring Program quality system will be described in 40 CFR Part 58 Appendix A and in guidance format in the QA Handbook for Air Pollution Measurement System Volume II. These elements are identified in Table 7-1.

Table 7-1 QA Element and Activity List

Quality System Elements	Activities
Planning	▸ Data Quality Objectives ▸ Performance Based Measurement Approach ▸ Regulation Development ▸ Graded approach to QA - QMPs/ QAPPs and SOPs ▸ Guidance Documents
Implementation	▸ Training ▸ Internal Quality Control Activities ▸ Data verification/validation ▸ Data Certification
Assessment/ Reporting	▸ Site Characterizations ▸ Performance Evaluations (NPAP, PEP, Region/SLT Performance audits) ▸ Assessment of Quality Systems & Technical Systems Audits ▸ Data Quality Assessments ▸ QA Reports

7.2 Planning Activities

7.2.1 Development of Data Quality Objectives

The DQO Process provides a general framework for ensuring that the data collected by EPA meets the needs of decision makers and data users. The process establishes the link between the specific end use(s) of the data with the data collection process which in turn identifies the quality and quantity of data needed to meet a program's goals The result of the DQO process is a series of data quality indicators (e.g., precision, bias, completeness, detectability) and acceptance requirements (called measurement quality objectives) for those indicators.

OAQPS will be responsible for developing DQOs for federally mandated data collection efforts such as the NCore Level 2 objectives and for the traditional NAAQS (NCore Level 3) comparisons. DQOs for other data collection activities (i.e., DQOs for non-trends speciation sites) would be the responsibility of the SLTs using the graded approach to QA described later in this section. DQOs will be developed based upon resource availability and priorities set by the NMSC, but would be expected to be completed in a two-year period, or at least prior to full implementation of an NCore Level 2 or 3 pollutant. $PM_{2.5}$ and ozone DQOs have already been developed. The precision and bias data quality indicators for these two pollutants have been included in 40 CFR Part 58 Appendix A. As DQO's are completed, they would be added to the CFR.

7.2.2. Move towards a Performance-Based Measurement Process (PBMS) Philosophy

A performance-based measurement process should be the primary tool for selection or identification of appropriate methods for ambient air monitoring. The philosophy behind PBMS is to determine "what" is needed and not "how" to do it. PBMS is a set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate methods to meet those needs in a cost-effective manner. PBMS can be achieved by developing data quality objectives (DQOs) early in the planning process. DQOs would then set the stage for the development of federal reference method acceptance criteria (where needed). As an example, the DQOs developed for $PM_{2.5}$ are now being used to determine the "acceptability" of continuous $PM_{2.5}$ monitors. Using a PBMS will put a greater importance of the identification of appropriate data quality indicators and measurement quality objectives and insuring that these are consistently defined and measured in order to provide for an assessment of data comparability.

a. PBMS for NAAQS comparison objectives. Due to the regulatory requirements for NAAQS comparisons, instruments used for this purpose will continue to meet the performance specifications of the Federal Reference and Equivalency Method criteria.

b. PBMS for NCore Level 2 objectives. Monitoring instruments used for the NCore Level 2 objectives that do not serve a dual purpose for comparison to the NAAQS do not necessarily need to meet FRM/FEM criteria but must meet the minimum data quality requirements developed through the DQO process that will be defined in CFR and guidance.

c. PBMS for other non-Federal objectives. SLTs will be responsible for selecting methods that will meet their data quality requirements for monitoring. The performance-based approach lends itself to flexibility but will put more responsibility on the SLTs for developing quality systems that meet their needs. Therefore, there will be a greater importance and emphasis on QA project plan (QAPP) development.

d. Data identification in AQS. Since the data quality requirements for NAAQS comparisons, NCore Level 2 and non-Federal objectives may not be the same, the data will have to be identified in AQS so it is appropriately used. Table 7-2 provides a partial list of the monitor types will be identified in AQS.

Table 7-2 Monitor Types

Monitor Type	Comments
NAAQS	Data that can be used for NAAQS - This would replace SLAMS/NAMS monitor types
NCORE2	Data that can be used for NCore Level 2 objectives
NAACOR2	Data that can be used for NAAQS and NCore Level 2 objectives (must be an FRM)
SPM	non-Federal objectives (special purpose monitoring). This type is already listed in AQS

7.2.3 Regulation Development

The QA Strategy Workgroup reviewed 40 CFR Part 58 Appendix A in order to determine what remained relevant to the Ambient Air Quality Monitoring Program quality system. In addition to restructuring this Appendix for readability, a number of changes were made:

- **Combined PSD (APP B) into APP A**. Appendix A and B are very similar and it was felt these two sections could be combined.
- **QMP- and QAPP approval.** Provides more explanatory information on quality management plans (QMPs) and QAPPs and mentions that allowance of QAPP approval at monitoring agency level as long as described and approved in QMP.
- **DQOs.** OAQPS responsibility to provide DQOs for Level 2 and NAAQS objectives.
- **Graded approach to QA.** Described this process in CFR in order to provide flexibility. A paper on this approach is available on AMTIC at www.epa.gov/ttn/amtic/geninfo.html.

- **Quality assurance lead.** Provides for monitoring organizations to designate a quality assurance lead with certain QA responsibilities. A paper on this approach is available on AMTIC at www.epa.gov/ttn/amtic/geninfo.html .

- **Reporting organization and primary quality assurance organization**. Defines these two terms in order to clarify the organization primarily responsible for the quality of the data. An additional field in AQS may be necessary to accommodate this change.

- **SO_2 and NO_2 manual audit checks** (formally 3.4.2 and 3.4.3)- Removed these sections.

- **Biweekly precision check concentration range-** changed the ranges to allow for lower concentration checks to be acceptable in cases where the majority of the data from a site are below the current range requirements.

- **Changed PM_{10} collocation requirement** to 15% of routine sites; similar to $PM_{2.5}$

- **Provide for quarterly data certifications.** Due to the emphasis on real-time reporting, data quality validation and evaluation is occurring earlier in the monitoring process than in the past. In addition, the QA Reports distributed by OAQPS (i.e., CY99 and CY00 $PM_{2.5}$ QA Reports) have limited usefulness because the data are not evaluated until after it is officially certified, typically 6 months after the calendar year in which it was collected. Certifications could occur sooner and a proposal for quarterly certifications is being considered.

- **Revised Automated Precision and Bias Statistics** - Changed statistics used to estimate precision and bias and will calculate them on a site basis as opposed to a reporting organization basis. The paper on this approach has been published for review.

These changes will be incorporated into a CFR package. A draft is expected to be completed in 2004 which will then go through the public comment process.

7.2.4 Using a Graded Approach to QA

As with any EPA funded activity, EPA QA Policy requires monitoring organizations to develop QMPs and QAPPs. Under the Strategy, the use of air monitoring data will have multiple applications. Therefore, some monitoring objectives may not call for quality systems and quality assurance documentation (i.e., QAPPS) to meet the stringent requirements for NAAQS comparison purposes but may have differing data quality needs based on their specific objectives. The revised EPA QA Policy allows for a graded approach to quality assurance. This approach allows for some flexibility in the development of QMPs, QAPPs and DQOs. The QA Strategy Workgroup developed a graded approach for the Ambient Air Monitoring Program. This approach has gained acceptance by the Workgroup and over FY 2004 will be reviewed with the intent on approval by the EPA Regional Offices who are required to review and approve QMPs and QAPPs. The graded approach is available on AMTIC at www.epa.gov/ttn/amtic/geninfo.html.

7.2.5 Guidance Documents

OAQPS will continue to develop guidance documents relevant to federally implemented monitoring programs. Within the next few years, guidance will be revised or developed for:

a. The QA handbook. The primary guidance document for the Ambient Air Quality Monitoring Program Quality System will continue to be the QA Handbook for Air Pollution Measurement Systems Volume II Part 1. This document went through a revision 1998. It was suggested at that time that this document be revised on a 5-year interval which means it is due for an update. Since OAQPS is in the process of revising its regulations, the Handbook will be updated to reflect these changes in FY04 and is expected to be completed in FY05. It is expected that QA requirements for the National Air Toxics Trends Program (NATTS) and for a coarse particulate program ($PM_{10-2.5}$) would be included in the next revision. Part 2 of the Handbook is used for the reference and equivalent methods and will also be used for generic technical guidance for other pollutant monitoring procedures used at NCore Level 2 and 3 sites.

b. Generic QAPP. Using the EPA Quality Staff QAPP guidance, OAQPS, in cooperation with the Institute of Tribal Environmental Professionals (ITEP), is in the process of planning for the development of a generic ambient air monitoring QAPP software product that would allow the SLTs to input the appropriate QA information into each section of their QAPP for their particular monitoring program. In FY 03 OAQPS received 50K of Tribal initiative funds to start development of this software product. It is anticipated that additional funds may be needed to augment the imitative funds for completion of this software.

7.3 Implementation Activities

7.3.1 Training

Section 11 contains additional details on training for QA. Implementation items related to training are as follow.

a. Develop quality assurance lead "Certification/Accreditation" program. One way to place more emphasis on training is to establish a national accreditation process to certify QA personnel. The QA Workgroup initially described a number of categories in which accreditation or certification would be useful. At a minimum, OAQPS will pursue the development of an accreditation process for the Quality Assurance Lead which is now defined in 40 CFR Part 58 Appendix A. This accreditation process would foster a level of consistency across the nation, but will not be mandatory. Effective April 23, 2003, the EPA Quality Staff meets the criteria for certification established by the Certified Provider Commission of the International Association for Continuing Education and Training (IACET) and is authorized to issue Continuing Education Units (CEUs) when EPA Quality Staff conduct the EPA Quality

Systems training courses. The QA Strategy Workgroup will develop a Quality Assurance Lead accreditation curriculum using the Quality Staff courses and the courses provided by the Air Pollution Training Institute (APTI). This curriculum will be completed by the end of calendar year 2004. A number of training related activities will be instituted:

- **Re-training** - If capital expenditures are made on automating QC activities, personnel normally performing these activities will need to be trained for alternate activities. It is suggested that more emphasis be placed on data assessments both related to QA, monitoring data and network assessments.

- **Conduct a poll for training-** It is suggested that a poll of SLTs be conducted to determine what QA related training is needed. It is suggested that STAPPA/ALAPCO could help develop/implement this poll.

- **Training at the annual QA conference -** Since 2001, OAQPS has facilitated two days of presentations and training at the annual EPA National Conference on Managing Environmental Quality Systems. Approximately 30 SLT representatives attended the first two ambient air monitoring sessions. This conference provides training on a number of courses that will be required for quality assurance lead certification mentioned above and ambient air monitoring QA related course (e.g.,APTI courses) could also be taught at the National Conference. SLT QA leads should be provided opportunities to attend this meeting.

- **Develop web-based training programs** - Based upon priority training needs, OAQPS will pursue the use of web-based training courses particularly the APTI courses and a training module related to the QA Handbook for Air Pollution Measurement Systems Volume II Part 1.

7.3.2 Internal Quality Control Activities

The majority of the day-to-day QA activities at the SLT monitoring organizations involve implementing or assessing quality control information, whether it be zero/span checks, collocated precision, or field, trip or lab blanks. Each monitoring method has required and suggested quality control samples that can be used to assess data quality of a phase (i.e., sampling) of the measurement system or the total measurement system. These QC checks will be included in validation templates that will be developed for each NCore Level 2 and 3 measurements.

Accordingly, the performance-based measurement system principal will be used to develop the necessary quality control samples in the regulations without mandating frequency and acceptance criteria. The CFR should identify the types of QC samples that will provide assessments of attaining the DQOs. As can be shown with the $PM_{2.5}$ DQO software tool, various combinations of uncertainty (i.e., precision, bias etc.) affect the attainment of the data quality objectives. The CFR would be revised to identify the uncertainties that needed to be measured as well as the confidence one wanted in the estimate of those uncertainties. The SLTs would then be responsible for developing a quality system that would measure, assess and control these uncertainties. Therefore, the SLTs would determine how frequently they needed to perform various QC checks and what the appropriate acceptance criteria should be. OAQPS, using the data in AQS, will also assess data uncertainty to determine if an SLT has developed a quality system that was "in control". For organizations with less QA resources or experience, the QA Handbook will continue to provide the suggested acceptance criteria and QC sample frequencies through the use of the validation templates.

It is strongly suggested that SLTs invest in cutting edge data logging and automated quality control and assessment technology. This technology would allow for more frequent QC checks while reducing man-power burdens of site visits and allow monitoring personnel more opportunity for data verification, reduction and assessments.

7.3.3 Data Validation/Verification

Verification and validation are processes used to ensure that specified requirements (i.e., collocated sampling) have been fulfilled and that particular requirements for a specified use (i.e., collocated precision acceptable for NAAQS comparison) have been fulfilled. Improvements and activities to be implemented in this area include:

a. Development of validation templates. Since the development of the $PM_{2.5}$ Validation Template, there has been an interest in developing similar templates for all criteria pollutants. The QA Strategy Workgroup is nearing completion on validation templates for the remaining criteria pollutants which will be incorporated into the next version of the QA Handbook. Following the PBMS paradigm, use of the template will not be considered mandatory, but will provide useful guidance for organizations developing QAPPs. OAQPS proposes to develop similar templates for other NCore Level 2 measurements. Other implementation activities in this area include:

b. Providing more automated requirements for data review/verification/ validation. It is recommended that an initial capital expenditure of information capture and transfer technologies (e.g., data loggers, telemetry, automated quality control) for automatic transfer of routine and quality control information to central facilities be considered. Included in this would be quality control systems for automating various QC checks, such as zero/span checks, or bi-weekly precision checks. This includes the use of various automated data evaluation processes to provide for more real-time consistent screening and data verification/validation activities. Real-time data transfer technology would allow personnel at centralized offices to implement various verification/validation techniques, identify problems, and take corrective actions in a more real-time mode.

7.3.4 Data Certification and Quicker Data Access on AQS

Due to the more recent emphasis on real-time reporting of data, the real-time review/verification/validation of data has become equally important. Because of more timely data assimilation, the current process of certifying a calendar year's worth of data six months after the end of the previous calendar year must be improved. A majority of data verification/validation efforts have already been automated in some SLTs. Data quality assessments would have more value if data was reported sooner, and accordingly, would require earlier certification of data. A number of recommendations on this topic include:

- **Providing for quarterly certifications-** Instead of waiting six months from the end of the calendar year, provide a mechanism for certification on a quarterly basis.

- **Certified/uncertified data flagging** - Data qualifiers are not used for the majority of the criteria pollutants, meaning that SLT personnel wait for data to be validated before uploading to AQS. Since many SLTs use data qualifiers on their local sites to inform data users that the real time data is not validated, AQS data could be initially uploaded as "unqualified" and on a quarterly basis, after validation, have this qualifier removed. This would allow OAQPS to develop generic data evaluation/validation reports on AQS that could be used or modified by the AQS user community, rather than having SLTs develop their own reports.

- **Developing QA/QC evaluation reports –** Opportunities exist to reduce the burden on data validation personnel through the development and generation of various validation/evaluation program reports.

7.4 Assessment And Reporting

The following activities will describe the various assessment and reporting features of the quality system.

7.4.1 Site Characterizations

Site characterizations are a type of audit to assess that samplers or monitors at the monitoring site meet the applicable siting criteria for existing NCore Level 2 and 3 objectives. Siting criteria have been described for SLAMS, NAMS and PAMS sites in 40 CFR Part 58 Appendix E. Siting criteria for NCore Level 2 sites need to be addressed. The on-site visit consists of the physical measurements and observations such as: height above ground level, proper spacing from various instruments, or distance from obstructions and roads. It is recommended that all NCore Level 2 sites undergo complete site characterizations at the start of the program and/or at start of site implementation to ensure that the sites are appropriately characterized from the start. As part of the technical systems audit function, on a three year basis, the EPA Regions should confirm the site information for all NCore Level 2 and 3 sites. It is also possible during NPEP audits that certain aspects of the site characterizations can be performed by Environmental Services Assistance Team (ESAT) personnel. This would allow for more frequent update and confirmation of site characteristics.

Recommendations and action items for site characterization that would apply to NCore include:

- **Setting minimal levels and tracking -** The requirements for the frequency of such characterization would be changed, if necessary. In addition, better tracking of this information would ensure adequate site characterizations are being performed. AQS has an area that can be revised for this tracking activity.

- **Ensuring updates made in AQS** - Information from inspections of monitors, sampling equipment added to site, latitude/longitude changes etc. can be described in the AQS tracking area mentioned above. Once changes are confirmed, this information could be deleted.

- **Developing and using a site characterization form**- A site characterization form and possibly software could be developed and distributed to provide some consistency in performing site characterizations.

- **Speeding up approvals for discontinued sites**- SLTs submit paperwork for discontinuing sites, but EPA approvals often take a considerable length of time. OAQPS will review this process and determine how to expedite the approval process.

7.4.2 Performance Evaluations

Performance evaluations (PE) are a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory. The types of audits that will be implemented by OAQPS are the NPEP and the Certification Programs described below:

- **The National Performance Evaluation Program (NPEP) -** The NPEP program will service NCore Level 2 and 3 sites**.** The following PE programs will be included under the NPEP:

- **$PM_{2.5}$ Performance Evaluation Program (PEP)** - This program has been operating since CY 1999 using the ESAT contractors to collocate FRM $PM_{2.5}$ instruments at 25% of a reporting organizations sites. In addition, during $PM_{2.5}$ audits, EPA will audit speciation monitors at both Speciation Trands sites as well as supplemental sites. It is anticipated that this would cost approximately $150,000 per year.

- **National Performance Audit Program (NPAP)** - This program, initially a mailable audit program, has been operating since 1970. It is currently being retooled into a through-the-probe audit system implemented by EPA Regional personnel and/or ESAT personnel currently implementing the PEP. OAQPS has expended internal capital for the outfitting of five trailers and one vehicle. By

FY05 the PEP and NPAP programs will be combined into a single program. In addition, in FY04 OAQPS will start evaluating the need for through-the-probe auditing in the National Toxics Trends Program (NATTS) and start outfitting the NPEP laboratories for this activity in FY05.

- **NATTS proficiency tests samples**- OAQPS will contract the development and distribution of audit samples quarterly to the laboratories analyzing NATTS samples. Details on these audits can be found in the NATTS Strategy document.

- **Certification programs**- Certification programs provide some independent testing of products and or instrumentation and are used to provide a sense of quality and comparability. The following certification programs (with the exception of protocol gas) will be implemented for NCoreLevel 2 and 3 sites.

- **Standard Reference Photometer Program (SRP)-** The Standard Reference Photometer which is used to certify SLT monitoring organizations ozone primary and transfer standards will continue to be implemented through the Office of Radiation and Indoor Air (ORIA). Within the last year the SRPs have been updated and it is anticipated that Standard Operating Procedures will be revised in calendar year 2004.

- **PAMS and NATTS gas cylinder certifications–** Currently ORIA performs gas cylinder certifications for the PAMS program. ORIA is proposing a similar service for certifying calibration standards for laboratories participating in the NATTS. Details on these audits can be found in the NATTS Strategy document.

- **Re-investing in the protocol gas program** - For many years ORD implemented a program that tested gas standards supplied by gas manufacturers to monitoring organizations. The program provided some level of quality control over the gas manufacturers. This program was discontinued in 1997 as part of the ORD divestment. Recently, some gas manufacturing vendors, due to market in-roads by smaller vendors with potentially inferior quality products, have expressed an interest resurrecting the program. A pilot test of this program occurred in FY03. Results will be available in FY04 with decisions made later in the year on whether or not we can implement a program, and if so where resources would be acquired.

7.4.3 Assessments of Quality Systems and Technical Systems Audits.

Two types of qualitative assessments will be implemented of the Ambient Air Monitoring Program: assessments of quality systems, and technical systems audits.

a. Assessments of quality systems. These assessments are a systematic, independent, and documented examination that use specified criteria to review an organization's quality system, mainly through the assessment of an organization's adherence to their quality management plan. Assessments of quality systems will be performed by the EPA Quality Staff on OAQPS once every three years and OAQPS will perform this assessment on the EPA Regions once every three years. As part of the technical systems audits described below, the EPA Regions will perform an assessment of quality systems of the SLTs. This process should provide feedback at all levels of the organization on strengths and weaknesses in the Ambient Air Monitoring Program quality system.

b. Technical Systems Audit (TSA). TSA is a thorough, systematic, on-site, qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management and reporting aspects of a system. EPA will continue to require TSA of reporting organizations once every three years. The TSA audit checklist, currently in the QA Handbook, will be revised to reflect new monitoring methods and or objectives and questions relative to an organizations quality management plan. An area for tracking audits will be developed on AQS.

7.4.4 Data Quality Assessments.

A data quality assessment (DQA) is a statistical evaluation of a data set to establish the extent to which it meets user-defined application requirements (e.g., DQOs). Historically, DQAs have received little attention in the ambient air monitoring community. With a move towards performance-based measurements systems and DQOs, there will be more emphasis on DQAs. OAQPS will be responsible for the development of DQAs for all objectives in which OAQPS has developed DQOs (NCore Levels 2 and 3). DQAs will be performed at the same frequency in which the priority decision is made. As an example, $PM_{2.5}$ NAAQS comparisons are made with an aggregation of three years of data; DQAs for $PM_{2.5}$ data would be performed at the same interval.

a. Developing DQA tools. Similar to the $PM_{2.5}$ DQO software that is being modified as a DQA tool, as DQO development on the other criteria pollutants move forward, DQA tools will also be made available. It is anticipated that these tools would be integrated with AQS.

7.4.5 QA Reports

QA reports provide a means for distributing information on the Ambient Air Monitoring Program Quality System. Two general types of reports will be developed at the Federal level.

a. Annual assessments of data quality indicators. OAQPS will provide automated reports on AMTIC or through AQS that would provide assessments of the data quality indicators (e.g. precision, accuracy, bias, completeness) that are reported to AQS. A report for the automated gaseous pollutants is currently being developed and would be used as an example for this type of report. SLTs will be able to comment on this report in order to improve its usefulness.

b. Interpretive reports. Following the discussion in the data quality assessment section above, interpretive QA reports will be developed at the same time frame as DQA and will provide a more thorough discussion on the quality system. DQA results would be included in these interpretive QA Reports.

7.5 Funding/Resource Issues

The timeframe that is anticipated for full implementation of NCore Level 2 and 3 monitoring will dictate the resources needed on a year to year basis to implement the QA activities at Headquarters/EPA Regions/SLTs. In order to ensure that expectations are met, it is imperative that an adequate estimate of the resources needed to implement this quality system at all three levels are enumerated, acknowledged as appropriate, and where not, either rectified or have expectations reduced. As an example, current funding levels for OAQPS QA activities will not cover some of the suggested activities described in this section In addition, QA activities need to be intimately tied to the monitoring process so that costs for the quality system increase/decrease commensurately with monitoring costs. Resource and funding related action items include:

- **Providing a reasonable estimate of the "cost of QA"** - Identify quality system elements for a "typical" SLT monitoring organization and provide an estimate of the costs of an adequate quality system. Use these estimates to provide a percentage of monitoring costs that should be allocated to the implementation of a quality system. The QA Strategy Workgroup developed a questionnaire that could be distributed to SLTs in order to get a reasonable handle on these costs. Similar procedures could be developed for EPA Regions and Headquarters.

- **Ensuring SLT funds are available for QA training –** EPA provides regular and continuing training on many aspects of air programs. It is important to include QA training as part of the overall training program.

- **Automating quality control procedures** -There are a number of implementation activities that are still being performed manually by some monitoring organizations (i.e., zero/span and precision checks) that can be automated. The technology section addresses the aspects of increasing awareness of this technology and moving to more automated systems. However, an initial expenditure of capital for both equipment and training will be required to ensure the achievement of this modernization.

- **Providing contractual support –** OAQPS will provide a mechanism to allow SLTs to tap into statistical expertise for development of data quality objectives, data quality assessments, and other statistically-related assessments.

- **Applying STAG resources for NPEP** - STAG resources should be used to cover the NPEP program. STAG funds currently pay for the $PM_{2.5}$ PEP and NATTS Proficiency Test Program but not the traditional NPAP program that is currently being re-invented to a through-the-probe audit process. Quality assurance is especially critical as new monitoring approaches are undertaken in NCore. Accordingly, as indicated in Table 7-3, the national performance evaluations QA component should be managed as a combined entity and it is recommended to increase STAG funds by $1.3 million to cover the $600,000 currently being funded by EPA, $500,000 to outfit the through the probe audit trailers to administer field audits for the NATTS program and $200,000 for audits of speciation monitors. These funds would cover all national QA costs for performance evaluations audits of NCore Level 2 measurements and NAAQS measurements at NCore Level 3 sites.

Table 7-3. Proposed Summary of Resources for Performance Evaluation Programs (in millions of dollars)

Program	**Current**		**Proposed**	**Comments**
	STAG	EPA	STAG	
PM2.5 PEP/Speciation	1.9		2.1	Continuance of the Performance Evaluation Program with the inclusion of speciation site audits
NATTS	0.4		0.4	Field and lab audit, proficiency tests (4/year/lab), and QA Reports
NPEP (criteria)	0	0.6	0.6	Through the probe audit program
NPEP (Toxics)	0	0	0.5	Initially outfitting through the probe laboratories with capital equipment to perform audits of Toxics
Total	2.3	0.6	3.6	

7.6 Next Steps

The recommendations of the Workgroup are based on a concerted effort to identify, prioritize, and take action on the many aspects of the quality assurance program, so that changes are consistent with the overall Strategy's holistic review of air monitoring networks. To that end, the recommendations presented here should be considered preliminary, in that the Workgroup will be continuing its efforts through for the next few years as the Strategy enters its implementation phase and our ideas and recommendations are tested. Continuing Workgroup participation by the monitoring organizations will help to assure a timely level of progress and provide an invaluable level of reality. On a periodic basis, the progress will be reported to the NMSC as well as identify where revisions to this QA strategy are needed.

Section 8 - Regulation Changes

8.1 Overview

There are three main federal regulations that are used to provide the framework for ambient air quality monitoring: 40 CFR Parts 50, 53, and 58. Part 50 applies to the NAAQS and the federal reference methods for each pollutant; Part 53 provides air quality monitoring equipment vendors with the application and testing requirements for federal reference and equivalency methods; Part 58 applies to ambient air quality surveillance, and is the primary focus for these regulation changes. Making changes to the regulations at this time will help remove obstacles for implementing the Strategy and codify NCore, and will only set minimum requirements with the understanding that state/local agencies and tribes can, and are encouraged to, exceed such minimums.

Within 40 CFR Part 58, there are a number of regulation changes which are necessary to foster the implementation of the Strategy, including:

- Network design changes
- Minimum monitoring criteria
- Replacement of NAMS/SLAMS with NCore
- Changes to the PAMS requirements
- Changes to information reporting requirements
- Movement toward performance-based systems
- Movement toward a graded quality assurance approach
- Movement toward more advanced information transfer technologies

In addition, there has not been a holistic review of Part 58 since the origination of this regulation over 30 years ago. Therefore, additional changes will help to simplify, consolidate, and clarify the existing language where appropriate, thereby reducing redundant or confusing aspects of the regulation. It should be noted that changes to Part 58 is an official process with its own public review and comment process. As a result, this section can only describe the features of the intended changes; the actual details will be part of that separate regulatory process.

8.2 Background Process

The development of the regulation elements needing to be modified has been an ongoing effort via a workgroup process between EPA and state and local agencies, as well as interaction with the NMSC. Since 2000, the workgroup has had many conference calls to identify: (1) those portions of the regulations needing review and revision; (2) initial suggestions for changes; (3) key issues and resolution of those issues; (4) development of and comment on early draft language. While the final proposed regulation is entirely under EPA's purview, much of the necessary background effort was done in cooperation with the state and local agencies.

8.3 Network Design and Criteria

One of the fundamental changes to the regulations is to remove the references to NAMS and SLAMS sites and to define NCore as the new national monitoring program. The revised regulation would establish:

- NCore monitoring purposes:
  - Highest concentration
  - Typical concentration in highest population density
  - Impact of significant sources
  - Regional pollutant transport
  - Background
  - Impacts on visibility, vegetation, welfare
- NCore monitoring objectives:
  - NAAQS compliance
  - Emissions strategy development and accountability
  - Timely reporting of data to the public
  - Support for air pollution/health studies
- NCore design criteria, including specific requirements for the number of NCore Level 2 sites by population, and the minimum level of multi-pollutants to be monitored (Table 8-1).

Table 8-1. NCore Design Criteria

Requirement	**Number of Level 2 Sites**	**Total # Level 2 Sites**
Each State	1	50
One additional for OH ,IL, PA, MI, NC	1	5
Two additional for NY, CA, TX, FL	2	8
Additional Rural Sites	12	12
TOTAL		75

- NCore minimum requirements for ozone monitoring (Table 8-2),

Table 8-2. NCore Ozone Monitoring			
CBSA, or county population for areas outside of a CBSA	**Most recent 3-yr design value concentrations >115% of any ozone NAAQS**	**Most recent 3-yr design value concentrations ±15% of any ozone NAAQS**	**Most recent 3-yr design value concentrations <85% of any ozone NAAQS**
>10 million	3	4	2-3
4-10 million	2	3	1-2
1-4 million	2	2-3	1
350k-1 million	2	2	1
200k-350k	1	1-2	0
<200k	1	1	0

- NCore minimum requirements for $PM_{2.5}$ (Table 8-3),

Table 8-3. NCore Requirements for $PM_{2.5}$			
CBSA, or county population for areas outside of a CBSA	**Most recent 3-yr design value >115% of any $PM_{2.5}$ NAAQS**	**Most recent 3-yr design value ±15% of any $PM_{2.5}$ NAAQS**	**Most recent 3-yr design value <85% of any $PM_{2.5}$ NAAQS**
>1 million	2-4	3-6	2
500k-1million	1-2	2-3	1
250k-500k	1	1-2	0
100k-250k	1	1-2	0
<100k	1	1	0

- NCore minimum requirements for continuous $PM_{2.5}$ monitors, for example, of one-half the required number of FRM samplers.

- NCore minimum requirements for $PM_{2.5}$ background, transport, and speciation sites.

- NCore minimum requirements for PM_{10} monitoring (Table 8-4),

Table 8-4. NCore PM_{10} Monitoring		
CBSA, or county population for areas outside of a CBSA	**Most recent 3-yr design value >85% of any PM_{10} NAAQS**	**Most recent 3-yr design value <85% of any PM_{10} NAAQS**
>1 million	3-6	1
500k-1 million	2-3	0
250k-500k	1-2	0
<250k	1	0

- NCore requirements to monitor for lead, as part of a national lead trends site assessment, in at least one location in each of the 10 EPA Regions. A location could be within the largest CBSA with a Region, or alternatively, at one of the Urban Air Toxics Trends sites within the Region.

- NCore requirements for other pollutants including carbon monoxide, nitrogen dioxide (to include reactive nitrogen gases, NOy), and sulfur dioxide.

- Requirements to leverage other monitoring programs into the NCore Level 2 site designs. These could include PAMS, air toxics monitoring sites, and $PM_{2.5}$ chemical speciation trend sites.

8.4 Changes to the PAMS Network

Consistent with the multi-pollutant objectives of NCore Level 2 sites, the PAMS sites provide more comprehensive data pertinent to ozone air pollution in non-attainment areas classified as serious, severe, or extreme. There are four types of PAMS sites, but the primary focus shifts to the Type 2 PAMS sites: those areas where maximum ozone precursor emissions are expected.

Table 8-5. Minimum Requirements Established for PAMS Sites		
Measurement	**Where Required**	**Sample Frequency (except upper air meteorology)**
Speciated VOC	Two sites per area; one must be at a Type 2 site	During PAMS monitoring periods: –hourly auto GC –8 3-hr canisters –1 morning, 1 afternoon canister plus continuous NMHC measurement
NOx	All type 2 sites	Hourly during ozone season
NOy	One site per area, either at Type 1 or Type 3 site	Hourly during ozone season
CO (ppb level)	All sites	Hourly during ozone season
Ozone	All sites	Hourly during ozone season
Surface met	All sites	Hourly during ozone season
Upper air met	One site in PAMS area	Sample frequency must be approved as part of the PAMS Network Description

8.5 Network Assessments

The regulation changes will include requirements for a network assessment every five years. (See Section 5 for a discussion of the current round of network assessments.) Along with this will be requirements for SLTs to develop a schedule for implementing the network changes consistent with the findings of the assessment. The final recommendations would have to be approved by the Regional Administrator prior to actually making the network changes. Where deemed necessary and appropriate, other network changes would be permitted in the years between network assessments.

8.6 Performance-Based Measurement Systems (PBMS)

As the move toward PBMS occurs, there will need to be some changes to the CFR. Instruments used for NAAQS comparison purposes will continue to meet performance specifications of the FRM/FEM criteria. For NCore Level 2 objectives, instruments serving other objectives will need to meet minimum data quality requirements developed through the DQO process, and these will be defined in regulation changes as well as guidance. More detailed discussions are presented in Section 7.

8.7 QA Related Changes to 40 CFR Part 58 Appendix A

The following regulation changes are expected:

- Combine Appendices A and B into Appendix A
- Process for QMP and QAPP approval
- Responsibility for providing DQOs
- Graded approach to QA
- Quality assurance lead person
- Defining a reporting organization; and primary quality assurance organization
- Removal of SO_2 and NO_2 manual audit checks
- Bi-weekly precision checks - changes in ranges
- Change PM_{10} co-location requirements to be that of $PM_{2.5}$
- Provide for quarterly data certifications
- Revise automated precision and bias statistics

Each of these is described in more detail in Section 7.2.

8.8 Timelines

It is expected that proposed regulations will be available for public review by November 2004 with final promulgation by June 2005.

Section 9 - Communications and Outreach

9.1 Introduction

The development of the Strategy and the move toward implementation require an important set communication tools to make sure SLTs, public interest groups, the business sector, and the general public have access to information on a timely basis. Without a concerted communications and outreach effort, expected changes to air monitoring networks may not be understood and appreciated for their benefits, which are summarized below.

9.1.1 Benefits to State and Local Air Agencies, Public Interest Groups and the General Public

a. Increased data to the public. The Strategy seeks to incorporate new, continuous technologies into the national network. Incorporation of these new technologies will lead to more efficient, electronic reporting of real-time data (similar to the ozone network reporting system). Moving from filter-based methods and periodic reporting, to continuous methods and subsequent satellite-GIS type reporting via internet networks will provide the public with more timely and current information.

b. Conservation of resources. Periodic review, assessment, and realignment of the monitoring network assure that resources are prudently invested to meet the most pressing air monitoring needs. This does not mean omitting monitors in crucial areas: it simply means using the local regional assessment to determine which monitors are providing redundant or little-value-added information and relocating them to locations which will provide more meaningful data.

c. Integrated NCore monitoring. Since NCore sites will include multiple-pollutant measurements, the foundation for health studies is improved, and future information about pollutant health effects will benefit the public. Also, a local area will have a basis for comparing its local measurements with national data, since each NCore Level 2 site will include similar monitors, FRM methods, and laboratory techniques. Trend assessments will also be performed at the NCore sites, which will yield more valuable information about the local area's air quality in relation to the Nation.

d. More resources for local issues. As NCore is implemented, there will be greater emphasis on monitoring programs to meet local needs. This flexibility, created by splitting Federal funds between Level 2-3 NCore sites and local sites, will allow agencies to monitor for pollutants which are of greatest importance to local communities. These needs could cover hot-spot monitoring, local source characterization, environmental justice issues, or any other need the local authority deems necessary.

e. Public involvement. A public education and outreach program is needed to communicate the purposes of air monitoring networks and to ensure adequate public involvement early in the process. SLT agencies are encouraged to identify special interest groups and conduct outreach efforts as appropriate to discuss potential monitoring network changes, with the understanding that monitors are placed to meet specific objectives, both national and local. Once those objectives are met, site and monitor relocations are a necessary process to assure that new objectives and priorities will be met in the best way possible. The public needs to be aware that consolidation or relocation of a monitor or monitoring station within a community means an improvement in the quality, value, and timeliness of the information provided by the network. SLTs are working with EPA to develop such a public education and outreach program.

9.1.2 Benefits to the Research and Academic Community

The networks operated by State and local agencies provide an enormous resource of "routine" data that complement the more advanced measurements conducted by research organizations. The data help them attempt to uncover the specific causes of adverse health effects related to air pollution, or test air quality simulation models that try to replicate the complex physical and chemical behavior of the atmosphere.

The NCore network will be designed to ensure that long-term research interests will benefit from the routine monitoring conducted by SLTs. This strategy recognizes the leveraging value of a spectrum of other air monitoring efforts, including intensive research oriented studies (NARSTO, $PM_{2.5}$ Supersites, CRPAQS, PM health centers), deposition monitoring (CASTNET, IADN, NADP) and numerous other smaller research projects. NCore will also provide, via the Level 1 sites, several national locations convenient for testing newly developed monitoring instruments under differing meteorological and air pollutant regimes.

It is anticipated that the NCore approach will meet scientific air monitoring needs to a much greater degree than the networks currently provide.

9.1.3 Benefits to Tribal Communities

The Strategy will have many of the same benefits for tribal air programs as it does for State and local agencies. However, the benefits of additional flexibility in targeting monitoring to each reservation's needs and priorities will be particularly important for the tribes. This flexibility is particularly important because the tribes are in the process of assessing air quality on Indian lands, and thus have ability to explore environmental and health concerns that are specific to their needs. (See Section 10.)

9.2 How This Information Will be Communicated

The essential information contained in the preceding paragraphs need to be communicated effectively to several different audiences. To do this, several communication products are currently being planned and/or developed:

- **Fact Sheet**. At approximately the same time as the release of the Draft Strategy Document, a fact sheet was posted on AMTIC and distributed to SLTs explaining, in general terms, the technical need for a revised air monitoring strategy. This fact sheet is approximately two pages in length, and covers points on continuous monitoring technology as well as establishment of an "NCore" network. This item targets most audiences

- **Quarterly Newsletter**. A quarterly newsletter is being distributed on AMTIC. (The website address is: http://www.epa.gov/ttn/amtic/newsltr.html. The newsletter provides updates on reviews, availability of materials (documents and presentations), the regional assessments, and other timely topics. It is intended to remain active during the implementation phase of the Strategy. The target audience is agency, tribal, and all public/private representatives with a more detailed interest in the latest progress for the Strategy.

- **Specialized Briefing Presentations**. Several packaged slide presentations are being developed for use and dissemination to different audiences. One will be more technical and detailed and will be targeted for use by EPA, Regional representatives, and SLTs (regional briefing package). A second presentation will be tailored for public interest groups, and knowledgeable groups and individuals (public interest briefing package). A third presentation will be simpler and less technical, and can be used by Federal, state and local agencies and tribes in communicating the Strategy to the general public (public-oriented briefing package). Having these packages available will help to assure consistency in communications throughout the country.

- **Monitoring Strategy Brochure**. A trifold brochure has been developed for a simplified, concise, non-technical explanation of the Strategy and air monitoring networks in general. This brochure has been developed by EPA, and coordinated with STAPPA/ALAPCO. Distribution will occur shortly after the finalization of the Strategy document in 2004. The brochure is targeted primarily for the general public.

9.3 Schedule

In developing a communications strategy, the following schedule has been developed:

Spring 2004:	Quarterly Newsletter posted on AMTIC Release of revised Fact Sheet National release of Monitoring Strategy Public Brochure Press release issued by EPA
Summer 2004:	Availability of regional and public interest briefing packages Release of Final Strategy Implementation Plan

9.4 Public Comment Process

A Draft Strategy document was released in September 2002, comprised of two key components: (1) a summary document which, in question and answer format, contained highlights of all the key elements of the Strategy; and (2) a main document which described in much greater detail all the elements of the Strategy. Both documents were available to the public via EPA's website, and a letter to the EPA Regional Offices and the State and local agencies, announcing the release of these documents, was issued by Stephen Page, Director of EPA OAQPS on September 27, 2002. At that time, responses were requested by December 1, 2002. Because several other interested parties requested more time to review and comment, the comment period was extended to February 28, 2003, and finally to June 1, 2003.

In total, there were 29 comment letters received. Of these, 21 were from State and local agencies; 3 from EPA Regional Offices; 2 from the public/public interest groups; 2 from industry; and 1 from the Tribes. Each letter was carefully reviewed and summarized, and a list of the key comment points was provided to the NMSC for review. As a result, a "Response to Comments" Addendum to this Strategy Document has been prepared, covering over 160 topics represented by the comment letters. The Addendum provides responses to each of the these topics. Where appropriate, changes to the Strategy were made in response the comments. Thus, this final Strategy document represents and includes meaningful public input.

Section 10 - Impact of this Strategy on Tribal Monitoring

In the 1990 Clean Air Act, Congress recognized EPA's obligation to work with the tribes in addressing air quality in Indian country, the result being that EPA's interaction with the Federally Recognized tribes was extremely limited before that time. Promulgation of the Tribal Authority Rule (TAR) in 1998 provided Tribes with the leverage to begin assessing the air quality on Tribal lands. Tribal nations generally are expanding ambient air monitoring efforts and it is generally recognized that there exists substantial needs for Tribal air monitoring support. Given the limited monitoring throughout Tribal lands, network assessments similar to the national and regional efforts discussed in Section 5 are inappropriate for the relatively new tribal prgrams because those assessments addressed aged and relatively dense monitoring networks. The prevailing air monitoring issues for Tribes include a severe shortage of resources for equipment, maintenance, operations, personnel and training.

Currently, there are 140 tribal air quality programs in various stages of development across the United States. This is a dramatic increase from only nine programs in 1995. These 140 Tribes operate approximately158 monitors in Indian Country for several types of pollutants and networks including PM (2.5 and 10), ozone, nitrogen and sulfur oxides, IMPROVE, and the NADP. These numbers will only increase as Tribes continue to build the capacity to assess air quality on their respective lands.

The National networks clearly can benefit from Tribal participation by gaining additional monitoring sites in those areas that Tribes choose to participate in the national network. Tribes share a spectrum of technical issues with States, since pollutant transport and meteorological systems ignore political boundaries. Accordingly, any measurement contribution from Tribal efforts should be viewed as an asset to a larger integrated national need for air quality measurements, and tribes should perceive some level of ownership of air quality data collected in non-Tribal lands that has relevance to Tribal air quality issues. There are many rural Tribal airsheds that could be considered pristine and therefore excellent candidates for background monitoring sites, potentially filling in important gaps in the nation's network. Tribes clearly have a part in NCore and their participation can benefit all parties as opportunities exist for Tribes to operate NCore Level 3 and Level 2 sites, particularly in rural areas where there remain significant spatial gaps in monitoring.

These comments should not be perceived as suggesting that the Tribal monitoring priority is fostering a connection to national networks. Monitoring priorities must be based on Tribal decisions, which in many cases involve developing a better characterization of local exposure to air pollutants. The linkage to national programs should be perceived as leveraging opportunities that simultaneously benefit Tribes and the national network.

Another recent development over the past 3 years has been the establishment of the Tribal Air Monitoring Support (TAMS) Center, which is a unique partnership between tribes, the Northern Arizona University Institute for Tribal Environmental Professionals (NAU ITEP) and EPA. Together, tribal environmental professionals, ITEP and EPA provide the full range of air monitoring technical support from monitoring network design, monitor siting, quality assurance/quality control to data analysis and interpretation. The TAMS Center recognizes the sovereignty and diversity of Indian nations and is designed to build capacity and empower Tribes to successfully manage their respective programs with equanimity on a national scale.

Starting in 2001, Tribes have been active participants in the RPOs. The RPOs have provided leadership in establishing needed rural monitoring throughout the central core of the nation. As active participants in technical planning and monitoring operations, the RPO process is perhaps the first venue where Tribes have been integrated in a large scale national monitoring program. Through this interaction with RPOs as well as participation in the current NAMS, there will likely be some number of NCore Level 2 sites that are operated by Tribes.

It also is recognized that resources are limited and now is the time to encourage collaboration between Tribal, Federal, State and local entities. To avoid past mistakes, it is important to recognize the benefits of including Tribes in national monitoring strategies as they have a lot to offer in terms of filling data gaps and identifying background conditions, as well as recognizing their right to participate and the benefits that participation confers. From a health perspective, Tribes also benefit by identifying pollutants that pose the greatest risk to their health and cultural resources.

Section 11 - Draft Implementation Plan

11.1. Introduction

The previous sections of this document provided the conceptual and design basis for moving forward with the national monitoring strategy. This section provides a summary of the actions that will effect transition from design to implementation. The implementation plan incorporates action oriented components of the Strategy (e.g., regulations revisions [section 11.2] and training [section 11.4], and introduces a funding strategy [section 11.4] and outreach approaches [section 11.5] to facilitate NCore implementation.

11.2. Monitoring Regulations

The monitoring regulations establish a referenceable body that codifies many elements of the Strategy. In addition to providing a legal basis for moving forward, the regulations embody a number of “obstacle-removing” sections that alleviate some of the unnecessary burdens faced by monitoring agencies, and enhance the ability to introduce new technologies into our networks.

- **Codification of NCore**. The regulations introduce the NCore system of multiple tiered monitoring stations that replace the current NAMS/SLAMS nomenclature.

- **Adjustment of minimum requirements for specific pollutant measurements.** Generally, the monitoring regulations require far fewer monitors than currently operated by SLTs. The $PM_{2.5}$ network is an exception as the vast majority of the nearly 1100 $PM_{2.5}$ FRMs were required under the 1997 regulations. The proposed revisions reduce the level of required FRMs substantially, allowing the introduction of more continuous $PM_{2.5}$ instruments.

- **New methods performance specifications.** Performance requirements that new PM mass methods must meet to establish national equivalency approval are based on utilizing the DQO process. The DQO approach provides an objective basis for defining performance requirements based on a combination of historical instrument performance and acceptable data quality. The regulations also introduce “regionally approved methods” which allows for the acceptance of continuous PM methods in airsheds where the behavior of instruments is well understood and clear quantitative association with FRM is demonstrated.

- **Periodic network assessments.** Requirements for periodic review of the relevancy of networks in meeting current objectives are included in the regulations. Previously, network reviews focused on meeting historically established monitoring objectives with primary focus on NAAQS. In NCore there is a need for periodic network assessments to evaluate whether the network is achieving all NCore monitoring objectives.

- **New QA procedures**. Section 7 provides details on the major changes made to the QA regulations found in 40 CFR Part 58 Appendix A.

11.3 Resource and Funding Strategy

The Strategy implies moving resources from programs of decreasing value to those of higher value, consistent with the principles presented in Section 1 (respecting the strong partnership across EPA and SLTs, retaining stability for the monitoring programs and accommodating SLT flexibility). The incoming assumption of a “zero-sum” constraint implies a reconfiguration of monitoring networks in contrast to the layering process accompanying deployment of the PAMS and $PM_{2.5}$ networks through the 1990's and early 2000's. Accordingly, this Strategy must rely on tailoring the current workforce in SLTs to accommodate a range of new technologies, implying a shift in skill sets from labor intensive integrated methods toward more technologically challenging continuous systems with enhanced data transmission and access capabilities. Attending this shift in skill sets is a need for adequate resources devoted to training, quality assurance and data analysis and interpretation.

The following discussion summarizes the current state of resources allocated for monitoring, and provides an example mapping of resource redistributions which follow the basic technical recommendations of the Strategy.

11.3.1 Implementation Using Current Funding Basis

Monitoring operations performed by SLTs are supported by Section 103 and 105 STAG funds. Table 11-1 provides estimates of the annual funding allocation over the last three years across air monitoring networks, and Table 11-2 provides a more detailed breakdown of the $PM_{2.5}$ budget. The first three networks (toxics, $PM_{2.5}$ and PAMS) represent deployments occurring since 1993 and reflect a shift toward separating monitoring resources from general program planning functions performed by Grantees. Prior to the PAMS program, implemented in the early 1990's, Section 105 funds for traditional criteria pollutants were not delineated in the total STAG agreements. Even greater accountability relating monitoring resources with monitoring outputs was fostered with the use of Section 103 resources to deploy the $PM_{2.5}$ network starting in 1999 and continuing today. This trend was carried on in 2000 with the deployment of the National Air Toxics network. Generally speaking, the use of Section 103 allows for a more efficient tracking of resources as agencies are not required to match Federal Grants. The sub units within State and local agencies responsible for conducting monitoring tend to favor the Section 103 funds as they clearly are earmarked to support monitoring activities. Given the overall change implied by the Strategy, it is imperative that a solid base of Section 103 resources serve as a basis for supporting both the stability of monitoring agencies as well as the needed change in monitoring approaches. Consideration should be given to moving all monitoring related resources to Section 103 or, minimally, delineate clearly the Section 105 resources allotted for monitoring activities to improve accountability.

The CASTNET network is managed centrally by EPA’s Office of Air and Radiation with the specific objective of tracking deposition patterns of major power generating emissions sources, the majority being located east of the Mississippi River. The discussion below will address how these existing funding bases will be adopted to support implementation of NCore.

Table 11-1. Approximate FY04 Annual Distribution of Monitoring Funds on a Network Basis.				
Network	**Budget ($ millions)**			**Notes**
	STAG (103)	**STAG (105) Fed Share**	**EPA Funds**	
PM2.5	42.5	1.25		$1.25M in Section 105 for IMPROVE
Toxics	10	6.5		
PAMS		14		All Section 105- assume 50% matching
CASTNET			4	All EPA S&T funds to contractors
Criteria pollutants (Not including PM2.5)		100		All Section 105- assumed 40% matching; large uncertainty range with little formal tracking within 105 program that delineates monitoring from the program activities
RPO supplements	$Unknown			No resources
Total	**52.5**	**121.75**	**4**	**174.25** Total Federal share of STAG funds

Table 11-2. Distribution of $PM_{2.5}$ Resources (All Section 103 Grants unless noted otherwise)		
Network component	**$Millions**	**Notes**
FRM operations	21.7	(Includes 0.5M tap for filters)
Continuous mass	3.8	
Speciation (field)	4.9	
Speciation (lab)	7.1	(6.7M through National Laboratory contract)
IMPROVE Section 103	3.1 (normally 3.7)	(for FY04 IMPROVE was underfunded by 600k to utilize carryover funds)
IMPROVE Section 105	1.25	
PEP (national QA)	1.9	
Total	**43.75**	

11.3.2 Example Shifts in STAG Allocations.

The current funding base for the networks is used as an example of how funding could be reallocated across measurements to support implementation of the strategy. ***The suggestions below are illustrative only, and do not reflect an EPA budget proposal.***

a. $PM_{2.5}$. The $42.5M in Section 103 STAG funds support the ongoing operations and maintenance of the PM2.5 network. Note that the majority of resources (Table 11-2) support $PM_{2.5}$ FRM measurements and the collection and analysis of chemical speciation data. The principal objectives of the FRM measurements and speciation data are to support designations of attainment/nonattainment areas, and the development of national emission reduction strategies and SIPs. In large measure, these objectives have been attained as the Agency is releasing designation recommendations based on the FRM data collected from 1999 through 2002, and has completed most of the technical analyses supporting major national programs such as the Interstate Air Quality Rule (IAQR). The SIP technical analyses will be based on the 2000-2002 time frame, attendant with the base emission inventory and air quality modeling analyses supporting attainment demonstrations.

As we move beyond this intensive period of analysis focusing on the current state of the environment, the networks need be more supportive of a longer range vision consistent with the NCore network. The focus of the networks should evolve toward characterizing changes effected by national air quality related programs and SIPs (i.e., measuring accountability), providing an infrastructure for public health advisories (AQI through AIRNow) and support for health effects and exposure studies that feed into periodic evaluation of health standards. Accordingly, resources need to be shifted to assess the progress of implementation plans to ensure that the billions of dollars in resources required to reduce $PM_{2.5}$ levels are reaping observable benefits. And, in the event progress is not being achieved as planned, the networks must be able to support restructuring or "mid course" corrections over the next ten to twenty years. These more forward looking objectives that explicitly serve the $PM_{2.5}$ program benefit from a multiple pollutant network consistent with the NCore design. Consequently, the funding base needs to be reconfigured consistent with the design of NCore, which relies on appropriately divesting in areas of the current $PM_{2.5}$ monitoring system that have served their current primary objective.

Consistent with these future needs it is proposed that FRM and speciation program resources be shifted to continuous and multi-pollutant measurement systems. (See Table 11-3) This proposed resource shift should address most resource requirements to implement the NCore Level 2 and 3 components. Note that there is overlap across criteria pollutant programs and NCore, as there is a large amount of repackaging the existing NAMS/SLAMS structure into NCore. Annual funding for $PM_{2.5}$ FRM network should be reduced from $21.7M to $10.7M, and funding for the speciation program in its current form reduced from $12M to $8M. This implies that the current $PM_{2.5}$ FRM monitoring be reduced by approximately 50%, and speciation monitoring by approximately 33%. The network review process should identify those sites to be reduced. The $14.7M in reduced current resources would be redirected to:

- add more continuous $PM_{2.5}$ monitors
- support the NCore Level 2 multi-pollutant sites,
- enhance the ITT infrastructure in the networks and the capital expenditures for hardware and site improvements to accommodate additional samplers and NCore level 2 sites, and
- support training and QA needs arising from modification of network operations.

b. Air toxics. The air toxics program is entering its first year of new funding base of $16.5M (i.e., $10M in Section 103; $6.5M in Section 105 STAG). As this program is under development, there is no recommended change in resource needs at this time. Please refer to the Air Toxics Implementation Plan: http://www.epa.gov/ttn/amtic .

c. PAMS. PAMS requirements have been scaled down to allow for more specific special studies of interest by local area/regions. The current $14M Federal 105 STAG contribution to PAMS should be reduced to $12M, an amount sufficient to cover the revised, minimum PAMS monitoring requirements. There has been a wealth of data collected from the PAMS program, but very limited and often sporadic analysis and interpretation of the data. To address this gap and yield value from the PAMS data bases, $0.5M will be set aside for analysis of the PAMS data. Ideally, this $0.5M should be combined with additional data analysis resources set aside for air toxics (approximately $400K) and proposed for $PM_{2.5.}$ A steering group of SLTs and EPA participants will establish a plan for this analysis that can include an allocation of these resources to SLTs or to other analytical groups. The remaining $1.5M will remain in STAG but serve as a funding base for quality assurance and training for all air quality programs. Matching contributions to this $12M 105 Grant are used for ozone precursor studies at the discretion of EPA Regional Offices and participating SLTs.

d. CASTNET. CASTNET is the only routinely operating air monitoring network managed by EPA headquarters. CASTNET was designed to assess deposition impacts associated with major power production facilities located in the Midwest and Eastern portions of the country. CASTNET should be perceived as a model network that successfully addresses the NCore accountability objective for tracking national air quality program progress in the rural Eastern United States where siting conditions are relatively free of urban "noise" that can compromise trends analyses. In addition, CASTNET provides a more science-oriented approach as the program has taken important strides toward integrating with other science based networks, including AIRMON, NADP, and IMPROVE. While CASTNET provides an excellent framework to support the national strategy, there remains a number of technological and measurement upgrades necessary to provide greater benefits nationally. CASTNET must be considered an integral component of the larger system of networks and can assist the Strategy in the following areas:

- A subset of CASTNET sites should be assigned NCore Level 2 status to address gaps in rural multi-pollutant monitoring stations.

- A subset of CASTNET sites should be elevated to serve as a test bed of special studies to evaluate emerging technologies that have potential for routine use in network operations, thus meeting some NCore Level 1 objectives. The focus of such technologies would be on those measurements (e.g., ammonia, nitric acid, major aerosol ions, trace gases) that support accountability and model evaluation analyses. This aspect is especially important as the desire to accommodate new technologies must be achieved carefully and in balance with historical techniques so as to maintain a credible record of pollutant trends that reflects shifts in atmospheric conditions and not in technologies.

- The existing contacts and user groups associated with CASTNET should be utilized as a larger integrating vehicle that promotes greater communication and coordination across networks focused on ecosystem and public welfare. The NADP-CASTNET sponsored workshop on ammonia (Washington, D.C., October 2003) provides an example of bringing together those responsible for managing ecosystem-based and public exposure networks.

Given the escalating costs of operations continued with these new demands, the CASTNET budget should be elevated from $4M to $5M annually using non-STAG funds [note that such an increase should be considered a secondary priority to NCore Level 1 funding].

e. Data analysis and interpretation. The value of the data collected from the multi-million dollar monitoring program is undervalued without an appropriate analysis and interpretation component. The CASAC Subcommittee criticized EPA's lack of organized archival processes, as well as access to and analysis of air quality data. These issues are discussed in more depth in Section 12. By allotting resources annually to data analysis and interpretation, sufficient funding would be available to make at least adequate use of the data, enhance information transfer, and provide a higher order of quality control and network assessment that emerges from data reviews and analysis. This specified resource allotment would take a very integrated perspective across pollutant categories and catalyze numerous local and other specific topic based analyses. Details of procedures for manging such an effort need to be worked out. Perhaps, a steering group of SLTs and EPA participants would establish a plan for this analysis that can include allocation of these resources to State and local agencies or to other analytical groups. The PAMS analysis effort is separated in recognition of the need to review a decade worth of PAMS data that has largely been neglected. In one to three years, the PAMS analysis component would be incorporated as part of the national analysis. This committee could take positive steps in improving the data archiving/access/distribution issues raised by CASAC, as a precursor to improving data analysis capability nationally. To promote scientific input to this process, thought should be given to having a dedicated CASAC subcommittee focusing on this data analysis component of the networks. Some examples of data analysis capacity building follow.

(i). Regular analysis for status and trends of criteria and air toxics air quality. The large amount of data being collected in the monitoring networks, along with important supplementary data (e.g., meteorological, remote sensing and QA data), will allow air program managers to adjust ongoing activities/decisions and explore new aspects of air pollution as they occur. For these data to be useful for managers, they must be analyzed on a regular basis for a complete set of measures, including detailed characterizations and specific progress or trend measures. In parallel and perhaps more imporatntly, a "tool set" to facilitate analysis should be developed to deliver data on annual, seasonal, near-term, and real time bases appropriately for various air pollutants across various spatial domains. The products would be based on a variety of techniques from simple temporal trends to complex spatial interpolation and would be useful at the national, regional, state and local levels. This approach would develop, for the entire air program, a set of analytical products anaologous to those developed for the visibility program (e.g., VIEWS website ***http://vista.cira.colostate.edu/views/*** developed under the Regional Planning Organzizations). A "dashboard" website would be needed for viewing regular updates and access to useable products; thus the need for automation of the basic tool set. In addition to the basic tool set, this approach would expand the tool set to new tools as special studies produce operational techniques and would work to identify unusual air quality events to study or address in the context of public health tracking.

(ii) Special studies on technical and policy relevant topics. Monitoring and air quality data (technical and analytical) uncertainties and limitations may affect policy decisions. Based on data from NCore and other monitoring sites, these topics should be investigated through special studies.   These studies would include a number of topics. An assessment of major programs (and their effectiveness), such as the NOx SIP call and the IAQR and the various approaches to reduce ozone concentrations, would be undertaken to provide insights into these programs with the potential to adjust those programs periodically. An investigation of multiple pollutants affected by independent control program elements (PM, ozone, air toxics) would advance the ability to "co-control" pollutants and avoid shifting air quality problems across programs (e.g., increasing air toxic emissions in response to VOC controls). A thorough study of "exceptional" and "natural" events is needed to provide a factual basis for the proper exclusion of data from program decisions. Along these lines, source attribution studies would be undertaken to inform regional and specific issue decisions. In addition, studies to evaluate the quality and uncertainties associated with collected data and special characterization of monitoring sites would be undertaken, and the collective information providing a dynamic feddback into network design.

(iii) Building air quality data analysis tools and capacity. Broadening the capacity for analyzing air quality data facilitates greater engagement, and adds analytical and quality assurance power to the entire network measurement and design process. With expanding detail in monitoring data and the need to understand air quality issues better, analytical tools have become complicated and complex to use. Techniques such as back trajectory; source apportionment; assimilation of satellite, monitoring and monitoring data have great potential to advance the ability to understand the progress of the Nation's efforts to address air quality problems. Guidance is needed for a range applications including network assessments and design, emissions inventory and model evaluation, conceptual model building (e.g., genesis and attributes of air quality problems) and observational models (source attribution and emissions strategy tools), as well as a spectrum of more direct regulatory problems. As special studies are completed by EPA, SLT, and regional analysts, there will be a need to develop new operational tools for the analytical techniques developed within the study. Accordingly, "how-to" instructions to aid in the use of existing and new tools would be developed and distributed. Specific special tools would be developed, evaluated and otherwise made available, as the need arises, to provide the analytical capacity needed to implement air programs. Efforts to bring knowledge developed within the research communities to practicing analysts would be undertaken.   For example, an annual conference for data analysts, as well as a virtual homepage for the Nation's air quality data analysts, could be developed to facilitate communication among analysts for expanded understanding of tools and exchange of ideas on monitoring and data analysis topics.

f. Quality Assurance.   As explained in Section 7, the monitoring regulations require State and local agencies to include independent performance evaluations to complement the more routine quality control efforts conducted by SLTs.   Funding of these programs has not been consistent and has been provided from different funding sources (103 STAG for the $PM_{2.5}$ PEP and EPA funds for the NPAP programs). A recommendation for more centralized QA was forwarded by the CASAC NAMS Subcommittee in the interest of ensuring data comparability across different geographic sections of the Nation.   The quality assurance subcommittee, comprised of SLT and EPA members, proposed using existing STAG resources to fund this critically important element. Accordingly, the national performance evaluations should be managed as a combined entity covering criteria and NCore Level 2 measurements.   The recommendation to allocate an additional $1.3M beyond the $2M assigned to the PEP would cover all national QA costs for independent audits of NCore Level 2 measurements and NAAQS measurements at NCore Level 3 sites. A small fraction ($100K) of these resources would be reserved for the national equivalency program charged with reviewing and approving instruments used for NAAQS measurements.

g. Training and Guidance. As mentioned earlier, training and guidance documents will be required for new types of monitoring instruments, information management technology, and quality assurance techniques. Approximately $200K per year (average over FY05-FY07) of STAG funds has been allocated to provide the necessary capital equipment and training needed for the monitoring strategy. Details of training and guidance development are found in Section 11.4

11.3.3 Identified and Anticipated Needs Exceeding Current Base Programs.

a. PMcoarse monitoring. EPA will be proposing new PM air quality standards that will include requirements to measure coarse particulate matter [$PM_{(10\text{-}2.5)}$]. The Agency expects that new continuous technologies will be used to measure $PM_{(10\text{-}25)}$ with attendant capital, operational and training expenses. The bulk of new requested resources should be directed at initial and recurring equipment and non-salaried maintenance costs (i.e., parts and replacements), and training. Divestment in operator time for related programs such as PM_{10} should provide an available workforce for $PM_{(10\text{-}2.5)}$ monitoring. Although the scope in terms of numbers of sites and locations is not known at this time, it is assumed that the projected sum of $PM_{(10\text{-}2.5)}$ and remaining PM_{10} sampling will be equal to or less than the current PM_{10} operational load. There will be recurring no-salaried costs for equipment repairs/upgrades and laboratory expenses for chemical speciation. Accordingly, a modest request of $10M STAG resources initially to be scaled down to $5M after three years is proposed to meet expected demand for $PM_{(10\text{-}2.5)}$ sampling.

b. NCore Level 1. The CASAC NAMS Subcommittee and SLT's have advocated the need for Level 1 sites to improve our ability to adopt advanced technologies and interface more effectively with the research community at a practical applications level. The STAG resources must remain within the SLT entities to provide the stable workforce for meeting monitoring needs. Less clear is a resource approach to fund NCore Level 1 sites needed to provide the technology interface with advanced technologies and the research community. While some capable SLT's will operate near Level 1 sites (e.g., the MANE-VU rural sites), the Level 1 program ideally provides resources to academic institutions and firms that are leaders in methods development and associated leaders in analysis of data. A recommendation is that $10M annually in EPA's Science and Technology funds be identified to support Level 1 operations.

c. CASTNET. As mentioned in Section 11.3.1, the CASTNET budget should be elevated from $4M to $5M annually.

11.3.4 Summary of Proposed Budget Changes

A compilation of the proposed changes discussed in this subsection are delineated in Table 11-3.

Table 11-3. Proposed summary of redistributed Federal resources. (All STAG funds except where noted)			
Program	**Current**	**Proposed**	**Comments**
$PM_{2.5}$ FRM	21.7	10.7	Assume a 3 year transition
$PM_{2.5}$ continuous mass	3.8	10.1	Assume a 3 year transition and absorb costs for ITT enhancements for all networks
$PM_{2.5}$ speciation	12	8	Retain all trend sites and reduce non trend sites from 160 to 80; assume three year transition
IMPROVE	4.35 (4.95)	4.95	IMPROVE network serves as core rural speciation trends network; needed network adjustments are handled effectively through IMPROVE Steering Committee and related RPO committees. IN FY04 IMPROVE was underfunded by 600K to utilize carryover funds.
PAMS	14	12.5	The revised PAMS requirements are estimated to require less than the assumed $25 total of Federal and State matching funds. Remaining funds are to be used to allow flexibility for studies tailored to city/region specific airsheds. $0.5M dedicated to analysis.
Toxics	16.5	16.5	Emerging program under development
CASTNET	4	5 (1)	Increase agency S&T funds $1M
criteria pollutants/ NCore Level 3	100/0	50/50	NCore Level 3 measurements are viewed as a subset of many of the existing criteria pollutant measurements. The 50/50 split reflects a balance between maintaining flexibility for State/local agencies to engage in special purpose monitoring outside the scope of NCore. This is a very rough estimate as there is extensive overlap between Level 3 and "local flexibility" needs. In addition, the $20M PM mass (FRM and continuous) are considered part of the NCore Level 2 and 3.
NCore Level 2	0	4.5	Recurring equipment and operating expenses associated with new measurements, enhanced data delivery and expanded platforms.
NCore Level 2 (Sentinel sites)	0	1.0	Recurring equipment and operating expenses associated with new measurements, enhanced data delivery and expanded platforms at continental boundary locations and reserved for non S/L/T organizations.
PMcoarse	0	***10***	This does not come from a redistribution, but reflects a modest request in increased STAG 103 anticipation to meet requirements set forth in the new PM standards.
NCore Level 1	0	***10***	This is not a redistribution within existing STAG programs, but a new request that should be agency S&T funds.
QA	1.9	3.2	1.3 M addition for performance evaluation (Table 7.3)
Training	0	0.2	Table 11.5 (average over 3 years FY05Y07)
Data analysis/interpretation	0	2.2	
Total STAG EPA	174.25 ***4.0***	174.25 ***25.0***	Shaded areas not included in total. The values track with the STAG totals listed in Table 11.1

11.4 Training and Guidance for SLT Agencies to Transition to New NCore Measurements.

The transition to the NCore network creates a need for training that addresses new methods, information transfer technologies, and an effective quality assurance program. There are five areas where some type of training or a transfer of information on the Strategy is required. These five areas are segregated into programmatic and technical areas as follows:

- **Programmatic**
  Monitoring Strategy- Overall concepts
  Network Development/Assessment

- **Technical**
  Methods Implementation
  Information Technology
  QA

The majority of the resources allocated to training and guidance will be directed towards the technical areas. These areas lend themselves to the following variety of training mechanisms:

- **Satellite Broadcasts and Videos (DVDs)** - This can provide broad to semi-detailed information about a topic and is used to provide an initial exposure to the area, concepts and rationale for the direction or procedure, time line for implementation and where one would get more detailed information and training. These formal presentation of the topic areas will be developed on DVD and distributed through the OAQPS Education Outreach Group.

- **Hands-on Sessions** - Formal detailed instruction on a particular area.

- **Guidance Documents** - Written guidance providing the necessary detail for an area when possible and generic guidance and suggestions when more than one alternative exits.

- **Vendor-** Training that particular vendors of instrumentation or information technology systems would provide.

- **Web-based training** - Training developed through software that can be posted on the internet.

- **Workshops-** National, Regional or local workshops where various training activities could be presented.

Table 11-4 provides the training mechanisms that will be proposed for the programmatic and technical areas.

Table 11-4 Training Mechanisms						
Area	Training Mechanisms					
	Satellite Broadcasts	Hands - On	Guidance Documents	Vendor	Web Based	Workshops
Monitoring Strategy	✔					✔
Network Development/Assessment	✔		✔			✔
Methods	✔	✔	✔	✔		✔
Information Technology	✔	✔*	✔	✔		✔
QA	✔	✔*	✔		✔	✔

* Information technology and QA training would be incorporated as needed in methods hands-on training activities.

11.4.1 Monitoring Strategy- Overall Concepts Training

Information on the overall concepts of the Monitoring Strategy and its implementation will be conveyed primarily through the Strategy document. However a satellite broadcast of the Strategy will be developed to cover the major concepts of the strategy, and EPA personnel will be available for invited presentations at workshops.

11.4.2 Network Development and Assessment Training

Periodic network assessments are needed to establish and maintain optimum air monitoring networks. Guidance and training materials are needed for future network assessments to provide more structure to the assessment process. The guidance is intended to promote greater national consistency while allowing for flexibility due to the substantial differences among the regions.

As Table 11-4 illustrates, three types of methods training are proposed:

- **Satellite Broadcasts and Videos (DVDs)** - A broadcast module on network assessment will be developed by OAQPS staff. This will provide an overview of the network assessment process, outline roles and responsibilities, and provide a summary of useful statistical techniques. Information on where to go to get more detailed information and training will also be included.

- **Guidance Documents** - EPA is developing a guidance document for use by Regional Offices in conducting network assessments. In addition to providing an overview of the network assessment process, the guidance will provide detailed information on the statistical and other techniques to be used.

- **Workshops**- OAQPS will either host a national meeting or incorporate a network assessment workshop into an appropriate national meeting. Network assessment training would be incorporated into these meetings.

11.4.3 Methods Implementation Training

EPA is enhancing its current on site monitoring platform in RTP, NC to raise the site to a basic Level 2 configuration. The motivation for this effort is to provide a headquarters contacts expert in operations of the trace gas instruments and information transfer technology in order to better gauge the issues and needed actions associated with implementing the technical aspects of the Strategy. Operation of trace gas instruments includes challenges associated with interferences of water vapor, need for frequent zeroing of baseline signal, and, with respect to NOy measurements, attention to sample line losses, conversion efficiencies and calibration approaches. The burden associated with frequent baseline zeroing should be reduced with remote capability provided by expanding ITT services.

Methods Implementation Training will include the following elements:

- Introduction- data uses- specific challenges- interferences
- Equipment Needs
- Initial monitor checking
- Set-up
- Calibration
- Maintenance
- Data Capture/Transfer
- QA/QC
- Data verification/validation/assessment

As Table 11-4 illustrates, five types of methods training are proposed:

- **Satellite Broadcasts and Videos (DVDs)** - A broadcast module on methods will be developed by OAQPS staff that are researching the implementation aspects of the methods in FY03-04 at the Air Training Facility (ATF) platform. This can provide broad to semi-detailed information about a topic and is used to provide an initial exposure to the area, concepts and rationale for the direction or procedure, time line for implementation and where one would get more detailed information and training.

- **Guidance Documents** - A technical assistance document (TAD) on the NCore Level 2 trace gas methods will be developed by late FY04 or early FY05. This TAD will include generic SOPs. Written guidance will be provide the necessary detail for an area when possible, and generic guidance and suggestions will be provided when more than one alternative exits.

- **Formal Hands-on Training -** Formal hands on training will be scheduled each year at the RTP and Las Vegas ATF using contract support (similar to PM Speciation Program). In FY05 one training session will be scheduled in RTP and will be dedicated to the NCore Level 2 pilot site operators (12 sites), and the site operators at the four pilot sites in the CASTNET program. In FY06 and 07 four formal sessions will be scheduled at the ATF facilities and funding for three additional training activities at local venues (e.g NESCAUM) will be secured.

- **Vendor Training -** OAQPS will invite vendors to attend national meetings and workshops as well as hands-on training activities. However no funding will be provided for vendor attendance. However, SLTs, as part of the bidding process for equipment should include hands-on training in the bid request if they so desire this training.

- **Workshops-** OAQPS will either host a national meeting or incorporate a major monitoring strategy workshop into an appropriate national meeting. Methods training would be incorporated into these meetings.

11.4.4 QA Training

Some discussion of QA training is included in Section 7. QA Training will include the following elements:

- EPA QA Policy
- Performance Based Measurement Concept
- Data Quality Objective Process
- Data Quality Indicators and Measurement Quality Objectives
- Audits and Performance Evaluations
- Data Verification & Validation
- Data Quality Assessments
- QA Training (certification/accreditation of QA leads described in section 7)

As Table 11-4 illustrates, five types of QA training are proposed:

- **Satellite Broadcasts and Videos (DVDs)** - A broadcast module on QA will be developed by OAQPS staff. This broadcast will provide a broad overview of the elements that make up the quality system, the changes or additions that were made to the CFR, and how these affect SLT monitoring and QA community.

- **Guidance Documents** - The major QA guidance document will be the QA Handbook for Air Pollution Measurement Systems Volume II Part 1. This will be revised in FY04 and FY05. A TAD on the NCore Level 2 trace gas methods will be developed by late FY04-early FY05. This TAD will include generic SOPs. Written guidance will provide the necessary detail for an area when possible, and generic guidance and suggestions will be provided when more than one alternative exists.

- **Formal Hands-on Training** - Formal hands on training for QA will be incorporated into methods training and will not be developed as stand alone training course. However, OAQPS will revise training material used in the Air Pollution Training Institute course "Quality Assurance for Air Pollution Measurement Systems" (APTI 470).

- **Web-based Training-** Due to the travel restrictions at a number of SLT's, it is difficult acquiring some of the QA training needed. Starting in FY06, OAQPS will develop a number of web-based training modules related to the elements listed above.

- **Workshops-** OAQPS will either host a national meeting or incorporate a major Strategy workshop into an appropriate national meeting. QA training would be incorporated into these meetings. In addition, QA training will be included at the national QA annual meeting where for the past 3 years ambient air monitoring sessions have been facilitated.

11.4.5 Information Technology Training

Information Technology Training includes the following elements:

- Introduction and overall concepts
- Performance needs for NCore
- Hardware and software considerations
- Telemetry options
- Incorporating data Validation
- Meeting AIRNow and AQS reporting needs
- Moving to XML as a common format

As Table 11-4 illustrates, four types of methods training are proposed:

- **Satellite Broadcasts and Videos (DVDs)** - A broadcast module on Information Technology will be developed by OAQPS staff that are researching this implementation area. This would cover areas such as the major concepts, performance needs, equipment considerations, telemetry options, data validation, reporting needs, and movement to a common XML format. Detailed discussions on individual data management systems are not expected to be covered in this forum.

- **Guidance Documents** - As appropriate the QA Handbook for Air Pollution Measurement Systems Volume II Part 1 will be revised to reflect the guidance of how IT systems are to support ambient air monitoring programs. This will be revised in FY04 and FY05.

- **Vendor Training -** OAQPS will invite vendors to attend national meetings and workshops as well as hands-on training activities. However, no funding will be provided for vendor attendance. However, SLT, as part of the bidding process for equipment should include hands-on training in the bid request if they so desire this training.

- **Workshops-** OAQPS will either host a national meeting or incorporate a major Strategy workshop into an appropriate national meeting. A module on information technology will be incorporated into these meetings.

11.4.6 Summary of Training Needs

Table 11-5 identifies the training and guidance activities, resource needs, potential sources of funds, and a timeline for implementing the activities. Guidance development is an inherent EPA responsibility for which non-STAG resources should support.

Table 11-5 Training/Guidance Resource Requirements and Timeline

Training and Guidance

Year (FY)	Technical Area & Activity	Cost (K)	Source	Date	Comments
04	**Network Assessment**				
	Draft guidance document	0	EPA	9/04	Developed by EPA staff.
	Methods				
	Technical Assistance Document	100	EPA	9/04	Developed by OAQPS staff with contractor support (important to get contractors involved if they will be used for methods training)
	QA				
	QA Handbook	0	EPA	9/04	Redbook. Developed by OAQPS staff
Tot.		**100**	EPA		
05	**Network Assessment**				
	Final guidance document	20	EPA	7/05	Contractor support for final review process
	Satellite Broadcast	20	EPA	6/05	Develop concurrent with final guidance.
	Methods				
	Methods Revision	10	EPA	11/1/04	Revisions - based on insights gained from Pilot work
	Hands-on Training	20	STAG	11/30/04	1 session for NCcore Level 2 Pilot station (12) operators in RTP. Limited attendance
	Equipment Purchase	150	STAG	2/05	Trace gas equipment and shelter for Las Vegas Facility. Equipment could be transferred to SLT after CY07
	Satellite Broadcast	20	EPA	6/1/05	Mid FY 05 after gaining some insight from Pilot Studies but early enough to help personnel prepare for CY06
	QA				
	QA Handbook	15	EPA	11/1/04	Completion of document.
	Satellite Broadcast	20	EPA	8/1/05	Mid FY 05 after gaining some insight from Pilot Studies but early enough to help personnel prepare for CY06

Table 11-5 Training/Guidance Resource Requirements and Timeline					
Training and Guidance					
Year (FY)	**Technical Area & Activity**	**Cost (K)**	**Source**	**Date**	**Comments**
Tot.		**275**	(105K EPA, 170 STAG)		
06	**Methods**				
	Methods Revision	10	EPA	11/1/05	Revisions - based on insights gained from Pilot work
	Hands-on Training	80	STAG	11/05 5/06	4 session for new operators in CY06 1 session each in RTP and Vegas in 11/05 and another 2 session 5/06 and additional funds for 3 sessions provided by invitation
	QA APTI 470 Revision	30	EPA	5/05	Revisions - based on insights gained from Pilot work and implementation of the Monitoring Strategy
	Web-Based Training	30	EPA	6/06	
	Data Validation Development	260	EPA	8/1/05	Utilizing the current data validation templates, the experiences learned in the pilot study and general good practices for data validation a "cookbook" will be developed to provide clear and easy to implement instructions for data management systems to validate data. This will include attempting to work with the data management companies to provide software upgrades as necessary for implementation of data validation.
Tot.		**410**	(330K EPA, 80 STAG)		
07	Methods Revision	10	EPA	11/1/06	Revisions - based on insights gained from Pilot work
	Hands-on Training	80	STAG	11/06 5/07	4 session for new operators in CY07 1 session each in RTP and Vegas in 11/05 and another 2 sessions 5/07 and additional funds for 3 sessions provided by invitation
Tot.		**90**	(10K EPA, 80K STAG)		

11.5 Leveraging: Integration Efforts with Other Networks and Organizations.

The CASAC Subcommittee's report recommended increasing integration with other organizations and networks outside of the traditional SLT monitoring programs funded through STAG resources. Opportunities exist to provide and receive reciprocal benefits from established networks and organizations that are more focused, for example, on ecosystem welfare or atmospheric processes, relative to the public exposure emphasis in the traditional monitoring networks.

Effective integration practices that enhance network economies and overall value need to be pursued. However, some skepticism should be acknowledged before engaging in a large scale integration exercise. To date, the Strategy has benefitted from a relatively narrow scope of participants allowing for a well-focused effort with stakeholders knowledgeable of the program and genuinely concerned about its future, without the benefit of a specific budgetary need or regulatory mandate. While the intent to integrate has merit, there is no clear, compelling benefit to individual organizations to participate as the true benefit is holistic in scope encompassing a universe of potential users where "greater" good is derived for all, but the individual payback likely perceived to be so small as to stifle any worthwhile engagement. Furthermore, many air agencies cannot go beyond their charters which involve only air quality. As long as air quality measurements can be integrated into ecosystem needs, rather than dictated by ecosystem needs, there should not be conflicts with respect to air agency goals and directives.

Given this context, it is imperative to proceed along a fairly proactive pathway with modest and achievable objectives to maximize engagement. The following actions are designed to facilitate greater network integration:

- **Addition of Ecosystem Support as NCore Objective.** The CASAC Subcommittee requested that the Strategy adopt a more proactive approach toward incorporating ecosystem welfare issues. Support for ecosystem welfare assessments has been added as an NCore objective, a needed precursor for subsequent integration efforts.

- **NCore Level 2 Siting**. A starting point to foster this integration can be coupled to a design effort that needs to be maintained over the next three years covering NCore deployment. Numerous issues will arise related to site selection and measurement needs that will benefit from better communications across networks and organizations. For simplicity, three disciplines (ecosytems, health, atmospheric processes) are separated as they often are atributed with different objectives, participants and perspectives yet share in some instances significant commonalities in data. A simple example of how such outreach can benefit these disciplines is the siting associated with NCore Level 2 (and 1). A listing of cities that are most likely targets for long term epidimiological studies would allow EPA and the States to priortize deployment of NCore Level 2 sites before States commit to a location not desired for such a purpose. Interaction on Ecosytem Assessment and Atmospheric processes support will be solicited primarily through interactions with the Air Quality Research Subcommittee (AQRS) of CENR. Similar dialogue on health effects and exposure research support will utilze EPA's existing relationship with the Health Effects Institute (HEI). Internally, EPA's health effects, toxicological and exposure scientists will be actively engaged in siting discussions. Within EPA, a specific design team consisting of OAQPS and ORD scientists will provide siting recommendations based on technical needs associated with national scale model evaluation and data analysis objectives.

- **CASTNET Pilot Study**. EPA's Office of Air and Radiation manages the CASTNET network which provides a conduit to the atmospheric deposition and ecosystem assessment community. With certain exceptions, there has been only limited coordination between the CASTNET and the national networks operated by SLT's. Over the last four years, integration with networks has been supported by the addition of IMPROVE $PM_{2.5}$ speciation monitors at eight CASTNET sites. Starting in late 2003, a pilot study was initiated to establish three advanced monitoring sites at CASTNET locations to test new continuous speciation technologies and trace gas instruments. These three sites may become rural NCore Level 2 sites or NCore Level 1 sites, and also provide some minimal technology transfer support.

- **Increased Coordination with National Atmospheric Deposition Program (NADP).** These positive steps taken to assimilate CASTNET measurements into the SLT national networks provides an important linkage both to the NADP networks: the National Trends Network (NTN), AIRMoN and the MDN. Several CASTNET sites share locations with NADP sites. The MDN will provide enormous value to the nation as it is the only infrastructure in place to monitor mercury on a routine basis.

- **Increased Integration with the PBT Monitoring Strategy and Emerging Mercury Monitoring Needs.** EPA has developed a series of recommendations, http://www.epa.gov/ttn/amtic/, to increase our ability to characterize persistent and bioaccumulative toxics (PBT) that include mercury, dioxins and persitent organic pollutants (POPs). In addition, the Agency has been working on a mercury emissions reduction rule that eventually will require ambient gaseous measurements in combination with precipitation and fish tissue mercury data. Currently, gas phase measurements are technically demanding and cost prohibitive to be instituted routinely. However, there are existing linkages between the MDN and CASTNET which could evolve in more comprehensive mercury measurements that are linked with a suite of pollutant measurements within the NCore framework.

- **Allocation of NCore Level 2 Sites as Sentinel Sites for International Transport**. Recognizing the increasing importance of contributions from global scale intercations, the NCore network should include an explict measurement linkage that addresses international pollutant transport. Such a linkage can be established through integration with PBT measurements which often are impacted by Global scale transport phenomena as well as though Sentinel sites located at key inflow and outflow locations near the coastlines and elsewhere. A fraction of NCore Level 2 resources are recommended to be set aside for such Sentinel sites.

- **RPOs.** The RPO's were established to focus on regional haze issues from a regional perspective, recognizing the technical need for addressing haze across numerous geographic and demographic boundaries. The RPO's have made important contributions to the nation's networks, as several key gaps across the nation have been filled by IMPROVE monitors based on the regional perspective taken by RPO's that may not have been accomplished through traditional SLT design needs. The RPO's provide a very sound technical organization that coordinates across SLTs and EPA and provides key support to the Strategy by:

  - adopting a multiple pollutant monitoring approach to address regional haze,

  - conducting field testing of advanced continuous PM speciation instruments, and

  - operating rural/regional sites that could qualify as NCore Level 2 sites.

- **Addition of ammonia and nitric acid to NCore Level 2 list**. Nitrogen is a critical environmental pollutant as it is a major player in atmospheric processes that impact secondary particle and ozone formation, and has substantial impacts on eutrophication and acidification of the nation's watersheds. The addition of nitric acid and ammonia as key national measurements benefits the health effects, atmospheric process and ecosystem welfare communities.

- **Increased communications with exposure and health effects research community and HEI.** The PM Supersites program included support for health effects and exposure research as one of three primary program objectives. As the program winds down, continued efforts must be pursued to ensure that the networks are responsive to the needs of health effects research community. While the NCore Level 2 design is based, in part, on supporting long term epidemiological studies, there still needs to be an effective communications mechanism to increase support to this community. Recent efforts by HEI have incorporated the national networks as part of their ongoing agenda. EPA and HEI should continue to pursue opportunities for integration. More specifically, EPA should engage active researchers in the health effects community and have a substantive meeting addressing important locations (e.g., those cities with planned long term studies) to help prioritize NCore Level 2 sites and comment on the NCore Level 2 parameter list. Additional attention also needs to be given to the proposed "daily" speciation sites which evolved into approximately 10 continuous speciation sites as discussed in Section 6.

- **NARSTO.** NARSTO always has considered the nation's air monitoring networks as a key infrastructure component upon which complementary special intensive field programs provide a rich base of data for understanding atmospheric processes. The NCore Level 2 design follows this construct; clearly, the NARSTO organization should be more engaged in supporting network design and understanding network outputs.

- **CENR/AQRS.** The AQRS of CENR is a multi-agency (EPA, NOAA, NPS, DOE, DOI, USDA) group positioned to foster integration across a variety air related topics. The AQRS has in the past pursued related inventorying of a variety of monitoring network efforts and generally is well positioned to offer guidance to EPA on effective approaches to integration. The implementation of the Strategy has been added to the AQRS agenda for 2004.

11.6 Network Deployment

Deployment of a full NCore Level 2 network will be phased in over a three year period (See Table 11-6), preceded by pilot programs to develop practical experience and knowledge of issues prior to a large scale network deployment. Three pilot programs were initiated in 2003 and should provide field results by the middle of 2004:

- **Internal EPA-RTP methods facility.** As described above, EPA maintains an monitoring platform for training and to gain experience with various technologies. Currently, this in-house facility is focused on trace gas methods and associated operational and quality assurance issues.

- **Joint OAQPS-OAP CASTNET pilot study.** EPA OAQPS and Office of Atmospheric Program (OAP) staff are funding a pilot study at three CASTNET sites to explore new continuous technologies that would complement the existing filter pack techniques and to leverage the CASTNET infrastructure to establish rural NCore Level 2 sites. In addition to testing continuous ion chromatography instrumentation for major aerosol ions, these sites will be outfitted with NCore Level 2 trace gas monitors.

- **NATTS.** The NATTS will be adding trace level CO instruments at four locations to assess the use of CO as potential surrogate for mobile source hazardous air pollutants. Most of the NATTS will be NCore Level 2 sites and eventually include CO measurements. These four sites are being treated as a pilot program to investigate both methodological issues as well as assessing CO as a surrogate for other measurements. The use of continuous CO data is attractive from a temporal perspective, as virtually all air toxics measurements are conducted through integrated techniques.

In addition to these pilot programs, there exist a handful of other studies being conducted by State and local agencies that will contribute to the knowledge base for addressing issues associated with trace gas measurements.

11.7 Implementation Oversight

Since there are so many implementation details with unknown outcomes, it is prudent for EPA to maintain ongoing oversight tools to ensure that the basic spirit and intent of the Strategy is carried out, and to minimize miscommunication. To date, two committees have served important roles in steering the direction of the Strategy. These include the NAMS steering committee and the CASAC NAMS Subcommittee. A core group of original NMSC members are members of SAMWG.[1] SAMWG meets twice annually, and provides a forum for exchange of technical information and monitoring policy discussions, and is a logical outlet that brings together State and local agency monitoring program leadership with EPA Headquarters and Regional Offices. In addition to providing technical leadership, SAMWG will be particularly valuable in working out many of the implications to agencies associated with funding shifts brought about by the Strategy. The CASAC NAMS Subcommittee met in Summer 2003 and provided useful feedback to EPA, much of which has been incorporated in this document. During that initial meeting, EPA and the Subcommittee agreed to extend the Subcommittee's role to monitor progress during implementation of the Strategy.

11.8 Implementation Schedule

The projected timelines for key actions to implement the Strategy are given in Table 11-6.

[1]SAMWG is undergoing a reorganization and likely to be renamed.

Table 11-6. Implementation Schedule		
Action	**Date**	**Notes**
<u>Monitoring Regulations</u>		
Draft Monitoring regulations	6/04	Large variation in time required to achieve necessary reviews.
Proposed regulations for public review	11/04	
Final regulations	3-6/05	
<u>Level 2 NCore site selection</u>		
Establish outreach mechanisms	3/04 - 4/05	Principal communications through CENR/AQRS on ecosytem and atmospheric process perspectives, and HEI on health effects and exposure.
Initial recommendations from EPA OAQPS, RO's and ORD	3-12/04	engage EPA health and air quality modeling scientists for Ncore site locations
Review and modifications	3-4/05	provide specific NCore Level site locations by 4/05
<u>Level 2 NCore Methods and technology guidance</u>		
EPA acquisition and protocol development	9/03-12/04	In-house purchase of equipment and staff familiarization
Pilot studies	3/04-3/05	At 4 Air Toxics NATTS, RTP, NC and 3 CASTNET locations
Guidance package for trace level gases	4/05	
<u>Level 2 NCore Deployment</u>		
Phase 1: pilot and related sites; approximately 12 stations	1/05	Expect flexibility in dates and numbers, holding fast to three year implementation schedule for Level 2 sites
Phase 2: establishment of ~ 25 post pilot sites in routine operations	1/06	
Phase 3: completion of ~75 stations	1/07	
<u>Network Assessment Guidance</u>	7/05	
<u>Training</u>....see detailed Table 11.5		
<u>Quality Assurance</u> .....see detailed Table 11.5		
<u>Data Analysis</u>		
Data analysis plan	6/05	Joint agency SLT plan on coordinated data analysis program

Section 12 - Issues

The success of the Strategy will be perceived from two perspectives:

- **Classical**. A classical view deals with the mechanical aspects of deploying multiple pollutant sites, conducting meaningful network assessments, and promulgating regulations. The menu of training, pilot studies and resource recommendations speak directly to this perspective, and entail a plethora of administrative and technical challenges.

- **Value.** Perhaps a more important perspective is based on the level of value derived from the networks in terms of how air and environmental program policy is shaped and evaluated. In addressing this issue, the real success of the Strategy ultimately will require other important systems, and perhaps cultural modification upgrades that allow for a meaningful dialogue across data generators and data user communities.

12.1 Resource Issues.

12.1.1 Funding Stability for Monitoring Agencies and Tribes. The early Strategy discussions evoked a concern that any change in the networks, especially a thinning in monitoring sites, would result in a reduction in resources and serious degradation of monitoring agencies. These concerns were allayed by stressing the importance of retaining a stable funding base as a Strategy operating principle, and emphasizing a reallocation of skill mix (from labor to technical) and measurement approaches. Retaining a stable funding base for monitoring agencies and Tribes is of paramount importance among numerous resource concerns. Although many environmental assessment initiatives are based on short duration (1-3 years) efforts, effective ambient monitoring practice requires a longer, stable operation that can capture gradual signal changes in atmospheric concentrations over decades, while maintaining and enhancing a substantial infrastructure. Both the cost effectiveness and technical credibility of monitoring operations are compromised if operated in a cyclical ramp up, ramp down mode. A combined challenge will require balancing a desire for network responsiveness and flexibility with a stable underpinning.

12.1.2 NCore Level 1. There is no assurance that resources will be available to support advanced monitoring sites that provide a necessary technology transfer mechanism across the research and applications communities. The need for these sites has been emphasized throughout this document. Level 1 sites address a major weakness inherent in the national networks, which is the ability to capture adequate environmental measurements relevant to many evolving demands for air programs. Resources for Level 1 measurements should not be extracted from the existing STAG resource pool, acknowledging the need for stable agency and Tribal funding support.

12.2 Technical Issues

12.2.1 Measurements. Measurement challenges include the need to detect at very low concentration levels, and adopting to emerging pollutants, including precursors of concern.

First, as environmental progress continues to reduce atmospheric pollutant levels, the ability to adequately measure pollutants in very low concentration ranges is compromised by numerous factors mostly related to a spectrum of interferences that remain relatively stable (e.g., water vapor) and take on increasing importance with decreasing target compound concentrations. Even more challenging is the continued emergence of priority environmental pollutants. A few examples include fine particulate matter in the late 1990's, complex fractions and specific compounds associated with aerosol carbon, and numerous HAPs in the air toxics program which present somewhat profound measurement difficulties. Such a trend will continue over the foreseeable future. Gradually, traditional measurement approaches will undergo a major renovation that embraces emerging technologies that offer unlimited potential for environmental measurements. Such technologies include a range of semiconductor and microchip arrangements as well as nanotechnology.

12.2.2 Data Transmittal and Receiving. As more monitoring systems are converted to near continuous output, there needs to be a corresponding adoption of modern data handling systems. This issue has more to do with enabling agencies with appropriate guidance and resources to update data systems, as the technology is well evolved and available.

12.2.3 Standardization versus performance based standards. There are competing interests between the desire to embrace new technologies and the need for highly consistent measurement results. A performance based approach for methods approval and laboratory protocols is viewed as progressive and technology friendly. With adequate quality control measures, such an approach conceptually can provide technology incentives concurrently with meeting measurement quality objectives. Lacking adequate quality controls carries an attendant risk of producing measurement inconsistencies that compromise data interpretation and degrade temporal and spatial relationships. The Strategy largely advocates a performance based approach, particularly in regard to accommodating continuous particulate matter measurements. On the other hand, the Strategy implicitly relies on measurement consistency given the emphasis on synthesizing data from across disparate regions of the nation. This apparent paradox must be recognized to ensure that quality assurance systems are supported and operating as intended, as the reliance on performance based approaches is contingent upon an effective quality assurance program.

12.3 Administrative: Use of STAG Grants for National QA and Data Analysis

The implementation plan proposes a variety of funding shifts within the current program structure which require solutions based on some combination of needed consensus building or an explicit pool of new resources. The basic funding shifts of moving resources from filter based methods to continuous and trace gas measurements is relatively straightforward, although it requires a substantial communications and training effort. To a lesser degree, there is a concern about the ability to reach consensus on funding sources for national level quality assurance and data analysis, as described in Section 11. Over the course of deploying the $PM_{2.5}$ network, EPA and States and local agencies reached agreement on utilizing Section 103 STAG funds to support the $PM_{2.5}$ performance evaluation program (PEP), the national level quality assurance program enabling EPA to develop estimates of FRM performance. The rationale for using STAG funds was predicated on the understanding that such QA was a required element of the program, and it was more efficient to manage the program nationally through EPA headquarters. Although consensus was reached on this approach, there always remained an underlying philosophical concern regarding whether such national QA should be funded through STAG or other EPA resources. From EPA's perspective, the STAG resources had a track record of stability that really is a prerequisite to maintain support for quality assurance efforts; whereas, EPA internal resources generally tend be volatile as they are subject to a spectrum of changing priorities. This issue is brought to attention here as the Strategy is recommending an increase in the STAG resources to support national level QA.

In addition to recommending a stable funding source for QA, the Strategy also recommends sectoring off STAG funds to support data analysis. This proposal follows the model established early in the air toxics monitoring program. The same issues discussed under QA apply here in an attempt to address an important gap in the monitoring programs. Assuming consensus is generated to dedicate STAG funds to data analysis, there remain a series of administrative questions regarding how such a program is carried out. Possible scenarios include establishing a management team of SLT/EPA members, charging EPA or a multi-state organization with this task with or without rotational turns.

12.4 Addressing Data Availability and Data Analysis Needs

The basic motivating reasons that initiated this Strategy remain as the principal obstacles to realizing the enormous potential of environmental data generated by the Nation's networks. Underlying all the rationale discussed in this introduction is a systematic problem of underutilization of environmental data. It is only through full data utilization that the concepts of meaningful network assessments and change, effective quality assurance insights, and integrated program relevancy can be realized. That is, retrospectively, if there existed a fully engaged and integrated data generating--data user--decision maker continuum network systems would be assessed and upgraded as a matter of daily routine.

The Strategy is taking positive steps to produce data more relevant to the user communities over the next few years. However, the Strategy lacks any definitive approach for promoting the use of its product, which requires an added level of commitment to data systems (e.g., transmission, archiving and distribution/access) and data analysis. This situation reflects a programmatic tendency toward compartmentalizing tasks. In this case, the Strategy development is led by the data collection/measurement component within EPA. The participation of partners in other functional areas (e.g., policy, data systems and analysis) has, understandably, been less of a priority. At this point, it is appropriate to acknowledge that substantial improvements need to be made to improve the linkages and effectiveness across numerous data systems that play various roles in handling air quality data with a commensurate education or communications effort that reaches the academic and private sector communities in addition to other government agencies typically supported by EPA.

12.4.1 Current Issues

There are two specific issues related to improving the accessibility to the data collected in the network. First, is reducing the time between pollution being in the air and EPA having information about it available for use. There are many reasons for delays in the "timeliness" of the data. First is the measurement method itself. Some samples can be taken in seconds, while others take hours or days to collect. Then there is a delay in measurement of a sample. Continuous methods are virtually instantaneous while filter or canister methods must include time for transit to a lab, queuing for analysis, the measurement(s) made, and transit of the information back to the agency responsible for quality assurance and transmittal to EPA. Once the data is submitted to EPA, it is immediately available for use. Another reason for delays in the availability of the data is that regulations only require submission to EPA by 90 days after the calendar quarter in which the sample was collected. As work will expand to fill available time, EPA must revisit the deadline requirements or investigate incentives for beating the deadline. The near-real-time data submitted to EPA is done voluntarily and not required to meet the same quality requirements as the regulatory data. The issue of timely data is closely related to those of measurements and standardization versus performance based standards raised in Section 12.2.

The second issue related to data accessibility is ease of access. Two factors contribute to difficulties in our partners and customers easily getting the data they need. First, the network has many monitors operating on relatively fine time scales. This means there is a large volume of data available. Generally, technology outpaced data transfer and storage issues, so this does not present an insurmountable problem. The primary issue regarding data volume is cost. EPA has a finite amount of storage and networking capacity which must be shared and balanced among numerous users and demands. Redirecting resources can help with this issue, but shifting these resources would impact some other part of the program. The other ease of access factor is the complexity of the data and the myriad potential analytical uses for it. Data is collected using different methods, on different schedules, with different accuracy, and is affected by natural and anthropogenic events. EPA can make data available as it is reported or in a form processed to uniform time and exposure metrics. The former is easiest for EPA but requires significant knowledge (or training) on the part of the consumer as to the contents and organization of the data and what pre-processing is necessary for their analysis. The latter is easier to use, but more prone to misuse if the analyst would apply a different set of assumptions in processing the data.

12.4.2 Data Archiving, Distribution and Analysis Efforts.

EPA is addressing these issues with a variety of approaches emerging from a long range “Data Warehouse” OAQPS planning effort as well inter office collaboration with the Agency’s Office of Environmental Information (OEI). Several pilot projects to gauge the usefulness of new data products and access methods will be launched over the next two years. Included is the first "versioned" set of data from the monitoring network, a static snapshot of the EPA air quality data that occasionally is needed as the multitude of data points submitted to EPA each day create a moving target compromising referencability. EPA’s system was taken off-line for several days so that a “static” copy could be made available, at the request of a community of EPA research grant recipients.

An effort is underway to make all measured (versus reduced) data in AQS available on demand, allowing a customer to extract a data file based on their selection of geographic area, time frame, and pollutants of interest. A subsequent addition of the more timely AirNow data (including quality assurance caveats)would provide an exponential enhancement in data delivery.

Another goal is to make detailed air quality data summaries available to anyone at any time by offering a variety of self-service tools to access the data. Currently web pages exist allowing querying of annual summary information, and air quality professionals can access any data in the system. The relevant databases and tools are being upgraded to enable public availability of daily summary information through internet access. The timeliness of this information also will improve as processing time is reduced between data coming into EPA and availability made to the public and our external partners.

The linkage to OEI offers the longer range potential to merge multi media data sets benefitting for ecosystem assessment support. Most important is the need for EPA to broaden its outreach efforts beyond traditional clients (e.g., STAG recipients) to key consumer communities including academia, public health organizations and the private sector to ensure delivery of effective products and services.

Data analysis efforts are addressed in Section 11. Included in the funding strategy is the recommendation to shift $2.5M annually of funds that previously had been allocated for measurement collection into a focused data analysis efforts.

12.5 Policy Conflicts

The original network assessments aroused the policy community in addition to agencies that feared funding cuts associated with network thinning. Policy concerns were based on the historical use of monitoring sites representing explicit demographic boundaries (e.g., a county or MSA), which were perceived as potentially in conflict with the more extended spatial applications of data used in the assessment analyses. Some of these concerns are:

- undermining legally bound agreements based on the results of specific monitoring stations; and

- removing monitoring sites in designated nonattainment locations and substituting other information representative of that location.

Network assessments produce recommendations on removing or relocating samplers based largely on technical merit. In some instances, these recommendations may be in conflict with existing policy or other needs. For example, a recommendation that an ozone monitor be discontinued in a “nonattainment” county due to redundancy of neighboring sampling sites raises interesting policy/technical issues. Issues such as this need to be resolved following a credible technical recommendation of network realignment. It should not be assumed that policy should override a technical recommendation, nor should technical approach override existing policy. It should be possible to develop case-by-case solutions to these issues where needed.

On the other hand, it should be recognized that policy precedents in many ways constrict the value of air quality data. By assuming that a monitor’s prime objective is to represent a limited demographic boundary, then the actual spatial value of data is severely undermined as a veritable tool chest of spatial modeling applications which attempt to reflect natural processes are relegated to secondary status and not given the critical mass/interest to become commonplace in air quality planning. Clearly, many approaches within air program policy are out of balance with natural systems, and a determined approach toward harmonizing air program analyses with natural systems is in order to extract the most value from environmental measurements. Also troubling is the delineated use of measurements and modeled predictions. Measurements are the current tool for strict regulatory applications, and models are used as a planning tool. The reality is that measurements really are just estimates of surrounding reality, and in one sense no different from a predictive output from a model. Both these tools need to be more effectively merged to support in unity a host of regulatory and planning applications.

These issues are indicative of a the need for better interaction between the policy/decision making and technical elements within air program operations, as well as across compartmentalized technical elements. The Strategy is only stating the issue by recognizing a lack of needed engagement between these communities.

12.6 Future Issues

It is fully expected that additional issues will develop as the Strategy is implemented. As such issues arise, EPA will engage in dialog with the appropriate entities (e.g., SLTs) and the appropriate staff (e.g., monitoring technical issues, funding issues, policy issues, etc.) so that the dialog is conducted with those individuals most knowledgeable with that specific topic. By engaging in such dialog in a timely manner, it is intended that potential implementation delays can be avoided or at least substantially reduced.

ADDENDUM
National Ambient Air Monitoring Strategy

Responses to Comments
On the
National Monitoring Strategy Documents

Topic 1. Network Realignments

1. Reducing monitors is not appropriate in areas with population growth.
   It is expected that as part of the Level 3 NCore sites, additional sites may in fact be warranted in areas of new population growth where no monitoring has been conducted before. However, even in these areas, within the existing core population areas, there may be opportunities to reduce monitors, especially those with long historical records and good correlation to adjacent monitors. Thus, in essence, there is a restructuring of the existing network to accommodate monitoring needs for population growth. This process is consistent with the Strategy.

2. Divestments may not be possible in low population states with minimum monitoring sites. It may not be possible to realize any appreciable cost savings to support a Level 2 site.
   We recognize that such conditions may exist, especially in some of the intermountain states. Consideration will be given to for an opt-out provision to allow an exemption from the regulatory minimum NCore site allocations provided that the state commits to meet the NCore requirements to the degree possible.

3. Reducing sites in non-attainment areas is not practical.
   One of the key objectives of the Strategy is to make more efficient use of our monitoring resources, so current and future monitoring needs can be accommodated within limited budgets. In both attainment and non-attainment areas, there are opportunities for re-evaluating existing monitors and monitoring sites. Where redundancies of information exist (e.g., the information provided by a monitor can be estimated with reasonable accuracy from data at adjacent monitors), opportunities for realigning our networks also exist. Where we can remove little-value-added sites and apply those saved resources to increase multi-pollutant sites with improved information technology flow, the public will be better served.

4. In some areas, SIP commitments and Maintenance Plans require additional monitors. This seems inconsistent with the Strategy.
   Such commitments are typically on a more localized scale (e.g., within a specific urbanized or rural area). Over the broader picture, the regulatory NCore requirements are specified on a statewide basis. Thus, while some local areas

may appear to have needs counter to the Strategy, there should still be enough flexibility within a state's domain to meet the needs of the Strategy. Also, within EPA, those involved in the policy aspects of planning requirements are looking at ways to foster better consistency between planning and monitoring programs.

5. It is inappropriate to expect reduced monitoring in areas of complex terrain and emissions gradients.
   This may or may not be the case. If existing monitors have a reasonable historical record, and there are good correlations among monitors, even in areas of complex terrain and emissions gradients, then opportunities for network realignment exist. Whether such opportunities are available is a function of the network assessment process.

6. Reductions in monitors may jeopardize local initiatives and state/local needs.
   To the contrary, the Strategy is intended to optimize state/local needs by allowing a greater level of local flexibility for such purposes. In essence, federal requirements for numbers of monitors will, in most cases, be reduced. In return, state/local agencies will be required to support one multi-pollutant site (or up to four multi-pollutant sites in the most heavily populated states) AND resources previously allocated to meeting the greater level of federal monitoring requirements will now be available to meet local needs and initiatives. In other words, in many states, local needs will have greater support from EPA than in the past.

7. This is the wrong time to be changing direction in air monitoring programs in light of the new ozone and PM2.5 standards.
   One of the objectives of the Strategy is to support, to a greater extent, new standards and associated monitoring needs. For ozone, existing monitors produce 8-hr data just as readily as the 1-hr data. It would be expected that part of the NCore Level 3 site network, realignments of monitoring sites may be appropriate to meet the needs for the new 8-hr standard. For PM2.5, it is recognized that the initial rapid deployment of over 1100 monitors nationally has provided data necessary for the designation process, but now the emphasis needs to shift toward continuous PM2.5 measurements at a more strategic subset of locations, thereby substantially reducing the high costs associated with filter-based monitoring. Further, the Strategy allows for readily incorporating monitoring needs for potential new standards, such as PMcoarse, within a reasonable proximity of existing resources. It would not be expected, for example, that there would be another $40 million per year allocated for PMcoarse, as was the case for PM2.5. Thus, we have to have a program which can more conveniently accommodate new monitoring needs. The Strategy will allow for this.

8. Realignment of monitors could have adverse effects on PSD/NSR programs, model validation, and designation/redesignation processes.

If the Strategy is implemented effectively, we do not anticipate adverse effects on any of these programs. To reiterate what has been stated earlier, the Strategy is intended to identify those sites for which the monitored data provide little additional value. In other words, perhaps due to certain monitoring densities in urban areas, there are monitors which are well-correlated with adjacent monitors, so the information provided can be estimated with reasonable confidence from the adjacent monitors. It is also intended that the Level 3 sites be properly situated so as to assure that the design-value sites are fully accounted for. For those pollutants which are substantially no longer exceeded, such as lead, carbon monoxide, and sulfur dioxide, again, opportunities are available for reducing monitoring without compromising important planning/policy considerations. Regarding model validation, it is recognized that many model validation programs are based on special one-time field studies which seek to gain a temporarily dense surface network along with aircraft measurements to validate conditions aloft. Since these special studies are associated with special funding for their support, the Strategy should not have any bearing on such studies. Further, the Strategy will bring additional information which may be of benefit to model validation, namely, a greater array of precursor information at the Level 2 sites, and a more complete suite of interim pollutant formation products at Level 1 sites.

9. Consideration should be given to not reducing SO2 monitoring because of the possible 5-minute average NAAQS.
   The Strategy is intended to accommodate new standards. It would be expected that: (1) any exceedances of the 5-minute standard would be associated with a specific source or sources of SO2 emissions capable of causing such conditions, and (2) that the NCore Level 3 network would include SO2 monitors in areas where such exceedances may be possible. Clearly, there are many locations where SO2 emissions sources are not of the degree to cause an exceedance, and hence, SO2 monitoring is not needed. This presumption can be augmented by modeling to determine maximum predicted impacts and by some temporary SO2 monitoring, if necessary, to verify continuing low SO2 levels.

10. The Strategy will result in less data for trend analyses.
    Given that both Level 2 and Level 3 sites will provide data for trend analyses, there should not be any substantial loss in information for trend determinations. One of the key objectives of the Level 3 sites is to assure that important information is not compromised, including sites with the higher concentrations, sufficient monitor density for proper air pollutant mapping (for ozone and PM), and linkages with historical trend sites. Thus important trend data will not be lost or compromised, though the number of sites providing essentially the same trend data could be less.

11. Before any realignments occur, we need to identify new investments first.
    Actually, new investments are an integral part of the Strategy. These encompass several processes: (1) the establishment of Level 2 sites and the monitoring

requirements for each one; (2) the network assessment process which helps to determine where, for example, re-location of monitors may provide more beneficial information; and (3) new standards, such as the potential PMcoarse standard, which would require monitoring for such pollutants. These processes are intended to be ongoing, such that new monitoring needs are identified as early as possible, and network changes can be made to meet these needs.

12. PAMS should not be discontinued.
    There is no intent to discontinue PAMS. Rather, PAMS, as well as other existing networks such as IMPROVE and CASTNET are intended to complement the NCore Level-2 and Level-3 sites to the degree feasible. With respect specifically to PAMS, it has been recognized that this program has not produced the value that was intended when the program was created. In 2000, there was a workshop devoted to making better use of the PAMS program and the data collected through it. This workshop has led to a "restructuring" of PAMS such that it becomes a more effective and meaningful monitoring and data analysis program. Within the concept of the Strategy, the PAMS program is expected to be included under the overall umbrella of NCore, with regulatory requirements for NCore PAMS sites.

13. Reductions in PM2.5 monitors will reduce ability to protect public health.
    When the PM2.5 network was rolled out in 1999, there were some 1100 filter-based sites nationwide. At the outset of any monitoring program where there is little information available, it is important to establish a dense enough network to capture the essential information needed to planning and policy purposes, as well as for informing the public. Once the initial information is obtained – and we now have at least three or more years of information from the majority of the PM2.5 sites – the need for maintaining a dense network is reduced, while at the same time maintaining the same level of useful information. Furthermore, the Strategy focuses on improved technologies, including greater use of continuous PM2.5 monitors, which will provide a greater level of real-time information to the public. For the purpose of public air quality advisories, forecasts, and general up-to-date PM2.5 data, the move toward continuous PM2.5 monitors will greatly enhance the ability to advise the public and protect public health.

14. The changes in the PM2.5 network should be timed to coincide with the development of the PMcoarse network.
    We agree that clearly there will be efficiencies in doing both simultaneously, but given that there is an undefined timeline for a PMcoarse standard at this time, actions to implement the Strategy should proceed independent of the PMcoarse standard setting process. Recognizing that the Strategy is intended to incorporate new monitoring needs as efficiently as possible, we believe it is most prudent to move forward with the Strategy at this time and not wait for new standards and timelines to evolve.

15. Divestments and network realignments should be based on public input and overall need.
With respect to public input, we agree that the public needs to be engaged, but not necessarily to the point where changes occur ONLY in response to public comments. The Strategy includes a strong public communications and outreach program, including the development of a brochure for general public consumption. State and local agencies are being encouraged to engage the public in a variety of possible public forums before any network changes occur. Experience has shown that network changes without public involvement can result in negative public perceptions, especially when removal of a monitoring site is involved. Rather, we are emphasizing that there is a need to be proactive, and discuss the purpose of monitoring sites, the rationale for their location, the rationale for projected network changes, and advantages for greater public availability of information through new monitoring and information transfer technologies. With respect to need, the Strategy places a strong emphasis on need. Previously, networks were developed, layered one on the other (e.g., an ozone network, a CO network, a PM10 network, etc.) with little regard for the considering the multi-pollutant advantages. Under the Strategy, the air monitoring networks are being considered holistically, with emphasis on the benefits of careful network planning in measuring and understanding the complex mixtures of pollutants which we breathe.

16. The changes proposed in the Strategy may not be legal.
The requirements for monitoring specified air pollutants are contained in 40CFR Part 58. These regulations are in the process of being revised to reflect the objectives of the Strategy. Changes to these regulations follow the same public review and comment process as other EPA regulations. Therefore, there should not be any legal impediment.

<u>Topic 2. NCore</u>

17. The NCore concept is not clearly defined.
Without knowing what specifically is unclear, it is hard to determine specific elements which need clarifying. However, the Final Strategy Document (FSD) adds more details as compared to the Draft Strategy Document, not only with respect to NCore, but throughout the document. In general, we believe the NCore concept, the three levels of monitoring structure, and the local/flexible component have at least been expressed sufficiently to indicate what it is intended to accomplish.

18. Why can't NCore be folded into the current monitoring program?
Please refer to the last two sentences in the response to comment #15. We believe that the most effective way to transition to a new monitoring paradigm is through a new strategy, rather than trying to add new layers onto what is believed to be a more cumbersome process.

19. There should be a minimum monitoring density established for AQI and mapping purposes.
We agree that there should be sufficient monitors for being responsive to public needs for AQI reporting and spatial mapping; however, there are so many parameters which can be considered for density purposes (e.g., urban vs rural populations; large vs small spatial gradients; flat vs complex terrain; etc.) that it is not really appropriate to establish a minimum density condition. Rather, Table 3 of the Draft Summary Document gave some indication of the expected changes for the required minimum number of nationwide monitors by pollutant. For those of greatest concern, ozone and PM2.5, the minimum number of required monitors actually increases. It is expected that state and local agencies will adequately realign their networks to assure that monitors used for AQI and mapping purposes will meet or exceed the value of information currently available to the public.

20. It is not clear how monitoring for air toxics, regional haze, and global warming would be implemented.
For air toxic monitoring, there are two aspects for consideration. First, where appropriate, the national air toxics trends sites (NATTS) network is proposed to be included at NCore Level 2 sites. There will be more Level 2 sites than NATTS, but Level 2 sites will not have a uniformly standard configuration. There will be a minimal multi-pollutant configuration for Level 2 sites, and some Level 2 locations will have more monitoring than the specified minimum. Air toxics monitoring is one aspect that will result in a greater level of monitoring at some of the Level 2 sites. Secondly, local air toxics conditions are more of a local-level determinant, and accordingly, locally-tailored air toxics monitoring is intended to be included with the local/flexible component of the Strategy.

For regional haze considerations, we believe the multi-pollutant approach will enhance relevant information, especially with respect to precursor pollutants. Aside from this, there are no specific monitoring requirements targeted specifically for regional haze purposes under NCore, except that states and local agencies can opt for specialized measurements as needed under the local/flexible portion of the Strategy. Similarly, there are no specific considerations for monitoring greenhouse gases (such as CO2 and methane), although it is possible that some monitoring for these compounds could be included within the Level 1 sites.

21. NCore should include other monitoring programs such as the National Dioxin Network, PAMS, CASTNET, and IMPROVE.
The overarching goal of the Strategy is to become more efficient in the way we monitor air quality across the nation using primarily Section 103 and 105 Grant Funds to state and local agencies. Other programs, such as CASTNET and IMPROVE have their own funding mechanisms. It is envisioned that NCore's structure will capitalize on the other existing networks for optimization and efficiency. For example, a Level 2 NCore location might be determined based on

using a PAMS site or a PM2.5 speciation site which can be expanded to include criteria pollutant monitoring and air toxics monitoring. Selection of a rural Level 2 site should account for existing IMPROVE and CASTNET sites such that the NCore site optimizes gap-filling situations while meeting Level 2 NCore objectives. This way, other networks are conceptually integrated into the NCore design while still maintaining their own objectives and funding. Also, please refer to the response to item #12.

22. NCore should at least coordinate with programs that monitor for bioaccumulative pollutants.
    We agree, though decisions on NCore siting should not necessarily be dictated by bioaccumulative pollutant (e.g., mercury) needs. Where it makes sense, bioaccumulative monitoring can be done at an NCore site if the host state/local agency or tribe can accommodate such monitoring, to include logistics, funding, resource availability, and operator training.

23. NCore should target more contaminated locations.
    To reiterate the purpose the distinct NCore levels: Level 2 sites are multipollutant sites in both urban and rural areas, with consistency as to the representativeness of these sites such that meaningful comparisons can be made among the sites. The Level 3 sites complement the Level 2 sites by assuring adequate network coverage to meet a number of important monitoring objectives, including locations where the highest levels (i.e., the most contaminated sites) either are occurring or are expected to occur. Because pollutants behave differently, locations of highest ozone may not be the same as those for particulates or air toxics. Thus representing an urban area with one Level 2 site could not necessarily achieve a "most contaminated" scenario. We want the Level 2 sites to be most "representative" of the specific urban or rural area, with the Level 3 sites targeting more individual pollutant characteristics.

24. There should be a formal process for site selection.
    There is a process for site selection. For Level 2 sites, EPA will establish guidance for determining representative locations. State and local agencies have the greatest expertise and knowledge about conditions in an area and are in the best position to recommend a specific location. Each recommendation will be forwarded to EPA Headquarters where reviews of the candidate sites will be made. If any candidate site is determined not to be meeting the national guidelines, a state/local agency would need to consider another location. For Level 3 sites, targeted needs include monitoring in areas with the highest concentration and greatest population exposure; defining nonattainment areas and boundaries; meeting SIP needs; evaluating local background conditions; meeting spatial mapping and AQI needs; and supplementing the Level 2 sites for trend analyses. All Level 3 sites will require EPA Regional Office approval. The Level 1 sites – the most fully instrumented of the NCore sites – will typically not be under state/local agency auspices. These sites, funded separately by EPA, will

require EPA Headquarters approval. Taken together, these do represent a reasonable process for site selection.

25. Supporting epidemiological studies will fail due to number of sites, species measured, and sampling frequency.
To the contrary, the NCore design should enhance data for epidemiological studies. Such studies typically must account for confounding parameters, and the fact that Level 2 sites will encompass multi-pollutant monitoring will provide data bases with much-needed co-located data. With the design for representative sites among urban and rural areas, comparisons among populations with differing pollutant exposures are also enhanced. Level 3 sites will augment these to help define spatial and temporal patterns within each urban area. The Strategy embraces moving more toward continuous, rather than filter-based monitors, and will enhance the temporal resolution of PM data. Regarding the number of sites, divestments are recommended where existing monitors provide little additional informational value and can be readily predicted by adjacent sites; and also for those pollutants for which no longer exceed health-based standards. The net effect of lesser monitors is minimal, but the strategic locations of NCore sites coupled with multi-pollutant intent, is a major step forward. Combined, these aspects of the Strategy should improve data bases for epidemiological purposes. The CASAC NAMS Subcommittee, as well as a number of epidemiologists, has embraced the concept.

26. NCore does not account for spatial variability, especially in urban areas.
The Level 2 NCore sites will not account for spatial variability, but the Level 3 sites will. One of the objectives of the Level 3 sites will be to maintain adequate spatial coverage for the pollutants of primary concern (e.g., ozone and fine PM) for spatial mapping and AQI purposes. If a state/local agency believes that an even greater level of spatial detail is warranted, the local/flexible portion of the Strategy allows for monitoring to meet specific local area needs and objectives on a temporary or on-going basis.

27. A “one-size-fits-all” approach is not a solution.
Nothing in the Strategy and NCore design advocates such an approach. While EPA maintains oversight approvals for the NCore sites, the determination of candidate sites resides with the state/local agencies and tribes. In addition, the Strategy allows for a local/flexible component to the monitoring design, whereby state/local agencies can allocate some of the available resources toward meeting monitoring needs specific to the community. This could be for addressing environmental justice concerns; local source monitoring; microscale or background monitoring; and other local needs. This flexibility is greater than currently exists and allows for a tailoring of the monitoring program. Clearly this is not a “one-size-fits-all” strategy.

28. There may be a disconnect between the number of proposed sites and the numbers determined by the DQO process.

We don't believe there is a "disconnect." Part of the Strategy includes a thorough review of quality assurance processes, with the intent of streamlining QA to mesh with the overall objectives of the Strategy.

29. There may not be a need for more rural sites and, in fact, some reductions may be warranted.
    This may be true in some instances, but not universally. It is envisioned that the rural component of the Level 2 NCore sites will encompass approximately 18 sites nationally. Some of these will focus on national background conditions; at least two sites would be targeted to measure global background conditions; some sites will focus on transport corridors; and others will focus on urban-regional pollution couples. There will be further guidance on the specifics for selecting such sites. It may very well be that some existing rural locations fit one of these rural monitoring objectives, and can become a candidate for a rural Level 2 NCore site. Such sites will also need to have a specified level of multi-pollutant monitors.

30. States should focus on compliance monitoring and not be burdened with additional responsibilities for methods development and research.
    There is no such burden placed on state and local agencies within the Strategy. Methods testing and research will be focused at the Level 1 sites which are not proposed to be the responsibility of state and local agencies. Rather, the Level 1 sites will be separately funded by EPA, and will likely be operated by contractors or universities. There may also be opportunities for Level 1 sites to be situated at a state/local agency monitoring site, if logistics and cooperative arrangements can be developed between the Level 1 site operator and the host agency. In such shared site arrangements, the responsibility for methods testing and research will reside with the contractor or university.

31. Trend sites need to include more than just Level 2 sites.
    We agree. Level 3 sites will also enrich the Level 2 site capabilities by providing a wider array of sites which can be used for trends analyses.

32. Upper air meteorological data should be emphasized.
    We recognize that upper air data are important in helping to characterize the conditions conducive to the accumulation, formation, and transport of pollutants. Wind profilers are included in the PAMS program, and the Strategy encourages the utilization of PAMS sites for development of Level 2 NCore sites where it is most appropriate do so. It is not the intent of the Strategy, however, to require upper air meteorological equipment at Level 2 sites, although there will be requirements for certain ground-based meteorological measurements, such as temperature, relative humidity, and wind speed/direction.

33. Criteria pollutant monitoring should not be decreased to support more air toxics monitoring.

There are two aspects to this. First, there is currently separate funding for air toxics trend monitoring. Realignments in criteria pollutant monitoring will not affect the air toxics monitoring program. Rather, it is envisioned that air toxics monitoring should, to the degree possible, be included as part of the multi-pollutant Level 2 NCore sites. This way, the informational value collected as part of these two programs can be maximized. The Strategy looks at other separate programs, such as PAMS, and attempts to maximize co-locations to the degree possible. In some cases, it may be possible to have PAMS, air toxics, PM-speciation, and NCore Level 2 monitoring all co-located at one location. Doing so optimizes the value of information because of the degree of multi-pollutant monitoring. Of course, not all urban locations lend themselves for such optimization, and the Strategy does not "force" this to happen.

Secondly, some state/local agencies may have community and environmental justice issues to address, and localized air toxics monitoring may be necessary. A local/flexible component to NCore provides state/local agencies the flexibility to accommodate such monitoring over and above the Level 2 and Level 3 requirements. As such, some of the resources accrued through network realignments can be utilized for these purposes. This process is intended to make maximum use of existing resources to address both national and local priorities.

34. Except for trend analyses, the Level 2 sites will not be useful.
    Members of the National Monitoring Strategy Committee (NMSC), comprised of key state, local, federal, and tribal members, helped to develop the Strategy. In doing so, it is the consensus of the NMSC that Level 2 sites will fill many more monitoring needs than just trends, including health assessments, consistency of data for inter-urban and inter-rural comparisons, support for SIP efforts with more information on pollutant precursors, gap-filling information in rural areas with respect to transport and background conditions, support for modeling, ecosystem analyses, and other scientific studies, and, in conjunction with the Level 3 sites, meeting the basic needs of a monitoring network for compliance, spatial mapping and public reporting, attainment/non-attainment boundary determinations, and population exposure, to name a few.

35. The number of Level 2 sites should be flexible.
    The recommended number of Level 2 sites represents the <u>minimum</u> number of such sites necessary to meet national monitoring needs. There is nothing preventing (and we are encouraging) state and local agencies to establish more than the minimum number. Some states already have an array of multi-pollutant monitoring sites, and having a Level 3 site meeting the criteria of a Level 2 site will, in essence, provide a greater level of Level 2-equivalent sites. We don't believe, however, that it is prudent to allow less than the specified minimum number of Level 2 sites nationally.

36. Some site locations may be physically limited to accommodate Level 2 multi-pollutant monitoring to the degree needed.

We recognize this may be the case in some circumstances, however, most states will have responsibility for establishing one Level 2 site, and the most populous states will have four. Since the recommendations for candidate Level 2 sites are to be made by the state/local agencies, we believe there will be an ample number of locations meeting Level 2 siting guidance and which can accommodate such sites logistically. In the event this is not possible, a new location may be needed which has the desirable attributes to accommodate the logistics needed for a Level 2 site.

37. Criteria for considering air toxics monitoring are lacking.
    To the degree possible, it is being recommended that air toxics trend sites be incorporated into the Level 2 NCore sites. Please see response to item #33.

38. Level 2 sites are inadequate to support epidemiological studies.
    Please refer to the response to item #25.

39. Level 2 sites may not be sufficient to assess the effectiveness of emissions reductions strategies.
    We agree. It is the expected combination of Level 2 and Level 3 sites that will help assess the effectiveness of control strategies through trend analyses and other data analytical tools.

40. Level 2 sites should include ammonia where appropriate.
    We agree. The FSD includes more specific reference to ammonia as a component to the Level 2 sites, especially in areas where ammonia emissions are an important element of particulate formation.

41. Level 2 sites should not include PMcoarse monitoring unless new standards are set.
    We agree. One of the objectives of the Strategy is to establish a monitoring network which can easily accommodate new monitors if and when ambient air quality standards are established for new pollutants.

42. In rural areas, flexibility for Level 2 sites is needed in low population areas for attainment/nonattainment determinations.
    The main focus for the rural Level 2 sites is given in the response item #29. There is no reason why such sites cannot be used for attainment/nonattainment purposes as well, but if the state/local agency believes that the rural Level 2 site(s) is (are) insufficient for that purpose, it can recommend additional locations as part of the Level 3 NCore network.

43. The Level 1 sites may not be able to deliver what is envisioned for them.
    The Level 1 sites are patterned in many respects after the PM Supersite program, which now has been operating for several years, and from all indications, is a successful program. The Level 1 sites will be more encompassing than the PM Supersites, will likely be operated by EPA contractors and/or universities, and

will have a funding stream separate from the state and local grants which will support the Level 2, Level 3, and to some extent, the local/flexible monitoring. With a separate funding stream and with a more focused research aim, every effort is being made to assure that the Level 1 sites achieve their objectives.

44. There is no specified mechanism for disseminating information from the Level 1 sites.
This is a good point. While the Level 1 objectives are more research and methods-testing oriented, some elements of the Level 1 sites will have accompanying monitoring similar to the more routine elements of other NCore sites. Where it is feasible to do so, real-time data collection for the more core pollutants should be incorporated into the overall NCore information transfer objectives.

45. Level 1 sites should include a host of monitoring for which current data are lacking.
The Level 1 sites are intended to include more pollutant monitoring than any other NCore level, targeted primarily at the following three needs: (1) the most comprehensive suite of measurements of all routine air monitoring networks; (2) a transfer technology mechanism to test emerging measurement methods under disparate conditions; and (3) a collaborative bridge across air and research programs. Any appropriate pollutant measurement meeting any of these needs is a candidate for inclusion in a Level 1 site. By definition, this should include a number of pollutants for which current data are lacking.

46. States should have total flexibility in selecting Level 3 sites.
States have a certain degree of flexibility in selecting Level 3 sites, provided they meet the guidelines for a Level 3 site. The EPA regional offices will have oversight approval authority for these sites to assure that the sites proposed by state/local agencies do meet the guidelines.

State/local agencies do have complete flexibility for any of the local/flexible sites designed to meet special local and community monitoring priorities. For these sites, EPA regional offices would need to be notified of such site locations, but would not have authority for approving or disapproving such locations.

47. The Strategy Document lacks sufficient detail about the state/local flexible monitoring sites, and this element of the Strategy should be more prominent.
We agree. The FSD adds appropriate details to the local/flexible component of the Strategy.

48. EPA should have oversight approval for any state/local flexible monitoring sites.
The intent of the EPA oversight authority is to assure that national requirements are being met, including the objectives for NCore Level 2 and 3 sites. Beyond this, however, the Strategy is cognizant of special local and community-oriented needs which are exclusive of national requirements. The intent here is to allow

state and local agencies the flexibility to meet those local needs, and hence, only notification to, not oversight approval by, EPA is necessary for these sites.

Topic 3. Air Toxics Issues

49. The relation between NCore and the NATTS network is not clear.
One of the key underlying principles for the NCore Level 2 sites is multi-pollutant monitoring. Co-location of monitoring from several existing monitoring programs, such as PAMS, PM2.5 speciation, and air toxics trends, significantly enhances the multi-pollutant concept. It is envisioned, therefore, that the initial phases of the NATTS network, approximately 10 to 15 air toxics trend sites, would be incorporated, where feasible and appropriate, as a component of the Level 2 multi-pollutant sites. The type of site representativeness needed for the air toxics sites, in many cases, is very much similar to the type of site representativeness needed for NCore Level 2 sites. Thus, to the degree feasible, we would expect existing air toxics trend sites to be expanded to meet Level 2 site requirements, or in the event the Level 2 site precedes the air toxics site, that the air toxics site would be co-located at the Level 2 site. In this way, we are able to leverage resources from several programs in meeting multiple program objectives. It may be that in some circumstances, the marriage of an air toxics trend site and an NCore Level 2 sites may not be appropriate because of the unique air quality conditions of an area. In such cases, the co-location of the two would not be appropriate. However, these situations are expected to be the exception, rather than the rule.

50. Core air toxics trend sites need augmentation at the state/local level.
We agree. While the trend sites are expected to be co-located with the NCore Level 2 network sites, where possible, there are likely to be additional state/local needs for air toxics monitoring. This component would be considered an aspect of the state/local flexible monitoring part of the Strategy.

51. The Strategy should incorporate recommendations of the Air Toxics Steering Committee.
We are cognizant of the actions of the Air Toxics Steering Committee and in fact, several members of the Air Toxics Steering Committee also serve on the National Monitoring Strategy Committee. Each committee has its own set of goals and objectives, and as far as the Strategy is concerned, we want to make sure that the proposed Strategy is consistent, and not conflicting, with what is being recommended by the Air Toxics Steering Committee. We believe this is the case.

52. There should be better linkage between the Draft Strategy Document and the Toxics Concept Paper.
For the same reasons explained in item #51, we believe we have maintained consistency between the two programs.

53. The discussion on air toxics needs more details.
We believe there is adequate discussion on air toxics. In fact, the CASAC NAMS Subcommittee suggested that too much emphasis was placed on air toxics within the context of the Strategy.

54. Air toxics monitoring serves more purposes than just trends.
We agree. The Strategy Document recognizes such additional monitoring purposes and recommends that this be part of the local/flexible monitoring sites.

55. Air toxics monitoring is needed near highways and intersections.
This may be a specific need for some locations, and may be appropriate as part of the local/flexible monitoring sites. Bear in mind, though, that NCore Level 2 multi-pollutant sites should be located in representative urban and rural locations. In most cases, near-highway and intersection locations would be too much influenced by local, rather than urban scale conditions, and therefore not good candidate Level 2 sites. Level 3 sites are intended to focus on criteria, not toxic, air pollutants.

56. A subcommittee should be formed to incorporate air toxics exposure and risk into network design.
The national air toxics network development and rollout is being formulated through the Air Toxics Steering Committee. From the standpoint of the National Monitoring Strategy, we want to maximize leveraging among the various existing other monitoring programs. It is not the intent of the Strategy to dictate strategies of the other programs, but to try and maintain consistency and leveraging among them.

57. Existing PAMS sites may not be appropriate air toxics sites.
We recognize that, in certain circumstances, optimum locations for air toxics sites are not consistent with optimum PAMS locations, or PM2.5 speciation sites. The intent under the Strategy is to optimize leveraging of the various monitoring programs to the degree feasible, so that we maximize the ability to co-locate monitors, rather than having isolated sites for each program.

<u>Topic 4. Funding</u>

58. The savings from divestments appear to be overestimated and will not be sufficient to support multi-pollutant sites.
This comment is quite common among state and local agencies. In the FSD, we have provided some specific funding changes to illustrate the potential for reallocation of resources to support the development of the NCore network. Savings estimates will vary by individual agency because of such factors as: (1) reductions in monitors, but not sites; (2) reductions in monitors and sites; and (3) reductions in filter based monitoring which carries additional laboratory analysis costs. The NMSC has recognized that there will be need for certain additional

capital costs for new instruments to support continuous PM monitoring, precursor pollutant monitoring, meteorological measurements; and information transfer technology. EPA is working with state and local agencies to seek separate funding for these capital costs. The savings from the divestment process is intended to offset new O&M costs for the new monitors.

59. In low population states with few monitors to begin with, there is very little opportunity for sufficient divestments to offset the additional costs for the NCore sites, even just the O&M portion.
Please see response to item #2.

60. Costs for new technologies should be recognized.
Please see response to item #58.

61. There needs to be more recognition of costs for more skilled labor and training.
We definitely recognize that there will be a need for training technicians to be able to operate and maintain new equipment, and this has been identified as an issue that still needs further resolution. Some agencies have staff with sufficient education and experience to be able to operate new technologies with some additional general training. Other agencies may not have staff with sufficient qualifications to meet the demands of operating, for example, a Level 2 site, and demands for such skills may affect agency staffing. Several approaches for training are discussed as part of the implementation phase of the Strategy, contained in Section 11 of the FSD.

62. There should be recognition of added costs for servicing rural and remote site locations.
One of the benefits of moving toward advanced information transfer technologies is the ability to perform remote routine equipment checks, such as calibrations and zero/span checks. This does not obviate the need for periodic on-site visits for repairs and more rigorous calibrations or audits. Under the Strategy, with new technologies implemented, it is envisioned that the number of field trips to the more rural or remote sites can be reduced as compared to the current needs for on-site visits by technicians.

63. Program costs need to account for inflationary adjustments.
One of the guiding principles for the Strategy is a zero-sum approach. That is, aside from initial catalyzing of the Strategy with special funding for new instruments and technologies, there will be no additional funding for the Strategy over the current funding for monitoring through the Section 105 and 103 grant programs. To the extent that the existing monitoring network is funded through these grant programs with or without inflationary adjustments, that same level of funding would be expected to support the Strategy.

64. How can EPA assure that any savings are properly reinvested.

For the Section 103 Grant process, funds are typically funded fully by EPA and earmarked for specific purposes. That will continue. For the Section 105 Grants, agencies are required to match a certain percentage, typically about 40%. Many of the 105 grants are programmatic and cover a wide range of agency functions, and there is usually grant guidance that accompanies the grants on an annual basis. But agencies have a certain degree of discretion as to how those funds are allocated among agency programs, air monitoring being one of them. Thus it may be more problematic to assure that an agency which accrues savings through divestments applies all of the saved funds to meet NCore objectives, especially if meeting such objectives are less costly than the savings through the divestment process. More specificity with respect to the annual grant guidance could be a remedy, but this issue clearly needs to explored further.

65. The use of the divestment savings is most properly determined by the state and local agencies.
This comment is almost the reverse of item #64. In other words, the commenter believes that EPA should not dictate the use of any saved funding, and such savings could be used for other air program needs. Since, as stated in item #63, this is a zero-sum approach, we believe that state/local agencies should earmark all divestment savings toward continued air monitoring. One of the benefits of the Strategy is that divestment savings in many cases could be sufficient not only to meet NCore Level 2 and 3 requirements, but also to cover local/flexible monitoring to meet local community needs. Failure to do this, we believe, is contrary to the principles of the Strategy and not in the best interest of the public.

66. Reductions of sensors do not save much, but reductions in sites do.
We agree. Please also refer to the response to item #58.

67. In areas where divestments have already occurred, additional cost savings may not be achievable.
We agree, but there are several considerations. First, if some areas were progressive enough to undertake network assessments and associated divestments ahead of time, there should have been accrued savings from these actions. Those saved resources could be considered for use in meeting Strategy objectives. Second, where state/local agencies may self-fund (i.e., funds other than EPA Grant funds) substantial portions of their monitoring networks, savings may be a result of local budget cutting, and therefore saved funds may no longer be available for reprogramming to meet Strategy objectives. In these cases, Grant guidance could specify the utilization of at least those portions of the monitoring network funds through EPA Grants to meet Strategy objectives. In any case, we do not see that there is necessarily a penalty associated with areas which have undertaken early divestments.

68. Zero-sum may work over the short-term, but not over the longer-term.
This is likely the case whether the Strategy is implemented or we stay with the existing structure. Costs for air monitoring, if nothing else, increase at some

inflationary rate (e.g., annual labor rate increases) and given no increase in funding, stresses in maintaining the networks will increase. However, one of the advantages of the Strategy over the current network process is that there is a local/flexible component, which allows for use of federal Grant funds to help with local monitoring needs. Under a long-term zero-sum approach, it is possible that some of the local/flexible monitoring may need to be reduced over time to preserve the national objectives. There will likely be continuing efforts on the part of STAPPA/ALAPCO and others to gain increases in Grant funding in the future.

69. Zero-sum approaches may not work in states which substantially fund their networks.
It is recognized that when we refer to "zero-sum," this refers to the EPA-funded portion of the monitoring networks. Although we hope state/local agencies recognize the importance of the air monitoring programs, we also recognize that other budget considerations often affect state/local agency budget allocations. Please also refer to item #67.

70. Savings from less filter-based measurements should be used to fund more meteorological monitoring.
The recommendations for minimum Level 2 NCore site configurations include certain basic meteorological measurements, including wind speed, wind direction, ambient temperature and relative humidity. State/local agencies and tribes could augment these as deemed locally appropriate as part of the local/flexible monitoring component of the Strategy.

71. Will the transition period require additional funds?
It is anticipated that there will need to be special funding for the capital costs of equipment to meet Level 2 and Level 3 NCore requirements, as well as for new information transfer technologies. Some funding may come from a special EPA allocation for this purpose, and some may be through competitive bid processes such as the National Environmental Information Exchange Network Grant. State and local agencies may be able to access external guidance to assist in putting together grant applications.

72. Where will the capital investments come from?
Please see response to item #71.

73. How can PM savings accrue if filter-based measurements are still used in addition to continuous monitors?
There are two key aspects to consider. First, the network assessments are intended to determine redundant and little-value-added PM10 and PM2.5 sites which no longer are necessary in order to maintain the same data integrity of the networks. Second, where co-located continuous monitors are situated, it is expected that the required frequency of filter-based sampling can be lengthened, such that fewer annual filter-based samples would be needed. Both of these

factors can lead to cost savings enough to cover, at least, the operating and maintenance costs of the continuous PM samplers.

74. Funding for new technology should be distributed equally among states.
It is expected that additional federal funding is necessary for the initial investment for new equipment. How these funds are to be distributed is yet to be determined, and will likely be negotiated between EPA and STAPPA/ALAPCO.

75. States should not lose out through fund redistributions.
Under the zero-sum approach, it is expected that States will retain approximately the same level of funding (for air monitoring) that they have received prior to the implementation of the Strategy. It is not the intent of the Strategy to be a mechanism for changing redistribution of Section 103 and 105 Grant funds given through each EPA Region, though the Regional Offices may slightly adjust funding among the States within their Region to optimize the implementation of the Strategy.

76. The Strategy does not define what a "geographic region" is for fund distribution purposes.
Please refer to response to item #75.

77. The Strategy does not state that funds will not be shifted across states.
Please refer to response to item #75.

78. Fund changes should be made internally within states, not across geographical boundaries.
Please refer to response to item #75.

79. The potential exists for shifting funds to states with highly urbanized areas.
We don't believe this is the case. Given that NCore Level 2 sites cover both urban and rural areas, and that Level 3 sites complement the Level 2 sites in both urban and rural areas, there should not be a greater emphasis on urban areas as compared to the current NAMS/SLAMS structure. If anything, the Strategy promotes greater spatial representation by including rural areas for several important objectives. Also, please refer to response to item #75.

80. The Strategy Document does not discuss how states would be affected by funding or lack thereof.
The FSD does discuss, in Section 11, the concepts for funding. This is augmented with recognized needs for additional one-time funding for capital costs associated with the purchase of new technologies for continuous monitoring and information transfer (e.g., telemetry systems). Please also refer to response to item #75.

81. Section 103 Grant funds should be used for Level 2 sites and Section 105 Grant funds for the Level 3 sites.

There are different purposes for Section 103 Grant funds and Section 105 Grant funds. Broadly, the Section 103 Grant funds are used more for research-oriented efforts and Section 105 Grant funds support air pollution control agency programs and planning efforts. Historically, the 103 Grant funds were used for the rollout of the PM2.5 monitoring program and the air toxics pilot monitoring programs. These programs can be integrated into the Level 2 sites, for example, but other routine monitoring for criteria pollutants are not justifiable under 103 Grant programs. Thus it would be difficult to divide the funding from 103 and 105 Grants specifically for Level 2 and Level 3 sites, respectively. Rather, it may be that combinations of 103 and 105 Grants will fund both Level 2 and Level 3 sites.

82. Level 1 sites must have new funding without impacting existing Section 105 and 103 Grants to States. Strategy should explicitly state this.
This is the intent. The FSD is clear about this.

83. The matching portion of the Section 105 Grant funds should be used to help fund the local/flexible monitoring.
We agree that this is one reasonable approach. However, we also recognize that savings through divestments and available resources for re-investments to meet NCore Level 2 and Level 3 requirements will likely vary from one state/local agency to another. It is anticipated that there will be enough available funding to cover the requirements for the Level 2/3 sites and still have additional funds to assist with the state/local/flexible monitoring. This is the ideal model. However, to require that the match portion of the Grant funding be used for the local/flexible monitoring may be too restrictive in specifying how the Grant funding is utilized.

84. EPA needs to assure that 105 Grant funds earmarked for state/local flexible monitoring programs are not re-directed by agencies to other agency functions.
Please refer to the response to item #64.

85. Can the use of 105 Grant funds to support the Strategy be codified in the air monitoring regulations?
No. State/local agencies generally have certain flexibilities in applying Grant funding to meet the objectives of the Grants under Section 105 of the Clean Air Act. The CAA also authorizes certain discretionary authority on the part of the Administrator to meet specific objectives, and other regulations mandating the use of such funds to meet Strategy objectives could be deemed to be in conflict with such discretionary authority as authorized by the CAA. Rather, we need to work within the framework of the Grant programs to assure that there is appropriate funding to support the local/flexible monitoring sites.

86. States should have enough funds for at least one Level 3 background site.
It is expected that the revised 40 CFR Part 58 regulations empowering the NCore structure will include background conditions as one of the objectives for the

NCore network. It would be expected, therefore, that state/local agencies would need to design their networks to accomplish the objectives specified, including background conditions. It is intended that there will be sufficient funding to meet the Level 2 and Level 3 network objectives.

87. New program requirements should have new funding.
The Strategy is designed to move from the existing SLAMS/NAMS structure to the NCore Structure. As such, it is a "renovation" of sorts of an existing network. Accordingly, we don't view this as a new program and an unfunded mandate. Rather, we view this as a restructuring with an appropriate element that takes into strong account the limits of available funding, and how we can accommodate the new structure under that funding limit. We do recognize the need for new funding for capital costs for purchase of new technologies. Please refer also to the responses to items #71 and #75.

88. Funding for QA needs more discussion.
We agree. Section 7 of the FSD now contains a discussion of funding and resource needs.

89. At least 40% of available funding should be allocated to the local/flexible monitoring.
Please refer to the response to item #83.

90. The Strategy needs to address funding needs for the development and testing of the Level 1 sites.
The exact funding needs for the Level 1 sites have yet to be determined, but this element is estimated to cost at least several million dollars to initiate. The costs for this component of NCore will be borne by EPA and not through the Grant programs to the state/local agencies.

91. The Strategy needs to recognize the resource needs of the Tribes.
The FSD includes a complete section (#10) on Tribes.

92. Efforts to establish PM2.5 continuous equivalency will be a drain on state/local resources.
Changes to federal regulations will move the equivalency process to more performance-based processes. It is expected that equivalency conditions could be demonstrated by vendors, rather than state/local agencies, such that the use of continuous monitors can be implemented without that burden being placed on the state/local agencies.

93. Some states have insufficient resources and capabilities to evaluate new technologies effectively.
Please refer to the responses to items #90 and #92.

Topic 5. Modeling

94. Models should not be used for defining non-attainment area boundaries.
We agree that models should not be the sole basis for defining non-attainment area boundaries, but we do believe that as credibility of models continues to improve, we need to begin the process of using models to fill in data gaps in ways that help us more accurately define non-attainment boundaries. To that extent deterministic models, statistical analyses, spatial interpolation analyses, as well as monitored data should all be in the toolbox for determining such boundaries. It should be noted that EPA policy staff have been part of the planning efforts for the Strategy to assure a linkage between what the Strategy intends to do and what the implications are from a policy/planning standpoint.

95. More efforts are needed to improve modeling and spatial mapping.
This is beyond the scope of the Strategy.

96. There is concern about smaller agencies' capabilities to obtain and use appropriate models.
This is an issue for consideration as part of the linkage with the policy/planning functions.

97. Sulfur dioxide and carbon monoxide have a role in modeling, and therefore divestments in these pollutant measurements should be done with care.
We recognize this fact. There are three considerations: (1) these measurements will be retained, at least, at the NCore Level 2 sites, so there will be a consistent national network including these pollutants; (2) the Strategy will promote trace level measurements of these pollutants, and (3) often, modeling is done in response to, and in conjunction with, targeted field studies. If additional measurements are needed for such field studies, they can and should be included in the study design.

98. There is concern that model strengths apply only to the lower 48 states, and not under extreme weather conditions.
When we refer to models, we also include the class of statistical/empirical models which do not need the physical/chemical/meteorological submodels which need validation. The statistical/empirical models can be used for establishing intersite relationships, spatial patterns, and other similar information which can be used to help in gap-filling processes – even in extreme conditions.

99. The Draft Strategy Document does not explain what "predictive modeling" is.
In the context of the Strategy, "predictive modeling" represents the ability to depict air quality conditions where there are no monitors. This can be done through deterministic modeling, such as that typically used for attainment demonstration purposes, whereby, with given emissions, meteorology, and other inputs, spatial grid patterns are displayed. "Predictive models" can also refer to statistical/empirical modeling methods which can provide interpolative results to

display conditions between monitors. Using the latter approach, we envision that "pseudo" stations can be utilized. These are stations with historical data which can be related statistically (e.g., regression equations) to other sites, such that if that station were discontinued, it still can be predicted from the remaining sites. This way, interpolative schemes do not lose the value of that spatial data provided by a monitor which is no longer active.

Topic 6. Technology

100. States testing new monitors should not be disadvantaged by the Strategy.
There is nothing in the Strategy that would favor one particular monitor over another. State/local agencies will still have the flexibility to pick and choose appropriate equipment for their networks, with the understanding, or course, that such equipment conforms to federal regulations.

101. New equipment must be fully tested before being implemented by state and local agencies.
We agree. One of the objectives for the NCore Level 1 sites is to provide platforms for testing new technologies under a variety of meteorological and pollutant conditions across the country. We want to assure that evolving technologies have ample opportunity for field testing before routine application and use.

102. New equipment must be simple enough to be operated by averaged trained technicians.
While we agree in concept, we cannot assure that new technologies won't be more complex to operate that the types of equipment average trained technicians are used to. We have identified "training in the use and operation of new technologies" as an issue which still needs to be addressed, and it is intended that EPA will work with state and local agencies and tribes in providing sufficient training for the operation of new equipment and technologies.

103. The Strategy does not discuss technology transfer from EPA to state/locals for new instrumentation.
Please refer to response to item #102.

104. EPA must resolve shortfalls in equipment performance.
EPA provides the essential requirements for acceptable instrumentation, but certainly cannot assure long-term performance of equipment. This is more in the domain of the vendors.

105. Vendors should be required to evaluate new technology equipment performance under all environmental conditions.
Please refer to response to item #101.

106. Rapid data polling may not be consistent with availability of high-speed communications.
There are numerous telemetry systems in operation across the country, not all specifically for air quality, but certainly of the same nature as envisioned for air quality telemetry systems. These employ various high-speed data communications technologies including high-speed internet, radio RF technology, and satellite bandwidth communications. Many of these operate on about a 15-minute polling frequency – the similar polling rate recommended in the Strategy – and are operating with very high data integrity. We do not believe this will be an issue.

107. There should be a standardized national information transfer technology process and protocol.
There are many advantages to such a proposal. However, we need to recognize that some state/local agencies have already invested substantial resources toward a workable telemetry system, and among those in use, there are differing software/hardware configurations. We need to try to develop recommendations for workable systems with fundamental commonalities, but recognize that a "one-size-fits-all" solution is likely not achievable in practice.

108. EPA should provide low-cost access to high-bandwidth communications satellites for polling remote sites.
This is something that certainly can be explored further. Because of the recent advances in wireless communications technologies, the number of truly remote sites, which have no other communications options other than satellite, is expected to be relatively small. Private communications companies offer satellite communications channels at modest costs – around $100 per month per site. The need therefore for EPA to secure high-bandwidth accessibility still needs to be evaluated.

109. There are few providers of two-way satellite communications service.
This is recognized, but those that do make the services available at reasonable costs. (See response to item #108.) Also, it may be possible to utilize TV dish services for two-way communications, and such costs including internet access are also very reasonable.

110. Satellite communications may require greater in-house computer support.
We don't believe this is the case. Currently-available systems can mix a variety of communications processes, including internet, direct telephone access, radio telemetry, and satellite, in such a way that the type of communication link is essentially invisible to the host central computer. In other words, appropriate software can accommodate these situations without needed greater in-house computer support.

111. There could be problems with high-speed data polling versus accuracy.

We don't believe this should be a concern. The advances in data logging capabilities, high-speed communications, and host software can easily accommodate data polling needs without compromising the integrity of the data.

112. EPA should push for "next generation" telemetry systems.

It appears that the marketplace is already fostering the development of hardware/software integration to accommodate high-speed data collection and transfer via a variety of communications media, and at the same time substantially improving automated QA of the data. There are many vendors now offering systems which one could call "next generation" when compared to the traditional telemetry systems that have been used over the past 20 years.

113. What's wrong with the current approaches in telemetering data?

The main problem is that current systems tend to be locked into costly land lines for communications; they cannot handle high-speed communications from mixed communications media; they cannot access more remote sites; and automated QA is limited. To meet the needs of the Strategy, modern telemetry and communications media are more appropriate.

114. We're concerned that EPA may prescribe a particular communications infrastructure.

The intent under the Strategy is to foster high-speed communications for more timely public access to air quality data and national displays under the AirNow program. We don't envision that one specific communications structure will be prescribed. Rather, we believe that certain specifications or criteria will be recommended, and each agency can choose an appropriate approach toward meeting such criteria. While there are clear advantages to having a consistent national telemetry network, we also recognize that a "one-size-fits-all" approach is likely not in the best interests of the state and local agencies.

115. The Frame Relay Process for internet polling is suggested.

There may be several processes for polling of data depending upon the form of communications utilized. As long as the hardware/software integration meets the needs of high-speed data transfer and processing, the intent of the Strategy will have been met.

116. Institutional and governmental users need access to the data.

The data should be considered as two-tiered. In the first tier, the rapid collection of data from the field is targeted for rapid communication to the public. It would seem appropriate that the data made available to the public can be utilized by anyone. However, this data, while undergoing certain QA to weed out outliers, are still not "certified" data. At some later point as required by regulations, state/local agencies are required to submit to EPA their fully validated data, although the period required to certify the data may be shortened

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EPA is cognizant of difficulties in accessing AQS data by external users.

Topic 7. Network Assessments

117. Assessments should involve more than just objective methods, especially for small networks.
We agree. It is expected that objective methods will serve as a useful guide and foundation for the network assessments, but that local criteria and subjective factors will also come into play. It is expected that the process used in each of the assessments will be well documented to support the conclusions reached.

118. There should be more input from meteorologists and modelers.
There is nothing preventing greater input from these areas of expertise.

119. EPA should have standardized guidelines and regional consistency for the assessments.
We agree that some measure of consistency is needed. EPA convened regional assessment workshops in October 2002 and September 2003. Because the status of the networks differs among the regions, standardized guidelines will not be applicable for this initial assessment. CASAC has recently advocated the need for standardized guidance, and EPA is expected to have such guidance developed before the end of 2005 – well in advance of the next round of network assessments.

120. The network assessments should have OAQPS oversight.
While direct oversight is not intended, OAQPS has had substantial input to the network assessment process. Please refer to the response to item #119.

121. Network assessments should be done every five years. The 2-3 cycle is too tight.
We agree. As originally proposed, the national/regional assessments are to be done every 5 years, with state/local assessments during the intervening period, about every 2-3 years. Since the process for these assessments does take considerable time to be done effectively, there would not be much time remaining before state/local agencies would need to begin their intervening review. Therefore, the FSD has been clarified to only reflect the 5-year assessment.

Topic 8. Quality Assurance

122. Quality assurance requirements should be short, simple, and easy to understand.
To the degree possible, this is the intent of the revisions to the quality assurance regulation.

123. There should be regular updates to the quality assurance program.

Part of the revisions to 40 CFR Part 58 regulations will include components of the quality assurance program.

124. Generic QAPP software products should be included.
This intent is included in the FSD. Also, it should be noted that EPA did receive Tribal Initiative Funds to develop a QAPP software product for Tribal use. This software product should be available for the general ambient air monitoring community in FY2004 or early FY2005.

125. Formal methods and procedures for new technologies (e.g., LIDAR, field GC's) should be established.
We agree. But with the realization of resource constraints, it is prudent to focus on those methods that are more established in the ambient air monitoring program, while relying on vendors for methods on the newer technologies. This could change if budget conditions improve in the future.

126. There should be performance-based audit programs.
By developing a performance-based quality system for the ambient air monitoring program, the audit programs will move in the same direction, not only by way of acceptance criteria, but the selection of the audits to perform.

127. There should be strict validation protocols to assure only validated data are used in models.
We agree, but these validation protocol need to be developed by the modeling community. Many times the primary objective of collecting information is not for modeling (e.g., NAAQS attainment) yet the data may be used for modeling. The modeling community needs to determine the measurement quality attributes that allow them to determine what data they consider acceptable for their use.

128. There should be data validation criteria for meteorological data.
We agree. As we proceed in developing and completing data validation for our primary measurements, it is envisioned that we will then work on the same processes for our secondary and supporting data.

129. The Strategy should include clear objectives and guidance for certification of data.
We agree. The issuance of such material will be included in the regulation revisions, guidance memoranda, or other documents (e.g., QA Handbook). The exact details for the form of issuance have not yet been completed. The fact is, though, that such details are not needed in the Strategy Document.

130. Quarterly, rather than annual certification processes should recognize increased staff time and long lead times for filter-based data.
This issue has been recognized in the discussions of the Quality Assurance Strategy Workgroup, though no specific recommendations have yet emerged.

131. Creative and innovative QA approaches may be best suited for meaningful Tribal participation.

The quality assurance protocols set out in 40 CFR Part 58 should be applicable to all monitoring programs regardless of the level of sophistication of the monitoring network. However, other QA elements are typically found in guidance documents. If such guidance is not deemed to be appropriately applicable to Tribal air monitoring programs, Tribal representatives should coordinate with EPA staff to determine more relevant guidance for Tribal programs. That level of detail, however, is beyond the scope of the Strategy.

132. Why is a process for certification/accreditation of personnel necessary?

The Quality Assurance Strategy Workgroup felt that a certification/accreditation process was a way to help in the personnel turnover process by ensuring consistency in QA knowledge within the Ambient Air Monitoring Program QA Community, and it established personnel growth goals for those using individual development plans.

<u>Topic 9. Monitoring Methods</u>

133. There are concerns about TEOM's not accounting for the full mass.

We are cognizant of some of the problems with TEOMs, especially in nitrate-rich areas where the heated inlets tend to volatilize some of the mass. Newer generation TEOM's do not have the same degree of problems. EPA is considering several approaches for the utilization of PM continuous monitors such that reliable measurements and data capture are assured.

134. There needs to be recognition of the logistical difficulties in adding continuous monitors (e.g., space, housing, etc.)

We believe such difficulties will be the exception, rather than the rule. For sites where only filter-based monitors exist, with no existing housings for any other instruments, there are commercially available housings designed to accommodate continuous PM monitors. Such enclosures are typically not very large, so in the large majority of sites, space for these will not be a problem.

135. Aetholometers should not be required for Level 2 sites.

Aetholometers will not be required for the base Level 2 sites; however, it may be appropriate to include aetholometers at some Level 2 sites where state/local agencies or Tribes determine that including aethelometers would enhance the multi-pollutant nature of the site. Since aethelometers measure black carbon, urban sites areas affected by diesel exhaust, or other areas affected by wintertime woodsmoke may benefit by having aethelometers included.

136. NOy provides little value in urban areas.

As currently proposed, requirements for NO/NOy will be included in the base design for Level 2 sites. Since NOy includes other reactive nitrogen species, such as nitric acid and PAN, in addition to NO and NO2, these measurements are *important components for understanding atmospheric chemistry. While it is generally true that in source-oriented urban areas, reactions have not yet occurred prior to transport to downwind areas, and NOx may be more appropriate in the urban areas, it is important to at least initially measure NOy in both urban and non-urban areas to determine the extent to which the other nitrogenous compounds exist.*

137. EPA needs to push for the development of acrolein and continuous carbonyl monitors.
While continuous monitors are one of the key concepts of the Strategy, the development of non-criteria pollutant monitors will likely remain within the domain of the private sector, similar to the development of continuous monitors for specific components of particulates. However, EPA ORD may take a more active role in this process.

138. A specification for a PMcoarse FRM may not be necessary.
The Strategy is designed to be able to accommodate new criteria pollutants, such as PMcoarse, with minimum impact on existing monitoring programs. FRM specifications are not within the scope of the Strategy.

139. There is a need to address the potential measurement differences as a function of vendor.
It is presumed that the establishment of federal reference or equivalent measurement methods assures measurement consistencies among various vendors. Similar to the response to item #138, the FRM-setting process is not part of the Strategy.

Topic 10. Regulation Changes

140. Any changes to the regulations should be short, simple, and easy to understand.
To the degree possible, regulation changes will meet these conditions.

141. There should not be any regulation changes until PM2.5 attainment/non-attainment conditions have been determined.
The empowering regulations for the Strategy are on a separate track from the PM2.5 process. This is necessary so that scheduling changes for one will not affect the timetable for the other.

142. The regulation changes are not clearly specified in the Draft Strategy Document.
This is because discussions between EPA and state/local agencies as part of the Regulation Workgroup were still in progress at the time the Draft Strategy Document was released. While a greater level of specificity is included in the FSD, it must be remembered that any regulation changes require a separate

regulatory action by EPA, with the issuance of a proposal, allowance for public comments, and final regulatory action. While the Final Strategy Document may summarize the potential regulatory changes, the final outcome will be based on that separate regulatory process.

143. Regulation changes must be more sensitive to accommodating new technologies.
Your comment is noted. Please also refer to the response to item #142.

144. Regulation changes should include only those elements which can be funded. The rest should be in guidance.
The regulation changes should encompass the elements necessary to assure that the Strategy is enabled effectively, noting that one of the principles of the Strategy is that monitoring encompasses a zero-sum approach. One of the difficulties in tying regulation changes to specific funding is that funding may change from year to year, and so what may fit this year, may not next year.

145. Regulations should not include requirements for 1- and 5-minute averages unless absolutely necessary.
Averaging times should be appropriate to meet air quality data objectives. Current advances in technologies, including instruments, data loggers, information transfer, computer processing and data archiving, make such approaches viable without encumbering significant additional staff resources, as would be the case for the previous generation of technologies.

146. Part 58.3 does not adequately address tribes.
The revised regulations will address this.

147. EPA should create new NAAQS for air toxics and retire old NAAQS no longer presenting health threats.
Changes in the National Ambient Air Quality Standards are not part of the Strategy. There are separate processes with respect to establishment/revision of the NAAQS.

Topic 11. Implementation

148. There needs to be recognition of the time needed to implement the Strategy.
The Draft Strategy Document did not directly address implementation issues. However, the FSD includes an entire section (#11) on implementation, including a realistic implementation schedule.

149. There needs to be a methodical approach toward implementation.
We agree. Please refer to response to item #148.

150. For implementation, more details and guidance are needed.
Please refer to response to item #148.

Topic 12. Coordination

151. The role of the EPA Regional Offices is poorly defined.
The Regional Offices play a major role in working with state/local agencies and tribes in: (1) conducting the initial and every-five-year network assessments, and approving network changes; (2) recommending approval (to OAQPS) of Level-2 NCore site locations, and approving Level-3 site locations; (3) in assuring proper resource allocations for Section 105 and Section 103 Grant Funds to state/local agencies; and (4) assisting, if necessary, state/local agencies with decisions regarding local/flexible monitoring needs. As such, the role of the Regional Offices are integral to the successful implementation of the Strategy.

152. Tribes need to be included in national monitoring programs.
This is clearly recognized in the Strategy. Tribes have representation on the National Monitoring Strategy Committee, which has had oversight on the development of the Strategy Document. It is recognized that, in most cases, state/local agency monitoring programs and supporting technical staff have had substantially more experience than the tribes, and to the degree that technology and knowledge sharing can be fostered between air agencies and tribes, the Strategy encourages such an approach. It is further recognized that tribes can play an important role in meeting the objectives of some rural Level-2 NCore sites.

153. Tribes do not have the same function/role as the state/local agencies.
Please refer to the response to item #152.

154. States should help share information, expertise, and equipment with tribes.
We agree. Please refer to the response to item #152.

Topic 13. Public Communications

155. The Strategy needs to address the impact on the public of reduced monitors.
The Strategy clearly recognizes the importance of public education and outreach with respect to any changes in the monitoring network. State/local agencies and tribes are encouraged to engage the public prior to making network changes. EPA, working with its contractors, is publishing a public brochure describing the purposes of air monitoring networks and the reasons for change. The brochure states that these efforts will result in more complete and more timely information to the public on a regular basis. This brochure is intended for widespread

distribution across the country, both in hardcopy form and as postings to SLT websites.

156. Care is needed in evaluating public need for information versus accuracy of information.
One of the key goals of the Strategy is to employ new technologies, including information transfer. The state-of-the-art with respect to data logging and automated data checks and flagging, coupled with high-speed communications pathways, can accommodate both concerns. We should be able to evolve our monitoring networks into efficient automated processes, with less manual interventions, with assurances that obviously erroneously information is flagged quickly, and with capabilities to provide the public with this information as close to real-time as possible. Under these conditions, however, we recognize the need to caveat such publicly-released data as "preliminary" until final certification of the data are provided by the agencies.

157. There is a greater need for public dissemination of air toxics data.
We agree. The Strategy proposes to include air toxics monitoring at some of the Level-2 sites where it is feasible and appropriate to do so. One of the difficulties right now in providing quick public access to such data is that samples are often collected in canisters or filters, and sent to laboratories for analysis. Because these processes often take days or weeks to complete, real-time information is typically not possible. Where continuous methods, such as auto-GC's, can be incorporated into the automated data collection and transfer processes, the potential for rapid dissemination of such data may be possible.

158. EPA should assume the lead role for public outreach.
We believe that public outreach efforts are a shared responsibility among EPA, the state and local agencies, and the tribes. However, EPA has taken leadership responsibility for the development of several communications/outreach pieces, including a web site, a fact sheet, and a public brochure. Please refer to the response to item #155.

159. Public outreach efforts should be limited to only those situations when agencies are questioned by the public and corporate entities.
We disagree with this statement. For the Strategy to be successful, a proactive approach for engaging the public is essential. We believe an informed public is a valuable asset, and as public agencies, we have a responsibility to foster that.

<u>Topic 14. Training</u>

160. EPA must support training of state/local staff.
Training is a key component to successfully implement the Strategy. With the incorporation of new technologies, from instrumentation to on-site computers and data loggers to information transfer devices, there will likely be critical needs to

train technicians. We consider training to be one of the key implementation described in Section 11 of the FSD. Please refer to the response to item #148.

161. EPA should establish a workgroup of trained and experienced monitoring staff to assist with needed training of state/local agency staff.
Your recommendation is noted. Please refer to the response to item #160.

162. There should be a greater level of importance given to training in the Strategy Document.
Please refer to the response to item #160. Training has been identified in the FSD as one of the important implementation issues.

<u>Topic 15. Miscellaneous</u>

163. The Draft Strategy Document needs substantial re-write and condensing.
The Final Strategy Document has been prepared in a more traditional format, and contains more detailed information, than the Draft Summary Document.

164. The Strategy Document should be simplified.
Please refer to the response to item #163.