TECHNICAL GUIDANCE FOR TRIBES ON AIR MONITORING ISSUES

(Draft -- format of NAAMS document)

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U. S. Environmental Protection Agency
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Technical Guidance for Tribes on Air Monitoring Issues

1. Purpose and Audience (This entire section probably needs to be rewritten specific to technical guidance for tribes.)

1.1 Background on EPA's Tribal Air Monitoring Program

EPA's tribal air policy emphasizes that as sovereign governments, tribes set their own air program goals. Therefore, EPA's goal for the tribal air program is appropriately to help the tribes understand their air quality problems and to establish and meet their air quality goals, rather than to set goals or timetables for the tribes.

Tribes are diverse in their air quality problems, challenges, and capabilities. In addition, tribes often also face non-air risks to the health of their members -- as well as other challenges and disadvantages -- that are different from those facing non-tribal communities. Because of the diversity in situations and goals from tribe to tribe, EPA has taken the approach of delegating to the Regional Office level the tasks of assisting tribes in identifying their goals and the task of managing the available resources to help meet those goals. Because Regions understand individual tribal situations, effective decisions about funding and in-kind assistance are best made at the Regional Office level. Regional Offices have taken the initiative on helping tribes set air quality goals and design ambient monitoring to support them. Regions have prioritized requests from tribes when they collectively exceed the tribal air management grant funds available to the Regional Office. Regional Offices also negotiate, award, and manage grants to individual tribes. Regional Offices provide in-person, telephone, and written guidance and assistance to the tribal governments at all these stages. Technical training on the actual operation of monitors is available to tribes through the Tribal Air Monitoring Support (TAMS) Center, which is supported by a grant from EPA Headquarters. To date, Regional Offices and individual tribes have entered into grants that have dedicated a portion of the available tribal air management resources to plan, establish, and operate approximately [insert #] ambient air monitoring stations in Indian country.

In the course of this deliberately highly decentralized process, Headquarters and Regional Offices have prepared a limited body of strategic guidance on tribal air monitoring, i.e., guidance on deciding whether to monitor, what type of monitoring to do, and how EPA will prioritize requests for funding assistance. This guidance is rather general in nature, reflecting the need to accommodate the diversity of tribal situations.[1]

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[1] The available strategic guidance (excluding technical guidance on monitor operations and maintenance) includes the following documents, and perhaps others at the individual Regional Office level:

1. 4-page section titled "Tribal Air Quality Management" in the *Final National Program and Grant Guidance for Fiscal Years 2006-2008,* April 27, 2005.
2. Memo from Jeffrey R. Holmstead, "Criteria for Providing Funds to Tribes from the State and Tribal Grant Assistance Appropriation for 103 and 105 Grants," January 27, 2005.
3. **"**MENU ITEM**:** Air Quality Monitoring Activities**,"** in *The Tribal Air Grant Framework - A Menu of Options For Developing Tribal Air Grant Work Plans and Managing Grants for Environmental Results*, September 2004. http://yosemite.epa.gov/R10/AIRPAGE.NSF/283d45bd5bb068e68825650f0064cdc2/e34950b285534aa988256dfe0063be55/$FILE/The%20TRIBAL%20AIR%20GRANTS%20FRAMEWORK%

In addition to this limited body of strategic guidance, tribes have access to the large body of EPA guidance on monitoring technologies, quality assurance, and data management. While originally prepared for use by state and local government agencies, this technical guidance is equally applicable to monitors in tribal settings.

1.2 Purpose of this Guidance Document

This guidance document is not intended to modify any existing EPA policies on tribal air quality management. The intended purpose of this guidance document is to improve the ability of tribes and regional offices to prioritize monitoring resources and to accomplish the following:

(1) ensure that tribal goals for tribal air monitoring projects are clearly stated and documented in grant agreements (or other suitable forms) before resources under EPA management are applied, that progress in meeting those goals is tracked, and that tracking results are used to make adjustments when appropriate.

Do we want to imply that regions are not applying standards consistently?

(2) serve as a useful information resource for tribes as they determine their need for monitoring, work plans and grant applications, as well as a one stop resource for locating technical information.

(3) assist tribes to understand monitoring data.

How do we do this?

(4) help integrate and coordinate tribal and state/local/national monitoring strategies and activities.

How? What does this mean? Section 4?

(5) Recognize the need for flexibility to address the unique needs of individual tribes.

Is this a separate point? Put in intro?

1.3 Audience

The intended audiences for this document are tribal environmental professionals and EPA Regional Office and Headquarters staff who are involved in resource

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4. Guidance for Conducting: TRIBAL AIR QUALITY ASSESSMENTS, U.S. EPA Region 10, April 15 2005.

allocations, tribal air grant award and management, program evaluation, strategic planning of monitoring networks, or technical support to monitoring programs. State monitoring officials may also benefit from reading this document, as it may improve their understanding of tribal goals and how EPA strives to help tribes meet their goals. This should allow them to collaborate more efficiently with tribes whenever collaboration serves state and tribal objectives.

This section is OK. If we adopt Bill's proposed new organization then we need to make sure the new organization addresses different audiences.

1.4 Relationship to EPA's Strategic Plan, Budget, and Program Assessment Process

EPA's Strategic Plan for 2003-2008 contains this statement regarding EPA's commitment to work with tribes:

> EPA is committed to working with tribes on a government-to-government basis to develop the infrastructure and skills tribes need to assess, understand, and control air quality on their lands. We will increase air monitoring in Indian country, and, in consultation with tribes, we will establish needed federal regulatory authorities and help tribes develop and manage their own air programs in a manner consistent with EPA Indian Policy and tribal traditions and culture. We plan to complete a policy determining when Federal Implementation Plans are appropriate for bringing Clean Air Act programs to Indian country. We will support tribal air programs by providing technical support, assistance with data development, and training and outreach, and we will help tribes participate in discussions of national policy and operations and in regional planning and coordination activities. Where tribes choose not to develop their own programs, we will implement air quality programs directly.

In developing its annual budget plans, EPA considers whether sufficient resources are available to support tribal air monitoring that is necessary and appropriate to protect air quality in Indian country or to provide important data that helps meets state, local, or national monitoring data needs. Each year, EPA's budget request to Congress requests a certain amount of funding for use in giving to grants to tribes to support air quality management. For the last several years, Congress has appropriated about $11 million for this purpose.[2] It has become apparent that increasing numbers of tribes are interested in establishing monitoring stations, and that not all interested tribes will be able to obtain

[2] In FY2005, EPA proposed to Congress that there be separate amounts of air grant funding for states and tribes. EPA observes these two separate ceilings in its operating plan under the enacted FY2005 budget. EPA has proposed the same separation for FY2006, and EPA has issued grant and technical guidance for FY2006 based on this separation. In FY2005, $ 11.1 million is available for tribal air management, see http://www.epa.gov/ocfo/budget/2005/2005bib.pdf. The proposed FY2006 budget provides $ 11 million, see http://www.epa.gov/ocfo/budget/2006/2006bib.pdf.

EPA financial support for ambient air monitoring if resources for tribal air quality management remain steady. Many if not all Regional Offices report that already they are not able to meet all requests to provide grant funds for tribal air monitoring. Other than reporting this situation, this guidance document is not intended to examine or make recommendations regarding the overall level of EPA funding and in-kind support to tribal air quality management. EPA considers this and other budget issues through other processes. The experience of working across Headquarters and Regional Office and with tribal professionals in the course of preparing this guidance document [will/has] better informed EPA staff about the tension between resources and needs, and will inform EPA budget decision-makers in future years.

The Office of Management and Budget (OMB) on a regular basis assesses EPA's Air Program to determine how well each part of the Air Program is managed in terms of having appropriate, and well defined goals; applying resources towards those goals; providing guidance to partners who help meet the goals; having systems in place to observe how well the goals are met; and making adjustments in the program when necessary to reach those goals. In addition to meeting OMB expectations, this "goals and feedback" model is just good common sense because it helps make sure that limited resources are used in ways that best meet the right goals. Programs that are found by OMB to have serious weaknesses in management are asked to make corrections and face the possibility of funding reduction in future year budget proposals to Congress.

The most recent round of review of the NAAQS air quality program by OMB has made EPA managers and staff more conscious about the importance of being able to document that the tribal assistance portion of the Air Program meets OMB measures and goals, guides participants to meet those goals, tracks progress, and make adjustments when needed. This guidance document on tribal air monitoring is a new part of such documentation.

It should be noted that unlike most EPA programs, the goals of the tribal air monitoring program have been set by the Regional offices and tribes with general guidance from Headquarters and OAQPS. A result is that people inside and outside of EPA who are not personally involved in working with tribes on monitoring projects need the benefit of reporting systems to be able to be aware of and assess what is being accomplished with available resources. The preparation of this document represents one cycle of such assessment and reporting, in that current and recent tribal air monitoring programs are reviewed in Section IV.

~~1.5 The Tribal Perspective~~ (this section can probably be dropped–JAT)

~~EPA received comment from NTAA and tribal professionals in October on the 11/05 draft. As a result of the comments received, we divided the Guidance effort into two documents: (1) EPA Guidance to identify and prioritize resources related to tribal air quality, and (2) Monitoring Guidance for tribes. The Tribal perspective section will appear in both documents.~~

Both documents convey EPA guidance and reflect EPA policies and both will be developed by a workgroup that include tribal environmental professionals. EPA has opened the development of this document to all interested tribal environmental professionals to assist us to make a document that takes into account tribal input and is meaningful to tribes, as well as to EPA. To ensure that tribal views are represented, particularly if they are not the same views as those represented in this document, we are at various points in the document delineating text blocks which will offer comment or reaction from the tribal perspective. These passages are provided by tribal environmental professionals and NTAA and do not represent EPA policy or guidance, but may be useful to some or all readers of this document.

2. History of Tribal Monitoring and Tribal Perspective

2.1 History of Tribal Monitoring

(to be completed)

2.2 Tribal Perspective

In 2004, the Environmental Protection Agency produced a final draft document on their National Ambient Air Monitoring Strategy (NAAMS). (This document should be reviewed and commented upon by this group). The EPA says interesting and positive things about the integration of tribes in the national air monitoring strategy document. EPA had decided originally to do a separate air monitoring strategy for tribes so that tribes would not get "lost" in the national strategy. This is an important issue.

One of the motivations for tribes to want to monitor the air quality are human health issues; it is not a scientific interest in this subject. This motivation is not addressed in the NAAMS. But the NAAMS document must be examined for it has many useful details that address tribal air monitoring.

It is useful to refer to this document: the National Ambient Air Monitoring Strategy. Some important points in it are:

EPA's entire air monitoring structure has clearly moved to the Ncore strategy. This document states that there is a role for tribal participation in several Levels of this strategy. These Levels are clearly framed in this NAAMS document. And the role of tribes is clearly stated.

Ambient monitoring systems are a critical part of America's air program infrastructure. Air data from these monitoring systems are used to do several things, such as: characterize "air quality" and associated health and ecosystem impacts, to develop emission strategies to reduce adverse impacts, and to account for air quality 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. The ambient air data provide a basis for an accounting of an air programs progress. Therefore you can determine the value of those investments.

The Ncore strategy , mentioned in the NAAMS, talks about:

Comprehensive monitors, (55 in rural areas) and Level 3 monitors (1,000 monitors specifically for local concerns, hotspots, etc). The 2004 EPA Draft Monitoring

Strategy also states that tribes have the right to participate in this Ncore strategy. Clearly the tribes have a purpose and a right to be involved with this strategy.

In this NAAMS there is fairly clear statement of tribal needs:

> "The prevailing air monitoring issues for Tribes include a severe shortage of resources for equipment, maintenance, operations, personnel and training".

This Tribal Perspective supports the NAAMS statement of need. The tribes care about monitoring for human health reasons, not necessarily scientific reasons. And the tribes need resources for air monitoring on tribal lands.

The NAAMS highlights the fact that the Ncore strategy could benefit from including tribes because the tribes can provide additional monitoring sites, fill data gaps, and identify background conditions. These are the reasons how tribal air monitoring could help the entire strategy. Tribal monitoring can help this air quality infrastructure.

Many tribes are in isolated areas, but are subject to poor downwind air quality. The tribes want to know the air quality data, and the effects on human health. This is the reason that many tribes want their own air monitors. Human health issues are of the utmost importance to tribes (you cannot take care of "Mother Earth" without your own health being good).

The NAAMS document also acknowledges that the priority for tribes is not just trying to be useful for the national strategy, but that:

> "Monitoring priorities must be based on <u>Tribal decisions</u>, which in many cases involve developing a better characterization of local exposure to air pollutants."

The NAAMS mentions the benefits of the TAMS center in Las Vegas, NV. This center for tribal air work is an important tool for the tribes. It helps the tribes in many ways to deal with their ambient air monitoring.

The NAAMS mentions the RPO's in integrating tribes into larger air monitoring strategies. The RPO's help tribes and states work on air issues, it brings them together for work on air monitoring. There must be team work on all levels to preserve air quality.

The NAAMS document recognizes that tribes will benefit by being able to identify threats to health. Tribes must be able to deal with air monitoring on tribal lands. Tribes do not trust the states or the Federal government to do this for them because of past historical experience. But the basic fact is that the Federal government and the Environmental Protection Agency have written into its basis, the protection of the tribes.

The original Tribal Monitoring Strategy paper spoke of the Ncore strategy. As outlined in the Ncore strategy, finding a meaningful way to participate in that strategy is important. A tribal affiliated group, such as the Institute for Tribal Environmental Professionals (ITEP), should be identified to do the "representativeness" analysis for all tribes, in certain regions of the US.   Identifying those tribes that is not currently represented by the Ncore network should be made. These tribes should have access to the regional air monitoring data to see the status of their air quality. This project should also be aimed at locating tribes that would serve to fill data gaps, and those that have air pristine enough to provide background conditions. A perfect example of how this could be performed is when ITEP worked with the Western Regional Air Partnership (WRAP).

Below is a template for this process. It discusses how ITEP worked with tribes in the West to uncover these tribal issues. Perhaps this template could be used over the entire US:

> In 1996, the Grand Canyon Visibility Transport Commission (GCVTC, the predecessor to WRAP) identified a need for emissions inventories and air monitoring on and near tribal lands in the Western USA. We need to do this Nation wide for all tribes. This western US project, funded by the Western Regional Air Partnership's (WRAP) Tribal Data Development Working Group (TDDWG), served as a first step in gathering existing information on tribal air quality in the WRAP region. This is an important template for all of the US. The purpose of this project was to assess the current state of tribal air quality data and programs in the WRAP region and to clarify future needs in tribal air quality data development. The information collected and summarized is meant to inform the committees on the magnitude of the gap in air quality data over tribal lands, in the West. It is also meant to provide a starting point for planning future data development efforts in Indian Country, all over the USA.
>
> Several critical issues were identified through this project, they include:
>
> - A serious limitation on environmental program resources among the WRAP tribes.
> - A high demand for new and continuing tribal air quality programs in the WRAP region.
> - A shortage of tribal staff to deal with air quality issues.

The following will describe how these issues were identified and could be a template for how this could be accomplished all over the USA.

ITEP was contracted to gather information on tribal air programs in the WRAP region for this project. ITEP compiled a list of the 237 federally recognized tribes in the WRAP region, along with environmental and/or air program contacts for each of the tribes. ITEP attempted to contact 220 of these tribes and 156 tribes completed the assessment instrument.   ITEP staff persons were assigned to make all of the contacts.

One of the critical findings of ITEP's inquiries was a serious limitation on environmental program resources among the WRAP tribes. This is true all over the US.

Information gathered in 2001, for the western states indicated that only 22% of the 156 tribes it contacted are currently involved in the WRAP. Of those not currently involved in the WRAP, 41% indicated that they were not involved due to lack of staff and/or resources. Twenty-five percent (25%) said that they were not aware of the WRAP prior to the ITEP phone call. This data suggests a need for a more active outreach program for tribes. This is true all over the US.

The shortage of tribal staff to deal with air quality issues was apparent in every phase of the WRAP project. It was difficult to schedule meetings due to tribal staff's full schedules. Additional staff in tribal air programs would increase the quality and quantity of tribal air programs, as well as provide tribal staff with time for informed and meaningful participation in air monitoring work.

Research also revealed a high demand for new and continuing tribal air quality programs in the WRAP region, and across the USA. When asked if the tribe had an air program, 38% (60 tribes) said that they did. The other 96 tribes indicated that they did not have an air program. Planning to meet the demands for tribal air programs should be underway, not only for these new tribes but for the tribes that have been found to be seriously understaffed**.** As more tribes endeavor to assess, monitor and protect their air quality, additional resources must be identified to support quality tribal air programs.

Many tribes in the WRAP region effect air quality through prescribed burning programs. One hundred fifty-six (156) tribes were asked if prescribed burning occurred on their reservation. Approximately half (76) of the tribes responding said that prescribed burning did occur on their reservation. An additional 14 tribes, who do not currently use prescribed burns, indicated that they plan to use them in the future. This information indicates that tribes should play an integral part in regional planning of fire emissions. Air monitoring is important where use of fire occurs often. This happens on tribal lands, and monitoring of the air is an important issue for tribes concerned with human health.
This project identified several challenges and opportunities for tribal air quality programs in the Western USA, and could be used as a template all over the USA.

[The coordinator/authors for this section may choose to convey the tribal perspective by the use of delineated text blocks within other individual sections as well as including this section.]

3. Background for Planning Tribal Air Monitoring

3.1 Introduction

This section contains general background on ambient air monitoring, as well as other technical information that is not specifically about tribal monitoring. It is intended to assist tribal professionals who are not already familiar with this material, so that they can participate more easily and effectively with EPA staff. In order to be brief and understandable to tribal professionals unfamiliar with the history, complexity, and technology of air monitoring and related topics, this section consists of thumbnail sketches and pointers to other documents for fuller descriptions. The thumbnail sketches are simplified and do not convey all provisions or nuances. They are intended to assist tribal staff in understanding the more detailed references, and in discussing these topics with EPA specialists and more experienced tribal professionals. Additional substantial amounts of information concerning (1) technical issues related to monitoring, emissions inventories and air data, (2) health and ecosystem-related topics, as well as (3) the Clean Air Act and associated EPA rules, and (4) government policies, program planning, budgets and grants, can be found by tribal professionals working through the following Internet addresses:

- Clean Air Act -- http://www.epa.gov/air/caa/
- Chief Financial Officer (EPA) -- http://www.epa.gov/ocfo/index.htm
- American Indian Environmental Office (EPA) -- http://www.epa.gov/indian/index.htm
- Tribal Air (EPA/OAR) -- http://www.epa.gov/air/tribal/
- Technology Transfer Network (EPA/OAR) -- http://www.epa.gov/ttn/
- Institute for Tribal Environmental Professionals -- http://www4.nau.edu/itep/programs/

3.2 Ambient Monitoring Technology Information Center (AMTIC)

The AMTIC Internet website contains information and files on ambient air quality monitoring programs, details on monitoring methods, relevant documents and articles, information on air quality trends and nonattainment areas, federal regulations related to ambient air quality monitoring, as well as information on training, contacts and related Internet sites. The AMTIC Internet website is a valuable starting point for tribal members seeking information on a wide range of air monitoring topics; its Internet address is:

-- http://www.epa.gov/ttn/amtic/

3.3 National Ambient Air Monitoring Strategy

The overarching goal of the draft National Ambient Air Monitoring Strategy is to improve the scientific and technical competency of the nation's air monitoring networks while increasing the ability to protect public and environmental welfare, and to accomplish this in flexible ways that accommodate future needs in an optimized resource constrained environment. Objectives in achieving this broad based goal include: manage the Nation's air monitoring networks, establish a new air monitoring approach, provide a greater degree of timely public air quality information, improve network efficiencies, foster the utilization of new measurement method technologies, encourage multi-pollutant measurements, provide a base air monitoring structure, develop and implement a major public information and outreach program, seek input from the scientific community, provide air monitoring platforms and data bases, and assess funding levels needed to maintain support for this monitoring strategy. The impact of this strategy on tribal monitoring is also addressed, including operation of monitoring sites by Tribes. Tribal monitoring programs should consider their activities in relation to implementation of this strategy and should be poised to influence the strategy as it evolves. The draft monitoring strategy document (December 2005) and supporting documents, which provide both a description of the strategy and reflect ongoing components of the strategic plan development, are available at the following Internet addresses:

-- http://www.epa.gov/ttn/amtic/monstratdoc.html
-- http://www.epa.gov/ttn/amtic/monitor.html

3.4 Existing State/Local/Tribal Monitoring Networks

Ambient air monitoring programs make it possible to evaluate the status of the atmosphere compared to clean air standards and historical information. A review of various air monitoring networks (e.g., SLAMS, NAMS, PAMS, SPMS, including tribal monitoring) is provided as part of the National Ambient Air Monitoring Strategy. That strategy and other relevant information (including types, purposes, history, funding) of monitoring networks, including tribal programs, are provided at the following addresses:

-- http://www.epa.gov/oar/oaqps/qa/monprog.html#Ambient
-- http://www.epa.gov/oar/oaqps/montring.html
-- http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/naamstrat2005.pdf
-- http://www.epa.gov/ttn/amtic/amlinks.html
-- http://www.epa.gov/castnet/
-- http://vista.cira.colostate.edu/improve/Default.htm
-- http://nadp.sws.uiuc.edu/
-- http://www4.nau.edu/tams/services/index.html
-- http://www.epa.gov/air/tribal/tribetotribe.html

3.5 Quality Assurance (QA) of Air Monitoring Programs

EPA uses its Quality System to manage the quality of environmental data collection, generation, and use; the primary goal is to ensure that data are of sufficient quantity and quality to support decisions for protecting the public and the environment. The Ambient Air Monitoring Quality Assurance program applies these principles to air quality data. This is accomplished through effective communication and cooperation with monitoring organizations, which include EPA, State, Local, Tribal agencies, the academic community and industry. To address QA requirements and associated resource needs, the following tools are routinely provided: guidance documents, The National Performance Evaluation Program, data quality assessments and reports, ambient air quality assurance training, and example QA project plans (QAPPs). Information on QA tools, QA requirements, and example applications should be given major consideration in the development of tribal monitoring programs; this information is available at the following Internet addresses:

-- http://www.epa.gov/quality/index.html
-- http://www.epa.gov/airprogm/oar/oaqps/qa/index.html
-- http://www.epa.gov/ttn/amtic/quality.html
-- http://www.epa.gov/ttnamti1/files/ambient/airtox/nattsqapp.pdf

3.6 Air Quality System (AQS)

The AQS is EPA's widely used repository of ambient air quality data. AQS stores data from over 10,000 monitors, 5000 of which are currently active. State, Local and Tribal agencies collect the data and submit it to AQS on a periodic basis. Tribes conducting air monitoring programs should strongly consider submitting the resulting air data to AQS, if they are not already doing so. A detailed description of AQS, supporting manuals and guides, web-based access, information on training, and links to other sources of air quality information, including State/Local/Tribal agencies, is provided at the following Internet address:

-- http://www.epa.gov/ttn/airs/airsaqs/

3.7 ITEP and TAMS Support

The Internet home page for the Institute for Tribal Environmental Professionals (ITEP) states that "ITEP was established in 1992 to assist Indian Tribes in the management of their environmental resources through effective training and educational programs." The subcomponent for the Tribal Air Monitoring Support Center states that "The Tribal Air Monitoring (TAMS) Center was created through a partnership between Tribes, the Institute for Tribal Environmental Professionals and the United States Environmental Protection Agency. It is the first technical training center designed specifically to meet the needs of tribes involved in air quality management and offers an array of training and support services to Tribal air professionals. The TAMS Center mission is to strive to develop tribal capacity to assess, understand and prevent environmental impacts that adversely affect health, cultural, and natural resources." Listings of training programs and services available to tribal programs are provided at the following Internet addresses:

-- http://www4.nau.edu/itep/
-- http://www4.nau.edu/tams/

3.8 National Emissions Inventory (NEI)

The National Emissions Inventory is a national data base of air emissions information with input from numerous State and local air agencies, from tribes, and from industry. This data base contains information on stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants (HAPS). The data base includes estimates of annual emissions, by source, of air pollutants in each area of the country, on an annual basis. Emissions estimates for individual point or major sources (facilities), as well as county level estimates for area, mobile and other sources, are available currently for 1990 and 1996 through 1999 for criteria pollutants, and for 1999 for HAPs; a final version of the 2002 NEI will be ready in early 2006. The NEI emissions data base is a key source of information useful to tribal air programs. More information about the NEI data base and the compilation of criteria pollutant and HAP emissions inventories, and links to the data base, are available at the following Internet addresses:

-- http://www.epa.gov/ttn/chief/net/index.html
-- http://www.epa.gov/ttn/chief/eiinformation.html

3.9 Air Quality Models

Air quality models, and how they can provide insight to ambient air quality in Indian country when monitoring is not available, should be of particular interest to tribes. There are three types of air quality models: dispersion, photochemical, and receptor models used in assessing control strategies and source impacts. Source code and associated user's guides and documentation are routinely provided for preferred/recommended models, screening models, and alternative models. In addition, guidance is provided for applying air quality models in regulatory applications for State Implementation Plans (SIP) demonstrations and revisions, as well as permit applications for new source reviews, including Prevention of Significant Deterioration (PSD) regulations. These latter applications are particularly relevant for estimating air quality impacts in Indian country. Also available is the Model Clearinghouse which is designed to help record the interpretation of modeling guidance for specific regulatory applications. Modeling contacts within the EPA Regional Offices and State environmental agencies can assist tribes in the regulatory application of air quality models. Detailed information on models, codes and guidance in their use is available at the following Internet addresses:

-- http://www.epa.gov/ttn/scram/
-- http://www.epa.gov/scram001/guidanceindex.htm
-- http://www.epa.gov/scram001/guidance_clearinghouse.htm

3.10 The NSR/PSD Programs (relationship to monitoring needs)

The New Source Review (NSR) and the Prevention of Significant Deterioration (PSD) programs apply to new major stationary sources and major modifications locating in areas designated as attainment or unclassifiable for the NAAQS. These programs generally require the permit applicant to conduct a source impact analysis, using monitored data and air quality models. For the NSR program, the impact analysis must demonstrate that the new or modified source will not cause or contribute to a violation of state or national air quality standards or cause an adverse impact to visibility in any federal Class I area. The PSD program is generally designed to provide a more comprehensive source impact analysis than the NSR program, including effect on air quality related values, e.g., visibility, that have been identified for Class I areas. NSR and PSD are major pollutant control programs that should be of concern to tribes. Coordination of NSR/PSD and the use of air monitoring data in source impact analyses, to identify existing (representative) conditions and potential future impacts, should be addressed by tribes; relevant information is available at the following Internet addresses:

-- http://www.epa.gov/nsr/
-- http://www.epa.gov/ttn/amtic/files/ambient/criteria/reldocs/4-87-007.pdf
-- http://www.epa.gov/ttnamti1/files/ambient/visible/r-99-003.pdf

3.11 Benchmarks for Health and Ecosystem Effects

General Air Benchmarks. Air Quality indicators, concentrations of criteria pollutants relative to the NAAQS, effects on health due to toxic air pollutants, and other ambient measures such as visibility and acid deposition, all provide benchmarks of the nation's air quality; these benchmarks are directly relatable to the needs of tribal programs. The 2003 Report on the Environment makes extensive use of indicators in assessing the status of health and ecosystem effects; preparation of a report that reflects 2006 has begun. The Report on the Environment, and associated information on criteria and toxic air pollutants, is available at the following Internet addresses:

-- http://www.epa.gov/indicators/index.htm
-- http://www.epa.gov/indicators/roe/html/roeTOC.htm
-- http://www.epa.gov/ttn/naaqs/
-- http://www.epa.gov/air/visibility/index.html
-- http://www.epa.gov/airmarkets/cmprpt/arp03/summary.html

Air Toxics and the Integrated Risk Information System (IRIS). IRIS was prepared and is maintained by EPA as an electronic database containing information on human health effects that may result from exposure to various chemicals in the environment. It was developed in response to the need for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The collection of computer files covering individual chemicals contains descriptive and quantitative information concerning (1) oral reference doses and inhalation reference concentrations (RfDs and RfCs, respectively) for chronic noncarcinogenic health effects and (2) hazard identification, oral slope factors, and oral and inhalation unit risks for carcinogenic effects. Information on IRIS and other sources of air toxics information that may prove useful to tribal programs are available at the following Internet addresses:

-- http://www.epa.gov/iris/index.html
-- http://www.epa.gov/ttnatw01/hlthef/hapindex.html
-- http://www.epa.gov/air/toxicair/index.html

3.12 National Air Toxics Assessment (NATA)

NATA is a national-scale assessment of 33 air pollutants (a subset of 32 air toxics on the Clean Air Act's list of 188, plus diesel particulate matter). The assessment considers the year 1996 (an update to 1999 is in preparation), including: (1) compilation of a national emissions inventory of air toxics emissions from outdoor sources; (2) estimates of ambient concentrations across the contiguous United States; (3) estimates of population exposures; and (4) characterizations of potential public health risks including both cancer and non-cancer effects. The goal of NATA is to identify those air toxics which are of greatest potential concern, in terms of contribution to population risk. This information should also be relevant and useful in assessing risk under Tribal programs. Results are available at:

-- http://www.epa.gov/ttn/atw/nata/

3.13 Indoor Air Issues (radon and mold)

Radon and mold can both be problems in indoor environments. Radon is odorless and tasteless, but may exist at ambient air levels that exceed safe limits in homes. Air containing radon that is breathed indoors is the second leading cause of lung cancer in the United States. Molds can gradually damage homes and furnishings and can cause potential health problems avoided. Internet addresses with additional information on radon and mold, associated effects, and mitigation strategies available for consideration by tribes are available at the following Internet addresses:

-- http://www.epa.gov/iaq/index.html

-- http://www.epa.gov/mold/index.html
-- http://www.epa.gov/radon/index.html
-- http://www.epa.gov/iaq/atozindex.html

4. Tribal Air Quality Issues, Relevant Air Monitoring Air Monitoring and Tribal Air Monitoring Activities

This section will examine the reasons for tribal air quality monitoring and provide examples of current tribal air monitoring.

Section 301 (d) of the 1990 Clean Air Act Amendments provides federally recognized tribal governments the authority to implement Clean Air Act programs for their reservations and other land that they can demonstrate jurisdiction. The Tribal Authority Rule (TAR) promulgated on February 12, 1998, further delineates the authority of tribes to implement air quality programs under the Act.

Tribes may need to conduct ambient air monitoring for a variety of reasons which include the following: (1) attainment with health and welfare based National Ambient Air Quality Standards (NAAQS); (2) impairment of visibility and biological diversity for vistas within or near reservations; (3) measurement of toxic air pollutants for health and ecological effects; (4) collection of near-real time data for reporting Air Quality Index (AQI) to the tribal community and to EPA's AIRNOW real-time mapping program, (5) monitoring air quality related to tribal environmental and cultural resource concerns, (6) being part of a Regional/State monitoring network (7) for determining air quality background levels and establishing air quality baselines and (8) to increase awareness that indoor environments play a large, if not the largest, role in causing the increase in asthma and respiratory disease.

Tribes have a need to understand the short and long term effects of long distance transport on tribal lands and the effects of atmospheric deposition on the ecology of their lands. Tribes also need air monitoring data to identify the role of off-reservation sources and /or to build a case or partnership for controlling those sources. Examples of these programs include long term IMPROVE, NADP, MDN, ozone, PM2.5, precursor gas and toxic air quality monitoring.

The following is a review with examples of how the tribes have conducted air quality monitoring to provide data: (see appendix?? for more detailed examples of specific air monitoring)

4.1 Air Monitoring for Compliance with Health Based NAAQSs

Tribes are currently monitoring to demonstrate compliance with national standards, primarily for ozone and particulate matter, in areas of the country that are not in compliance with the NAAQSs for these pollutants or have no existing monitoring. The data from these sites may be used to demonstrate the need to develop a tribal implementation plan, to show the inadequacies of state or federal implementation plans (or monitoring networks) or to warn tribal members of unhealthy air quality. Tribes may also be well located to perform air monitoring that broadens the coverage of state SIP monitoring networks. For example, several tribes in Regions 1 operate ozone and PM2.5 air monitoring sites in areas that the states are unable to monitor, such as the island of Martha's Vineyard, MA or far eastern ME.

An example of this type of air monitoring is the ozone air quality monitoring being performed is the Wampanoag Tribe of Gay Head at Aquinnah, MA (Martha's Vineyard). The tribe is currently operating an air monitoring program consisting of an ozone monitor, an IMPROVE sampler, and a meteorological station. The station is located in the Massachusetts non-attainment area in an area where there is no state air monitoring. In 2005 the station recorded four days above the 8-hr. ozone NAAQS and provided the tribe with health related air quality data to inform tribal members. Data from this station will also provide the tribe with the ability to ensure that ozone air quality standards will be met in the future.

PM10 monitoring has been on-going in non-attainment areas on Tribal lands in Montana for many years. The Confederated Salish and Kootenai Tribes and the Northern Cheyenne Tribes were designated non-attainment for PM10 in 1989. Ongoing monitoring for PM10 will be required to satisfy compliance with their respective Tribal Implementation Plans. PM2.5 monitoring was also initiated in these two areas as a screening tool to ensure compliance with the PM2.5 standard.

4.2 Impairment of Visibility for Vistas within or near Reservations

Visibility measurements are another important measurement objective for tribal reservations designated as Federal mandatory Class 1 areas or in areas where regional haze is of concern. The CAA amendments of 1990 set a target of improving visibility in mandatory Class 1 Areas to natural visibility conditions by 2064. Data from these sites will provide tribes important information to determine the impacts from regional haze on visual impairment on tribal lands. Examples of visibility measurements on tribal lands include the operation of IMPROVE monitors by a number of tribes and the operation of haze-cameras on tribal lands. The Aroostook Band of Micmac Indians operate both an IMPROVE monitor and a haze camera at their air monitoring site in Presque Isle Maine. Data from this site is included in the National IMPROVE web page and the haze camera is included as part of the NESCAUM haze-cam network. The Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation in northern Montana also operate an IMPROVE monitor which they use to monitor the status of their voluntary Class 1 air shed. They, the Confederated Salish and Kootenai Tribes, and the Northern Cheyenne Tribes operate IMPROVE samplers that supplement the core IMPROVE network and provide valuable information on areas that would otherwise lack monitoring resolution.

4.3 Toxic Air Pollutants for Health and Ecological Effects

Tribes are also monitoring for hazardous air pollutants and/or air toxics. Air monitoring for these pollutants can either be for short term exposures when there is a chemical release or for long term community and ecological impacts. Sources of these pollutants include nearby stationary sources, area sources, mobile sources, and long distance transport from urban areas. Data from these sites provide the tribes critical information on hazardous pollutant exposures and impacts of air toxics on communities and tribal lands through risk analyses conducted using this monitoring data. Examples of this type of monitoring include mercury deposition monitoring or the impact of a nearby power plant or pulp mill. The Nez Perce Tribe of Idaho is currently conducting air toxics monitoring in the town of Lewiston and on their reservation for toxic emissions from the Potlatch pulp mill in Lewiston. Several tribes in Maine conduct monitoring for metals and mercury deposition for long term trend data on their tribal lands. In addition several New England Tribes are collecting and analyzing fish tissue data both as a measure of fish contamination and as an indicator of mercury deposition.

4.4 Monitoring to Support AQI and AIRNow

Some Tribes are operating continuous monitoring for ozone and PM2.5 and convert these data to the appropriate AQI, based on EPA's AQI concept. This AQI relates concentration of pollutants to their potential health effects and can be used to alert a community to unhealthy air quality conditions. Another critical role for tribal monitoring is being part of the national AIRNOW mapping program. These sites provide near real-time data quality information and valuable information to better understand the fate and transport of air pollution. The data is also valuable in providing data to improve the mapping programs in rural area where there is little or no state data.

4.5 Significant Air Quality Related Environmental and Cultural Resource Concerns

One of the most important reasons that tribes are conducting air quality monitoring is to gather information on the long term air quality effects on the tribal community and on tribal lands. In many cases tribes use their ancestral lands for subsistence hunting and fishing, traditional rites, and harvesting native plants. Tribes are concerned that long term exposures to air pollutants, acid rain, and heavy metal deposition will adversely affect these resources. It should be noted that this type of air monitoring requires a long term commitment both in term of funding and in resources (for operation of equipment and analyses/assessments of the data). Examples of this type of monitoring include operating trace level SO2, CO and NOy monitors, sulfate, nitrate, metals, and NADP & MDN samplers and IMPROVE samplers.

4.6 Regional Monitoring

Another critical role for tribal monitoring is being part of a Regional/State monitoring network. Tribes may be well located to perform air monitoring that broadens the coverage of state SIP monitoring networks and supports the national AIRNOW mapping program. Several tribes in Regions 1 operate ozone and PM2.5 air monitoring sites in areas that the states are unable to monitor, such as the island of Martha's Vineyard, MA or far eastern ME. Not only do these sites provide extended coverage for the regional air monitoring program, but also they provide improved coverage for EPA's AIRNOW real-time air quality mapping program. These sites provide valuable information to better understand the fate and transport of air pollution.

4.7 Determining Air Quality Background Levels and Establishing Air Quality Baselines for PSD

In some cases tribes will need to conduct air quality monitoring to determine air quality background levels or to establish a baseline. This information is important for the protection of areas with pristine air quality and to provide quantitative data before new stationary sources are located in or near Indian Country.

4.8 Indoor Air Quality

The increase in asthma and respiratory disease, and the attempt to discover their causes has led to an increased awareness that indoor environments play a large, if not the largest, role in causing this issue. Molds, tobacco smoke, Radon, improper ventilation, insect infestations, and cooking/heating fires all play a role in increasing the effects of respiratory distress on effected populations and to a disproportionate extent the tribal members. Funding for monitoring projects such as the Radon monitoring program, Tools for Schools, and others, can be used to assist in identifying problems and suggest solutions. This information can be used to act or can influence other mechanisms to assist in remediation of Indoor Air Quality issues.

4.9 Source Monitoring

Tribes may need to conduct emission monitoring on their major point sources for compliance purposes. This may be in the form of stack tests or by conducting continuous emission monitoring. Normally source monitoring is conducted for particulate, sulfur dioxide, nitrogen oxides, volatile organic compounds and/or carbon monoxide. ***(Please send in examples of tribal source monitoring projects)***

5. Implementation of Monitoring

There is a growing movement in the United States of Tribal agencies taking an increased interest in ambient air quality issues on Tribal lands.

Tribes wishing to examine ambient air quality issues on their Reservations or Tribal lands should have a strategy in place as they develop their work plan and program strategy. Tribal agencies often decide that the best way to assess the current air quality situation is through the use of ambient air quality monitors. A strategic approach to monitoring should incorporate specific planning stages so that monitoring time and money is spent wisely. Consideration of the following sections will help Tribes plan and carry out an appropriate strategy.

5.1 Objectives

The type of air monitoring sampler to be used should depend heavily on the monitoring objectives the Tribe has developed concentrating on what they want the data to provide. Such reasons might include, but are not limited to:

- To determine the location and levels of the highest concentrations expected to occur in the area covered by a monitoring network (potentially to establish official status as attainment/non-attainment)
- To determine concentrations that are representative of longer averaging periods or a broader geographic area
- To assess potential toxic hot spots
- To assess visibility
- To ensure protection of PSD increments
- To determine impact on ambient pollution levels of significant local source categories
- To determine baseline concentration levels (to compare to future levels to measure changes and try to determine source of changes)
- To study pollutant transport issues in order to understand how the tribal area is being impacted by upwind sources and what those sources are
- To assess mercury and other persistent bioaccumulative toxics (PBT) deposition
- To develop control strategies
- To perform model validation
- To aid in public air quality reporting and forecasting

Four important questions should be considered by the Tribe before monitoring begins:

1) Why are we monitoring?
2) What are we monitoring?

3) Who in the tribal organization will watch the results as they come in, and how?
4) What could our response or plan be if our monitoring data indicates unhealthy conditions?

Tribes need to consider what purpose the data collected will be used for. Validated, defensible data may be needed for applications such as attainment/non-attainment designation purposes. If a Tribe wishes to make such a designation, a Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor must be used for the pollutant of concern. These are monitors that have specifically been approved by the EPA to use for assessing compliance with the National Ambient Air Quality Standards (NAAQS) for that pollutant. If a tribe is not monitoring to demonstrate compliance, other types of monitors could be used. For example; the type of PM filter samplers used in the IMPROVE program, a TEOM-based continuous PM monitor, or passive badge-type ozone monitors. These types of monitors have not been approved by EPA for compliance purposes but are still considered to be a viable form of monitoring. A Tribe might choose one of these unofficial monitors over an FRM or FEM based on ease of operation, cost, simpler access to laboratory services, or other reasons.

Tribes should be aware that data collected with federal money, such as EPA grants, is considered to be in the public domain and EPA's expectation is that eventually the data will be accessible to the general public. Data collected during a limited start-up period while a Tribe is still working out problems can be an exception if agreed to with the EPA Regional Office. If a Tribe wants to keep data confidential, it cannot be collected using federal funds.

5.2 Pollutant Selection

The Tribe should research a complete list of technical information resources on local, regional and even national levels depending on the pollutant of interest and type of monitoring incorporated. A Tribe can identify which pollutants are of the greatest concern through existing methods and tools such as:

- EPA Air Quality System (AQS): A national database that tracks air monitoring data from state, local, tribal, and other entities
- Toxic Release Inventory (TRI)
- Other tribes and tribal consortiums who have their own monitoring programs
- Data from existing programs such as Interagency Monitoring of Protected Visual Environments (IMPROVE), Clean Air Status and Trends Network (CASTNET), National Atmospheric Deposition Program (NADP), etc.
- State and Tribal Emission inventories (many tribes do their own inventory prior to making monitoring decisions)
- Private industry monitoring data
- Climatology data

- Observations from other environmental programs within the same tribe (i.e. water quality, forestry, wildlife management)
- Federal Land Managers
- Regional Planning Organizations - Central Regional Air Planning Association (CENRAP), Western Regional Air Partnership (WRAP), Visibility Improvement State and Tribal Association of the Southeast (VISTAS), Mid-Atlantic/Northeast Visibility Union (MANE-VU), Midwest RPO, etc.)

In correlation with the data, the type and need of monitoring should also focus on the category of source. The category of source will help determine what method of monitoring should be utilized and if it is worth pursuing. Categories can be broken down as follows:

- Stationary or Point (please see SCC codes for full list)
  - Factories
  - Power Plants
  - Chemical Process Industries
  - Petroleum Refineries

- Area (please see AP-42, Chapter 13)
  - Dry Cleaners
  - Road Dust
  - Gas Stations, Auto Body Shops
  - Woodburning Stoves, Burn Barrels
  - Crop Burning/Prescribed Burning

- Mobile (please see AP-42, Chapter xx for full listing)
  - On-Road
    - Trucks (Semi tractors/trailers)
    - Buses
    - Cars
  - Off-Road
    - Farm vehicles
    - Construction Equipment
    - Trains
    - Recreational Vehicles (Boats, ATV's, Snowmobiles, etc.)

Tribes can assess the risks that different pollutants pose by studying unit risks and reference concentrations. This information is available on EPA's website (National Center for Environmental Assessment (NCEA) , Integrated Risk Information System (IRIS), Technology Transfer Network – National-Scale Air Toxics Assessment) . The EPA has its own assessment group called the Risk Assessment Forum, made up of senior EPA scientists. This forum "was established to promote Agency-wide consensus on difficult and controversial risk assessment issues and to ensure that this consensus is incorporated into appropriate Agency risk assessment guidance". Tribes should be aware that the scientific understanding of these pollutants may change over time, as more data becomes available. Also, different organizations and experts can have different assessments of these substances. Tribes should make sure they are looking at data from credible sources.

Tribes that are considering monitoring or that are already conducting monitoring are encouraged to watch for proposed changes in the NAAQS or scientific data on health risks with regard to the pollutant of potential concern. For example, if a NAAQS standard were to be lowered for PM10 (or any other criteria pollutant that was being monitored for) because new evidence indicated the adverse health impacts suspected were no longer an issue, then the tribe would want to re-evaluate the purpose of the monitoring and consider whether it is still necessary. To keep abreast of changes in the standards, tribes can use a variety of sources. Information is often available through the National Tribal Air Association (NTAA), through EPA outreach efforts, through Regional Tribal Operations Committees (RTOC), or on EPA's Ambient Monitoring Technology Information Center (AMTIC) website.

5.3 Monitor Selection

Once the pollutant parameter (or pollutant wished to monitor for) has been identified, the sampling methodology should be decided upon. The final decision on what type of monitor to use will focus on many factors such as (but not limited to): cost; accuracy; level of tribal monitoring experience; seasonal conditions; expected program continuity; the need to monitor for one or multiple pollutants; monitor maintenance/service requirements; and conditions at monitoring site (electricity and phone line availability). Ambient air monitors can be broken down into two general groups, manual and continuous:

- Manual Samplers
    - Time averaged data
    - Sampling Media
        - Filters, Cartridges, Canisters, Precipitation samples
    - Analyzed in separate step in a qualified laboratory
    - Most do not need a shed or trailer, may need shade

- Continuous Samplers
    - Instrumental methods (clarify)
    - On-line data (clarify)
    - Continuous data stream
    - Most or all need a shed or trailer

This step is a difficult and important one. For example, many Tribes are involved in particulate sampling. They may choose to deploy a couple of manual $PM_{2.5}$ samplers in an area of their Tribal land. This will require an operator to collect the filters to have them analyzed by a lab. The Tribe may choose a continuous $PM_{2.5}$ monitor, which will involve a data logger to record readings and can be downloaded from a modem to a remote site. However, a continuous monitor may be more complex and may require a shed or trailer and more maintenance. Or the Tribe may choose to use mini-volume samplers which are more portable and can be used in a mobile status but do require laboratory analysis. Tribes can obtain laboratory services to weigh PM filters from TAMS without charge, or for a fee (payable from EPA grant funds) from the IMPROVE program or from national contracts administered by EPA. The Tribe may want to host monitoring sites in existing national programs, such as the National Atmospheric Deposition Program/Mercury Deposition Network (NADP/MDN) and CASTNET, which offer assistance in all areas of operation. In these program a Tribe would typically contribute staff time for site operation and maintenance but the national program would pay for laboratory analysis and/or program costs. Before joining a national program, the Tribe should make sure that the program is a good match for the Tribe and that the monitoring objectives of the program are similar to the Tribe's.

Tribes are strongly encouraged to collect meteorological data at the monitoring site. Usually a minimal station measures wind speed and direction, relative humidity, temperature, barometric pressure, and precipitation, and uses a data logger for gathering and storing data. This involves purchasing and operating additional pieces of equipment. There are standard procedures for submitting meteorological data to the AQS and/or AIRNOW data systems so that the Tribe and others can access it.

5.4 Siting

A monitoring site should be chosen based on what information the tribe wishes to capture and the objectives described in Section A. Some Reservations are so large that monitors are needed in multiple locations or a Tribe may wish to place multiple monitors in order to study transport issues. Multiple monitors for different pollutants may be placed at the same site, which provides a more robust data set for understanding what is happening to air quality and why. Needless redundancy in monitors at one site should, of course, be avoided.

A site should be chosen with consideration for the following concerns. The site should be in a location where data collection objectives can be addressed (i.e. close to a school, close to a certain source, rural for background levels, etc). Each monitor has set criterion for siting to make sure that it monitors real ambient air. This should be investigated for each monitor before a purchase or site is decided upon. Most importantly, monitors need to be situated a certain distance away from trees or other tall obstructions, such as buildings, and the monitor probe needs to be situated a certain distance above the ground. The site should be easily and safely accessible by staff, should allow for electrical and phone hook-up, or solar power if feasible, and should minimize opportunities for vandalism. The site should be accessible year-round, through spring rains and winter snowfalls, and should allow for location of a shed or trailer, if needed. It is useful for the site to be accessible by a vehicle carrying equipment and gases needed for quality assurance audits.

Because many Reservations are located in rural areas, impediments may exist to running electrical or phone service to site locations. Tribes are encouraged to look at alternative solutions, such as radio, satellite, or Internet-based communications systems and generator, wind, or solar-derived power.

Depending on the type of monitor chosen and the local climate, a monitoring shed or trailer that is weather-tight, temperature-controlled, and has adequate space may be needed. If a trailer is not available, shed kits can be purchased locally. The Tribe should consider future monitoring needs when arranging for a shelter so that extra space and adequate power sources are available.

Tribes should consider the timing involved in installing a monitor. For example, a grant received in late summer may result in monitors being placed the following spring. Time is needed to receive the grant money, order the monitor, prepare the site, write the QAPP, contract laboratory analysis, and learn how to operate the monitor. These steps can take months and can be slowed by weather conditions.

5.5 Funding

Once a Tribe has identified pollutants of concern, found a site, and has chosen a specific monitor funds should be sought. Initially, a Tribe may choose to work with their EPA regional contacts to begin development of a work plan, which will be required in order to receive EPA funds and will be used to organize the direction of the air program. This is especially important in the planning phase as many of the air monitoring development steps can be incorporated into the work plan objectives and thus funded by EPA. This also obligates EPA to provide guidance and technical assistance throughout the whole process.

The EPA offers ambient air funding under Sections 103 and 105 of the Clean Air Act. Section 103 grants are for air program planning and short-term projects while Section 105 grants are for operating an ongoing air program and for long-term projects. Section 103 grants have the advantage of not requiring the Tribe to match any of the federal funds, while Section 105 grants require a Tribal match of between 5% and 40% of the total amount of the grant. Further information on Tribal match requirements can be found in Section 10 of this document or 40CFR § 35.575 or 40CFR § 49.4{q}. A Tribe should start out with a 103 grant and can then apply for 105 funding after the air program has been established. Tribes can also perform some air-related activities under EPA's General Assistance Program (GAP).

Other funding options are also available to tribes and should be explored. As more Tribes apply for EPA air grants, competition has become tighter. In addition, EPA's budget is not growing and may shrink in the future. This means that tribes may have to look at alternate funding sources. Creative opportunities can be found for Tribes to link their interests to those of other organizations. For instance, National Oceanic an

Atmospheric Administration (NOAA) grants could be awarded for Tribes to obtain meteorological data that is of interest both to NOAA and the Tribe. A United States Department of Agriculture (USDA) – Concentrated Animal Feeding Operations (CAFO) grant could be obtained to fund ammonia monitoring (of interest in regional haze considerations). Indian Health Services (IHS) may fund monitoring if it is believed that air emissions are directly causing health problems on the Reservation. These are just a few suggestions for places where Tribes can look for funds.

As mentioned in Section A, the desire to keep data confidential may also lead tribes to pursue other alternatives. Some tribes pay for their monitoring using tribal funds. Other Tribes have obtained monitoring money through Regional Planning Organizations (RPOs) to collect monitoring data beneficial to both the Tribe and the RPO. Some Tribes work with state agencies to share monitoring costs and responsibilities and then share the data with the state agency. Some air-related activities can coincide with other federal grants. For example, a meteorological station could serve to gather air-quality data and could also gather data for alternative wind energy feasibility studies under a Federal Energy Resources Commission grant.

Before any kind of funding request can be made, cost information must be collected for the monitor and for ancillary costs. Ancillary costs vary widely with the type of monitor needed and where it will be located. These may cover: construction of a monitoring shed or purchase of a monitoring trailer; installation of electricity and phone service (these costs may be considerable in rural areas); purchase of a data management system; lab costs; purchase of calibration devices; spare parts for monitor; tools for working on the monitor; shipping costs to the lab; and lab services themselves [3]. If the Tribe is becoming part of a program, such as IMPROVE, many of these costs will be combined into an annual program fee. Some monitors and/or calibration equipment are very complex and must be shipped back to the vendor for servicing, so these costs should be considered. Vendors often offer services to visit the site and install more complex monitors and provide training sessions to Tribal staff. Though this may be costly, the Tribe may want to consider this option. A dedicated computer, palm, or laptop may be purchased for downloading data, analyzing it, and uploading it to various databases or websites.

Tribes may attend training courses to prepare for monitoring. The Institute for Tribal Environmental Professionals (ITEP) and the Tribal Air Monitoring Support (TAMS) center offer courses including: air toxics monitoring; meteorological monitoring; writing a QAPP; dataloggers; air quality computations; data management; PM monitoring; ozone monitoring; Tribal Emission Inventory Software Solution (TEISS); and EPA's Air Quality System (AQS). Tribes should consider which of these courses they may want to attend and plan for travel costs.

[3] For example, the cost of lab and shipping services for an IMPROVE protocol site is $33,000 per year.

5.6 Quality Assurance/Quality Control

Depending on the Tribe's objectives (see Part A of this section) the data obtained must be quality assured to an acceptable level. Data is useless if the Tribe is unable to show that it was collected properly (i.e. verifiable and defensible). Data collected for designation purposes is going to be held to a higher standard than data collected for informational purposes, however in any case a Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) will be needed, along with regularly scheduled audits, verifications, and calibrations.

The most important step in a quality assurance/quality control (QA/QC) program is learning to operate and service the monitor properly. ITEP courses are available for some types of monitors but not all. Some vendors offer regular training courses at their facilities or offer services to set up the monitor and train the staff for a daily fee plus travel costs. Neighboring tribes, tribal consortiums, or state or local agencies may also offer assistance. If a Tribe is a member of an RPO, arrangements might be made for some training. Federal agencies such as the Forest Service and Park Service sometimes operate monitors and may be able to offer assistance.

The Tribe must prepare a QAPP and SOP's for all monitoring activities. This can be a months-long process, depending on the complexity of the monitor and the purpose the Tribe will be using the data for. Once the Tribe has finished writing the QAPP, it is submitted to the Regional Office for approval. Although QAPPs are supposed to be written and approved before any data is collected, this may be unrealistic for tribes. It is hard to write a QAPP for a monitor one has never seen or operated. Although QAPPs may be copied from another tribal or state agency, the operation of the monitor still needs to be understood by the Tribal operators because the operators must follow the QAPP on a daily basis. Ancillary equipment also needs to be understood for proper operation and maintenance. Weather instruments, data loggers, electric surge protectors, and associated computers fall under this category.

The EPA's OAQPS is working with ITEP to develop a generic ambient air monitoring QAPPs software product. This product is planned to be available in September of 2006. The EPA is also considering the implementation of a Quality Assurance certification program in its draft National Monitoring Strategy. This program would establish a national accreditation process to certify QA personnel. Although participation would not be mandatory, the program would help foster consistency in training and QA requirements across the nation.

Calibrations of all equipment at the monitoring site must also be scheduled regularly. Calibrations test the monitor's response at a number of data points and at a zero point. Calibrations are performed for any of the following reasons (not an exhaustive list): initial instrument installation; instrument Zero/Precision/Span drift tolerances are exceeded; maintenance or repairs affect calibration; instrument is physically relocated; instrument has not been calibrated within 3 months. Calibrations can be performed by Tribal staff and are required regularly enough that this is the most efficient scenario. A Tribe can also hire a contractor.

Zero/Span/Precision (ZPS) checks are performed on some continuous monitors. These instruments are subject to drift and variation in internal patterns over time as part of their normal operation. The calibration relationship between what the instrument is reading and the true value of what it is measuring must be checked periodically through ZPS checks. These checks are done very routinely and it is probably best for Tribal staff to learn to perform them. Learning these techniques will help with learning to do calibrations and general maintenance. Procedures can be found in the instruction manuals that come with the monitor or can be copied from other state or tribal agencies.

Field blanks are used to assess contamination that might occur as a result of inadequate sample container preparation, or contamination that may occur during shipping or handling in the field. Blanks are used only for physical samples sent for laboratory analysis.

Tribe must schedule regular audits, which are formal detailed studies of one or more aspects of a project conducted by independent auditors. Audits study specific criteria previously determined by the site manager to be critical to the success of the project and test a monitor's response to a known input. There are system audits and performance audits. Performance audits check how far "off" a monitor's response is from its input and checks the slope of a best-fit line. The system audit tests the gas standards used for calibrations, spans, and precision checks; shows that the data pass validity tests concerning completeness, reasonability, span limits, and precision points; verifies siting criteria; and ensures that recommendations from previous have been implemented.

EPA audit guidelines and requirements can be found in guidance documents for each specific pollutant. Auditing equipment needs to be completely independent of equipment used for routine calibration and QC checks on the equipment. Audit criteria should be included in a Tribe's QAPP so the Tribe can assess when a monitor has passed an audit and when it has not.

In each EPA Region, EPA employees have designed monitoring trailers and conduct traveling audits each summer for tribes in those regions (Regions 1 and 2 share a trailer). Audits can also be performed by other Tribes, TAMS staff, state agencies, or by contractors. A Tribe may even consider contracting out the entire operation of a monitor, although these costs may be prohibitive and contractors may not have the same dedication or interest for the project as the Tribe. In addition, learning how to plan, implement, operate and maintain a monitoring network is often believed to be a crucial part of Tribal capacity-building.

The EPA also requires Tribes to write Quality Management Plans (QMP's), which cover the operation of an entire office. The EPA looks at a Tribe's QMP along with its QAPP's when awarding funds.

5.7 Data Management

During and after the data collection process, Tribes need to handle the data they produce. Continuous monitors collect large volumes of data that need to be recorded as it is generated. Data from all types of monitors needs to be stored until it can be reviewed and quality assured. Once the data is quality assured, it needs to be corrected, flagged as necessary, and placed in a repository where other interested parties can view it. Since this document contains an entire section (Section VIII) devoted to data storage and access, we will offer only a short synopsis here.

ITEP offers Data Analysis courses where Tribes can learn basic statistical techniques used for demonstrating compliance with the NAAQS. Certain data needs to be uploaded to the EPA's AQS or AIRNOW databases if funded with EPA grants. Some Tribes place their data on a website so Tribal members can access it on a day-to-day basis. A number of tribes work with state agencies or RPO's and offer their data on those agencies' websites.
Refer to the independent multi-tribe real time data system that is similar to Texas's. Tim Hanley can describe it???

Part of data management involves site and instrument logbooks where information and results are recorded manually. A site logbook should be kept to detail maintenance activities, problems at the site and how these problems were corrected. For example, power outages and equipment failures need to be noted. In addition to a site logbook, a separate logbook should be kept for each individual monitor to record the results of calibrations and other procedures. Logbooks serve as the "institutional memory" of a site or monitor and can help staff members remember when a specific problem occurred and how it was addressed.

5.8 Data Access

One goal of collecting monitoring data is to allow the general population to see monitoring data as soon as it is processed and quality-assured. Sensitive individuals can then choose to limit their physical activity if pollution levels are high. Data can be useful to other groups who are studying air pollution for scientific or policy-setting purposes. All data gathered using federal funds should to be sent to the EPA so it can be included in national databases. Some tribes also choose to use their own website to make data available to their constituents. Other tribes work with other agencies or contractors to disseminate their data.

Refer to the independent multi-tribe real time data system that is similar to Texas's. Tim Hanley can describe it???

6. How to Request EPA Funding and Other Support

Air quality monitoring activities may qualify for a variety of EPA or other agency grant support depending upon its context, purpose and other factors. Within EPA grant funds may be available for monitoring air pollution levels through appropriations made for the Indian General Assistance Program (IGAP) from the American Indian Environmental Office, for tribal projects and program implementation under the Office of Air and Radiation, through the Direct Implementation Tribal Cooperative Agreement mechanism to assist EPA with implementation of the CAA within Indian country, or a variety of other miscellaneous grant opportunities available to a variety of organizations, including tribes, such as for air toxics projects, environmental education, and community projects that can vary from year to year. Other agencies that may fund monitoring include the Bureau of Indian Affairs, nonprofit groups, and foundations..

EPA provides a variety of tools, guidance and references that tribes may access through the web to develop proposals and workplans to submit for grant funding. Many of these sites can be found through the links available at: http://www.epa.gov/ogd/.While there is some consistency across the agency on what the criteria will be for funding, each Region also may have its own specific criteria and procedures, as well as deadlines that must be complied with in order to increase an applicant's chances of receiving financial support.

On the OAR Tribal Air Website additional information and assistance can be found, including the Tribal Air Grants Framework: A Menu of Options, which was designed especially for tribal air grantees and EPA Project Officers to assist them to be able to effectively develop and manage these grants for environmental results. This can be accessed at: http://www.epa.gov/air/tribal/pdfs/menuofoptions.pdf**.** Within this Framework are at least two Menu items that may assist tribes who are seeking grant funding in order assess or monitor their air quality, along with a variety of others for other types of air-related work activities.

The two most relevant Menu items are: ***The Menu Item for Conducting a Basic Air Quality Assessment***, and ***The Menu Item for Conducting Air Quality Monitoring.*** The former will assist an applicant in identifying the activities that will assist in documenting whether there is a need for monitoring or whether some other activity may be more appropriate to address an air quality concern. The latter provides some of the activities that can be considered for inclusion in a workplan for conducting air quality monitoring. Both have examples of applicable Objectives, Outputs, and Outcomes, as well as examples of how EPA may measure national accomplishments in this area.

Assessment and baseline air quality monitoring is typically eligible for funding through the IGAP program. The Regional Tribal Office can provide more specific information on the requirements for this funding. Assessment and baseline, as well as regulatory, monitoring can be funded under Clean Air Act authority or OAR grant resources. For details on the CAA 103 or CAA 105 authorities and the Direct

Implementation Cooperative Agreement funding mechanisms and how a tribe may qualify for this funding, the EPA Regional Office of Air's Tribal Coordinator can provide specific information.

7. Storage and Access to Monitoring Data

7.1 Problem Statement

Tribes collect environmental data principally for internal use so tribal leaders can make informed decisions to accomplish their environmental policy objectives. Historically, EPA has required tribes in some Regions to submit data to the Air Quality System (AQS) as a deliverable for their Clean Air Act related grants. Not all EPA Regions have required tribal data to be submitted to AQS. Recently, there has been a push by EPA for all tribes to submit their data to AQS in all EPA Regions.

Many tribes have argued that forcing them to submit data to AQS is an infringement on their inherent tribal sovereignty. Others have argued that it isn't stated in the Tribal Authority Rule that tribal data must be submitted to a national database, and the new requirement is policy, not law. There is a link between tribal sovereignty and data collected on tribal lands, and some tribal governments are expressing significant reluctance to being forced to submit data to national databases, such as AQS. Policy relating to tribal AQS data submittal should carefully consider tribal concerns and include dialog with tribal leaders at the highest levels of government.

There is also a "right to know" aspect in US public environmental policy. Both tribal and non-tribal US citizens live within the tribal environmental jurisdictions as defined by the Tribal Authority Rule of the Clean Air Act, and policies developed and implemented within Indian country can also impact neighboring jurisdictions. This complicates the issue of tribal sovereignty as it relates to public access to environmental information. This is especially true for environmental data gathered through federal funding. These are also things that need to be considered.

As previously stated, several tribes currently submit their data to AQS. There are other tribes that are very open to submitting data to AQS in principal, yet the resources to accomplish the task are limited. Technical staff within tribal nations are frequently tasked with multiple duties. This sometimes requires one person to develop and utilize technical expertise in virtually every aspect of implementing the Clean Air Act within their jurisdictions. The time they can spend submitting data to AQS is limited. Since this is an infrequent task, usually only required on a quarterly basis, it can also be a difficult task to master. New resources to assist with AQS data submittal may be necessary. Presently there isn't a single person anywhere in the US whose sole job is to assist tribes with AQS entry.

Historically, some tribes relied heavily on various consultants to enter air monitoring data into AQS on their behalf. However, since there is currently less funding available from EPA to the tribes, the responsibility has now been shifted back to the tribes to submit their air monitoring data into AQS themselves. While it is true that some regional EPA offices have been entering tribal raw data into AQS for a few tribes, there is a push to limit regional assistance by training tribal air quality staff so they may resume responsibility of entering their own data into AQS.

7.2 Description of AQS for Tribal Needs

The Air Quality System (AQS) contains ambient air pollution data collected by EPA, state, local, and tribal air pollution control agencies from thousands of monitoring stations. AQS also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information. So far, 27 tribes submit their own data into AQS, while 14 tribes have others such as EPA Regional offices, states or contractors submitting their data into AQS. Currently there are 7 tribes submitting data using the new tribal code.

7.3 Getting Data into AQS

EPA regulations require state/local/tribal environmental agencies to report air monitoring data at least quarterly. Data for one calendar quarter are due to EPA by the end of the following quarter. However, some values may be absent due to incomplete reporting, and some values subsequently may be changed due to quality assurance activities. Today, States, Local and Tribal agencies submit their data directly to AQS via a web application. Users will need access to the internet in order to access AQS. Registered users may also retrieve data through the AQS application and through the use of third party software such as the Discoverer tool from Oracle Corporation. In the future, data from AQS will be available via the AQS Data Mart that will be in production late spring 2006.

7.4 Who has Access to Data Once Submitted to AQS

The Office of Air Quality Planning and Standards (OAQPS) and other AQS users rely upon the system data to assess air quality, assist in Attainment/Non-Attainment designations, evaluate State Implementation Plans for Non-Attainment Areas, perform modeling for permit review analysis, and other air quality management functions. AQS information is also used to prepare reports for Congress as mandated by the Clean Air Act.

7.5 How AQS can be used to Retrieve Tribal Monitoring Data in Useful Forms

OAQPS modified AQS to allow the use of tribal codes in the place of state/county codes for data loading and retrieval. This change allows tribal users to submit and retrieve tribal data without using a reference to geo-political FIPS State and County codes, and thus reinforce EPA's commitment to recognizing tribal sovereignty. Should any tribe (or any user for that matter) need assistance or help loading or retrieving data, AQS has user support which is provided through the EPA Call Center. There is a toll free number (866-411-4372), and e-mail (epacallcenter@epa.gov) that users may use to get help with the AQS application. This helpline covers all aspects of AQS, i.e., simple questions such as changing passwords to modifying reports to retrieve specific data or change/correct monitoring data. Also EPA's ten regional offices each have an AQS representative that can assist tribes in using AQS. There is also training available at the annual AQS conference that tribes can take advantage of during the conference.

8. Understanding Monitoring Data and Its Implications

8.1 Background

There are many approaches to data interpretation ranging from a simple data summary to complex statistical procedures. The range of possibilities can be overwhelming, but is easily narrowed by asking a simple question: "Why was monitoring conducted in the first place?" The appropriate use of monitoring data is intimately linked with the monitoring objective. Assuming that the monitoring agency has followed the procedures outlined in previous sections of this document, the existing or proposed monitoring plan has a purpose in mind and steps have been taken to ensure that the final data product is adequate for its intended purpose.

For example, an agency located in a potential high ozone area may set up an ozone monitor to gauge attainment of the National Ambient Air Quality Standard (NAAQS). Quality assurance measures must be put in place to collect reliable data for a 3-year period. If the dataset is found to meet data quality objectives then it may be used as the basis for NAAQS attainment designation for the county. If the data are incomplete or otherwise compromised, then an attainment determination will not be possible.

Similarly, there are data quality requirements for hazardous air pollutant (HAP) monitoring which is intended for use in exposure assessment and health risk interpretation. It is not uncommon for an agency to collect ambient HAP data only to discover later that the wrong target compounds were reported or that detection limits were too high to allow comparing the data against cancer risk benchmarks. These problems can be minimized by effective planning which identifies the intended use of monitoring data and delineates specific monitoring quality objectives.

8.2 Purpose

The main goal of this section is to help Tribal staff achieve their monitoring program objectives through an effective use of monitoring data. We will give an overview of potential data uses and provide links to relevant guidance documents and examples. Possible data uses include: determining attainment of NAAQS for criteria pollutants; characterizing population exposure to HAPs, also known as "air toxics"; assessing air pollutant trends over time; and attributing source contribution to air pollution.

Basic data summary and statistical techniques allow the monitoring agency to effectively communicate project results. These methods are important for a variety of purposes: to inform Tribal members and other stakeholders about local air quality; to summarize monitoring results in a final project report or grant related documents; and to describe prior air quality findings as part of the justification for new or continued funding in a grant application.

This section will be useful to an agency that has already collected a dataset and needs help understanding it. However it may be even more valuable to a program manager who is in the stages of planning an air quality study as it will provide a clear understanding of what an ambient monitoring program can do for them and what questions it can answer. Depending on the technical capabilities of Tribal staff, some of the techniques described here may be performed in-house while others may require partnering with another agency or hiring a contractor.

8.3 Recommendations for Specific Data Uses

8.3.1 Criteria pollutants

Tribal agencies that conduct ambient air quality monitoring most frequently collect data for the six common pollutants (also referred to as "criteria" pollutants): carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). PM falls into two categories: particles smaller than 10 microns in diameter (PM_{10}) and particles smaller than 2.5 microns ($PM_{2.5}$). This section will describe how criteria pollutant monitoring data may be interpreted and used as part of an air quality management program.

For more information on sources of criteria pollutants, health and environmental effects, efforts to help reduce emissions, and other helpful resources, see: www.epa.gov/air/urbanair/6poll.html

8.3.1.1 NAAQS attainment

EPA has set NAAQS standards for the six criteria pollutants. The NAAQS include both primary and secondary standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. The table below lists the current NAAQS for criteria pollutants. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

Table 1. National Ambient Air Quality Standards

Pollutant	Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[1]	None
	35 ppm (40 mg/m^3)	1-hour[1]	None
Lead	1.5 $\mu g/m^3$	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 $\mu g/m^3$)	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM_{10})	50 $\mu g/m^3$	Annual[2] (Arith. Mean)	Same as Primary
	150 ug/m^3	24-hour[1]	

Particulate Matter ($PM_{2.5}$)	15.0 μg/m[3]	Annual[3] (Arith. Mean)	Same as Primary
	65 ug/m[3]	24-hour[4]	
Ozone	0.08 ppm	8-hour[5]	Same as Primary
Sulfur Oxides	0.03 ppm	Annual (Arith. Mean)	-------
	0.14 ppm	24-hour[1]	-------
	-------	3-hour[1]	0.5 ppm (1,300 ug/m[3])

[1] Not to be exceeded more than once per year.
[2] To attain this standard, the 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 ug/m[3].
[3] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 ug/m[3].
[4] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 ug/m[3].
[5] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

"Designation" is the term EPA use to describe the air quality in a given area for any of the criteria pollutants. Geographic areas are designated as "attainment" or "nonattainment" based on ambient air monitoring data collected in that area and reported to the Air Quality System (AQS) national database. Tribes and States submit recommendations to the EPA as to whether or not an area is attaining the NAAQS for a criteria pollutant. After working with the Tribal or State agencies and considering the air quality data, EPA officially designates an area as attainment or nonattainment. If an area is designated as nonattainment EPA informs the public that the air in the area is unhealthy to breathe, and states, local and tribal governments must develop and implement control plans to reduce pollution. A Tribal Implementation Plan (TIP) is a set of regulatory programs that a tribe can develop and adopt to help attain or maintain national air quality standards. Once a nonattainment area meets the standards and additional redesignation requirements in the CAA [Section 107(d)(3)(E)], EPA will designate the area to attainment as a "maintenance area."

The website listed below provides an unofficial list of Tribes in 8-hour ozone nonattainment areas as of April 15, 2004. Official nonattainment boundaries are specified in 40 CFR Part 81. www.epa.gov/ozonedesignations/tribaldesig.htm

Detailed instructions on how to determine attainment status based on ambient monitoring data may be found in the Code of Federal Regulations (CFR) Title 40 Part 50. The relevant passages for each criteria pollutant is included as Attachment 1 and may also be accessed on the web at:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=e18bc4907fc6d399c035b0bd125e238b&tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl

8.3.1.2 Understanding the Air Quality Index (AQI) and AIRNow

The AQI is an index for reporting daily air quality. It tells how clean or polluted the air is, and what associated health effects might be a concern for the public. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. EPA calculates the AQI for five of the criteria pollutants: O_3, PM, CO, SO_2, and NO_x. The AQI scale runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy – at first for certain sensitive groups of people, then for everyone as AQI values get higher.

Raw ambient air monitoring data is converted into AQI values using standard formulas developed by EPA. An AQI value is calculated for each pollutant in an area. The highest AQI value for the individual pollutants is the AQI value for that day. For example, if a certain date had AQI values of 90 for ozone and 88 for sulfur dioxide, the AQI value would be 90 for the pollutant ozone on that day.

The purpose of the AQI is to help the public understand what local air quality means to their health. To make it easier to understand, the AQI is divided into six categories, each of which corresponds to a different level of health concern. The six levels of health concern and what they mean are:

- **"Good"** The AQI value for your community is between 0 and 50. Air quality is considered satisfactory, and air pollution poses little or no risk.
- **"Moderate"** The AQI for your community is between 51 and 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.
- **"Unhealthy for Sensitive Groups"** When AQI values are between 101 and 150, members of sensitive groups may experience health effects. This means they are likely to be affected at lower levels than the general public. For example, people with lung disease are at greater risk from exposure to ozone, while people with either lung disease or heart disease are at greater risk from exposure to particle pollution. The general public is not likely to be affected when the AQI is in this range.
- **"Unhealthy"** Everyone may begin to experience health effects when AQI values are between 151 and 200. Members of sensitive groups may experience more serious health effects.
- **"Very Unhealthy"** AQI values between 201 and 300 trigger a health alert, meaning everyone may experience more serious health effects.
- **"Hazardous"** AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected.

The AIRNow Web site delivers daily AQI forecasts as well as real-time AQI conditions for over 300 cities across the United States. The EPA developed the AIRNow program together with the National Oceanic and Atmospheric Administration (NOAA), National Park Service (NPS), Tribal, State, and Local agencies to provide the public with easy access to national air quality information. AQI data are presented in maps which were generated based on "real-time" ambient monitoring data using either federal reference or equivalent monitoring techniques or techniques approved by the state, local or tribal monitoring agencies. Although some preliminary data quality assessments are performed, the data as such are not fully verified and validated through the quality assurance procedures monitoring organizations use to officially submit and certify data in AQS. Therefore, data are used on the AIRNow Web site only for the purpose of reporting the AQI. Information on the AIRNow web site is not used to formulate or support regulation, guidance or any other Agency decision or position.

In 2005 there were 13 Tribal monitoring agencies that participated in AIRNow. Tribes interested in joining the AIRNow network should contact the appropriate OAQPS staffer, who is currently Richard Wayland.

Air quality forecasts and more information about AQI and AIRNow is available at: www.airnow.gov

8.3.2 Air quality characterization for ambient, deposition, and visibility data

The previous section was focused specifically on criteria pollutants and interpreting data in terms of the NAAQS rules. Beyond the six criteria pollutants, however, there are hundreds of other pollutants and indices that a monitoring agency may wish to address. These non-criteria pollutants and measures include ambient air toxics, wet/dry deposition, visibility data, and even biomonitoring of ozone injury to sensitive plants. These types of data do not have corresponding national air quality standards that help to guide data summary and interpretation. Instead, monitoring results should be described using basic summary statistics. The data may also be visualized using simple graphic techniques.

8.3.2.1 Basic summary statistics

The first step in summarizing air quality data is to take inventory of the number of samples collected, the range of measurements, and to provide related information about the monitoring schedule. It is important to specify the measurement units of the pollutant. If any of the samples are below detection limits (called "nondetects") then it becomes necessary to state the method detection limit (MDL) as well as the number or percent of samples below the MDL. An example in table form is shown below.

Table 2. Example of monitoring data summary

Pollutant	**Sampling schedule**	**Sampling period**	**Total samples**	**Unit**	**MDL**	**Min. value**	**Max. value**	**Percent samples <MDL**
Benzene	1-in-6 days	Jan. 2003 – Dec. 2004	107	ppbC	0.01	0.02	1.3	0
1,3-butadiene	1-in-6 days	Jan. 2003 – Dec. 2004	107	ppbC	0.01	Below MDL	0.8	78%
Arsenic (PM_{10})	Monthly	Jan. 2003 – June. 2004	18	ug/m^3	0.002	Below MDL	0.012	65%
Cadmium (PM_{10})	Monthly	Jan. 2003 – June. 2004	18	ug/m^3	0.01	Below MDL	0.02	21%
Lead (PM_{10})	Monthly	Jan. 2003 – June. 2004	18	ug/m^3	0.005	0.008	0.31	0

If any of the monitored pollutants has nondetect values then this issue must be resolved before moving on to data analysis. EPA recommends that nondetects be replaced with a value equal to half of the detection limit for a given pollutant (1/2 MDL). In the example above, the detection limit for 1,3-butadiene is 0.01 ppbC, thus nondetects should be replaced with 0.005 ppbC throughout the dataset. These substituted values are then used alongside “real” values in calculating summary statistics. We do not advise deleting nondetects from the dataset because this will cause an upward bias in the results; similarly nondetects should not be replaced by zeroes because this biases the results downward.

Note that a high percentage of nondetects results in less reliable data summary statistics. Although there is no definite cut-off, a pollutant with greater than 50% nondetects should be treated with care and one with more than 80% nondetects may be removed from further analysis. Depending on the importance of a specific pollutant to the monitoring study, the data analyst has a few choices: state that the pollutant has a very high rate of nondetects and remove it from the data analysis; include the pollutant and point out potential problems related to nondetects; include the pollutant and use advanced statistical techniques developed for datasets with a high rate of nondetects.

Statistical techniques that may be useful in handling datasets with a high rate of nondetects are described in the following article:

Less than obvious – statistical treatment of data below the detection limit, Dennis R. Helsel (USGS), Environmental Science and Technology, Vol. 24, No. 12, 1990.

The rest of this section will describe ways to summarize basic characteristics of the dataset using common statistical measures. Some useful examples include: measures of central tendency, such as the mean or median; measures of relative standing, such as percentiles; measures of dispersion, such as range, variance, standard deviation, coefficient of variation, or interquartile range; measures of distribution symmetry or shape; and measures of association between two or more variables, such as correlation. These measures can then be used for description and communication about the dataset.

The definitions and procedures outlined in parts 3.2.1 and 3.2.2. are primarily taken from the EPA document "Guidance for Data Quality Assessment – Practical Methods for Data Analysis"
(EPA/600/R-96/084) which is available in full at this website:
www.epa.gov/quality/qs-docs/g9-final.pdf

This section provides mathematical formulas that allow the user to calculate descriptive statistics using a simple calculator or computer spreadsheet program. Data analysts that are interested in continuing on to do advanced statistical procedures may consider investing in a statistical software package and attending training sessions to practice using them. The end of this section provides resources for those interested in learning more.

Central tendency

The most common estimates for central tendency in environmental data are the mean and median. The **mean** may be considered to be the "center of gravity" of the dataset. It is calculated as a basic arithmetic average. The **median** is the value which falls directly in the middle of the data when the measurements are ranked in order from smallest to largest. Thus ½ of the data are smaller than the sample median and ½ of the data are larger than the sample median. Unlike the mean, the median is not influenced by a small number of extreme values.

Formula 1. Measuring central tendency

Let $X_1, X_2, \ldots, X_n$ represent the n data points.

Sample Mean: The sample mean $\bar{x}$ is the sum of all the data points divided by the total number of data points (n):

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

Sample Median: The sample median ($\tilde{X}$) is the center of the data when the measurements are ranked in order from smallest to largest. To compute the sample median, list the data from smallest to largest and label these points $X_{(1)}, X_{(2)}, \ldots, X_{(n)}$ (so that $X_{(1)}$ is the smallest, $X_{(2)}$ is the second smallest, and $X_{(n)}$ is the largest).

If the number of data points is odd, then $\tilde{X} = X_{([n+1]/2)}$

If the number of data points is even, then $\tilde{X} = \dfrac{X_{(n/2)} + X_{([n/2]+1)}}{2}$

Relative Standing (Percentiles)

It may be useful to know the relative position of one or several observations in relation to all of the observations. Percentiles are one such measure of relative standing that may also be useful for summarizing data. A percentile is the data value that is greater than or equal to a given percentage of the data values. For example the data point which is the 25^{th} percentile is greater than or equal to 25% of the data values and is less than or equal to 75%. Important percentiles usually reviewed are the quartiles of the data: the 25^{th}, 50th, and 75^{th} percentiles. The 50^{th} percentile is also called the sample median (previously described), and the 25^{th} and 75^{th} percentiles are used to estimate the dispersion of a data set (next section).

Formula 2. Calculating percentiles

Let $X_1, X_2, \ldots, X_n$ represent the n data points. To compute the p^{th} percentile, y(p), first list the data from smallest to largest and label these points $X_{(1)}, X_{(2)}, \ldots, X_{(n)}$ (so that $X_{(1)}$ is the smallest, $X_{(2)}$ is the second smallest, and $X_{(n)}$ is the largest). Let t = p/100, and multiply the sample size n by t. Divide the result into the integer part and the fractional part, i.e., let nt = j + g where j is the integer part and g is the fraction part. Then the p^{th} percentile, y(p), is calculated by:

If g = 0, $y(p) = (X_{(j)} + X_{(j+1)})/2$

otherwise, $y(p) = X_{(j+1)}$

Example: The 90^{th} and 95^{th} percentile will be computed for the following 10 data points (ordered from smallest to largest) : 4, 4, 4, 5, 5, 6, 7, 7, 8, and 10 ppb.

For the 95th percentile, t = p/100 = 95/100= .95 and nt = (10)(.95) = 9.5 = 9 + .5. Therefore, j = 9 and g = .5. Because $g = .5 \neq 0$, $y(95) = X_{(j+1)} = X_{(9+1)} = X_{(10)}$ = 10 ppm. Therefore, 10 ppm is the 95^{th} percentile of the above data.

Measures of Dispersion

Measures of central tendency are more meaningful if accompanied by information on how the data spread out from the center. Measures of dispersion in a data set include the range, variance, sample standard deviation, coefficient of variation, and the interquartile range. These measures are all described below and formulas provided.

The easiest measure of dispersion to compute is the sample ***range***. For small samples, the range is easy to interpret and may adequately represent the dispersion of the data. For large samples, the range is not very informative because it only considers (and therefore is greatly influenced) by extreme values.

The sample ***variance*** measures the dispersion from the mean of a data set. A large sample variance implies that there is a large spread among the data so that the data are not clustered around the mean. A small sample variance implies that there is little spread among the data so that most of the data are near the mean. The sample variance is affected by extreme values and by a large number of nondetects. The sample standard deviation is the square root of the sample variance and has the same unit of measure as the data.

The ***coefficient of variation (CV)*** is a unitless measure that allows the comparison of dispersion across several sets of data. The CV is often used in environmental applications because variability (expressed as a standard deviation) is often proportional to the mean.

When extreme values are present, the ***interquartile range*** may be more representative of the dispersion of the data than the standard deviation. This statistical quantity does not depend on extreme values and is therefore useful when the data include a large number of nondetects.

Formula 3. Calculating measures of dispersion

Let $X_1, X_2, \ldots, X_n$ represent the n data points.

Sample Range: The sample range (R) is the difference between the largest value and the smallest value of the sample, i.e., R = maximum - minimum.

Sample Variance: To compute the sample variance (s^2), compute:

$$s^2 = \frac{\sum_{i=1}^{n} X_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} X_i\right)^2}{n-1}$$

Sample Standard Deviation: The sample standard deviation (s) is the square root of the sample variance, i.e.,

$$s = \sqrt{s^2}$$

Coefficient of Variation: The coefficient of variation (CV) is the standard deviation divided by the sample mean (Section 2.2.2), i.e., CV = $s/\bar{X}$. The CV is often expressed as a percentage.

Interquartile Range: Use the directions in Section 2.2.1 to compute the 25^{th} and 75^{th} percentiles of the data (y(25) and y(75) respectively). The interquartile range (IQR) is the difference between these values, i.e.,
IQR = y(75) - y(25).

8.3.2.2 Trends analysis

EPA uses trend analysis to assess year-to-year changes in ambient air quality and pollutant emissions. Annual Trends Reports are EPA's "report card" on the status of air quality and emission reductions. Annual trends reports and special studies dating back to 1994 are available at: www.epa.gov/airtrends/reports.html. Some methods used in these reports will be useful to Tribal agencies.

The data analyst needs a reasonably long and complete dataset to be able to distinguish a genuine trend from other kinds of data variability. A suspected trend in data may not be a “real” trend, but a function of data variation caused by weather conditions or other factors. For example, because higher temperatures cause more formation of some pollutants, like ozone and formaldehyde, a year with warmer temperatures may have higher concentrations of these pollutants, regardless of any possible changes in precursor emissions. Thus the measurements in one year may be higher than the previous year, but we cannot reliably say that there is an upward trend in ambient concentrations.

Although it is tempting to calculate trends based on two or three years of data, more years are needed to calculate a meaningful trend. For dispersion modeling, meteorologists recommend using between 3 and 5 years of data just to assess the "baseline" condition. With this in mind, we suggest the following:

- 1 to 3 years of monitoring data – do not use for trend analysis
- 4 to 5 years of monitoring data – consider trend results to be "preliminary"
- 6 or more years of monitoring data – adequate dataset for trend analysis

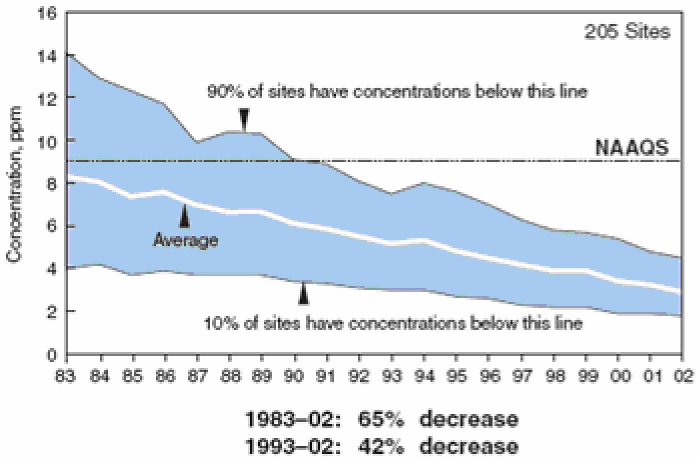
If there are enough years of data available, then it is also important to confirm that each year has adequate data completeness. Multi-year trends can only be calculated if each year has a valid summary statistic (e.g. annual mean) based on sufficient data. The issue of data completeness was previously discussed in the section on data quality objectives and data validation.

Assuming that there are enough complete years of monitoring, then an annual air quality statistic can be determined for each individual year of air monitoring and then a trend may be evaluated for multiple years. The trend statistic can be one of those described in Section 3.2.1 (such as the annual average or 90th percentile) or a NAAQS design value as described in Section 3.1.1 (such as the $PM_{2.5}$ 24-hour maximum). This section will explain how to quantify and visualize trends in monitoring data.

Percent change

Actual ambient concentrations have little meaning to the general public and a change in concentration (for example a "0.04 ppb decline over 8 years") is even more abstract. For this reason EPA most often explains trends in terms of a percent change over time. The example below shows the trend calculation and graph format most widely used in trend reports. The main trend statistic is the combined annual average of multiple monitoring sites. The figure also shows the 90th and 10th percentiles of all site averages for each year.

Figure 1. CO air quality, 1983-2002, based on annual second maximum 8-hr average



Formula 4. Percent change over multiple years of monitoring

$$P = \left[\frac{(C_F - C_S)}{C_S}\right] \times 100$$

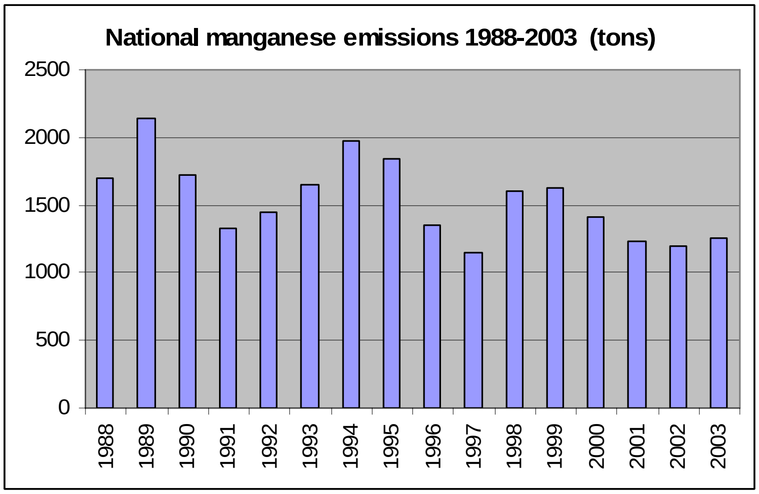
Where C_S = concentration at the start; C_F = concentration at the finish of the time period. A positive P indicates an upward trend and a negative value indicates a downward trend.

In the carbon monoxide example above,

$$P = \left(\frac{2.9\,ppm - 8.2\,ppm}{8.2\,ppm}\right) \times 100 = -64.6\%$$

There are some important pitfalls to the percent change approach to trends. The main concern is that if the dataset has strong year-to-year variability, then the existence of a positive or negative trend is dependent on which years are chosen as the start and finish. The figure below shows national annual total manganese emissions as reported to the Toxics Release Inventory (TRI). The percent change in emissions between 1988 and 2003 is –26%. However, the downward trend is magnified if we look only at 1989 through 1997 (–88%); the trend is relatively flat if the time period is 1993–1999 (–2%); the trend reversed if we look at 1991 to 1999 (+19%). For this reason it is preferable to use the percent change method for a dataset with smooth trends. Highly variable datasets should be evaluated by using a moving average (described below) or with a more rigorous statistical method, such as linear regression or using non-parametric methods.

Figure 2. Example of dataset with variable year-to-year data



National Air Toxics Trend Site (NATTS) method

Trends within the new NATTS network are figured based on six (6) years of annual average concentrations for key HAPs, specifically benzene, 1,3-butadiene, arsenic, chromium, acrolein, and formaldehyde. The trend is calculated by finding the percent difference between the mean of the first three annual concentrations and the mean of the last three annual concentrations. This is a variation on the percent change method described above.

Formula 5. NATTS trend method

First the annual average concentration (Xi) is found for each year i = 1, 2, 3, 4, 5 & 6. Then the mean (X) for the first three years and the mean (Y) for years 4 through 6 is calculated:

$$X = \frac{X_1 + X_2 + X_3}{3} \text{ and } Y = \frac{X_4 + X_5 + X_6}{3}$$

The downward trend (T) is the percent decrease from the first 3-year period to the second.

$$T = \frac{X - Y}{X} \cdot 100$$

According to the DQOs for the NATTS program, a trend of at least 15% is considered a significant decrease. A tribal agency may wish to adopt this protocol for their own monitoring program or adapt it as needed through consultation with quality assurance experts. The Quality Assurance Guidance Document for the NATTS program

is available at:
www.epa.gov/ttn/amtic/files/ambient/airtox/nattsqapp.pdf

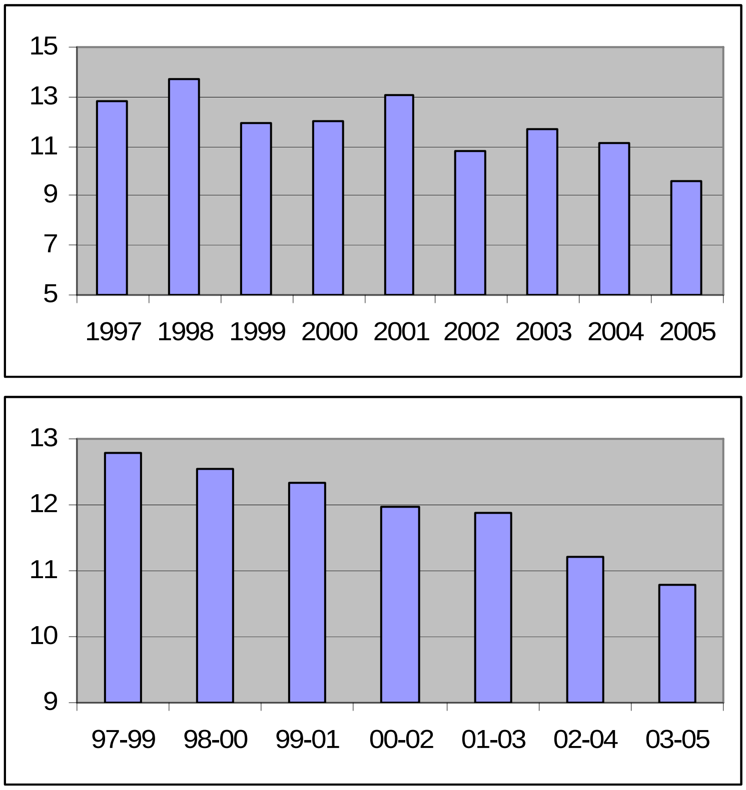
Moving average

A dataset with considerable year-to-year variability may be smoothed out by calculating a moving average. Instead at looking at annual averages that rise and fall with each year, we look at 3-year, 4-year, or 5-year averages which are less subject to variability swings.

The example below shows data graphed first as annual averages and then as a moving 3-year average. The first figure shows annual averages from 1997 to 2005; the second shows the combined average for 1997 through 1999, then 1998-2000, 1999-2001, and so forth. The downward trend in data is more evident in the second figure.

Year	Mercury wet deposition (µg/m^2)
1997	12.8
1998	13.7
1999	11.9
2000	12.0
2001	13.1
2002	10.8
2003	11.7
2004	11.1
2005	9.6

Figure 3. Data trend presented with annual average and moving average



8.3.2.3 Data visualization

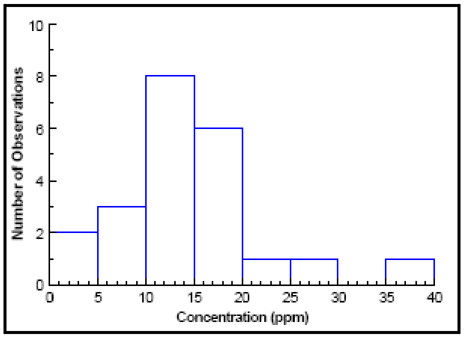
Simple graphing techniques are useful to describe the dataset and communicate monitoring results. Graphs can be used to identify patterns and trends in the data. Graphical representations include displays of individual data points, statistical quantities, temporal data, spatial data, and two or more variables.

Detailed instructions on how to produce these graphics are provided in Section 2 of the previously mentioned "Guidance for Data Quality Assessment – Practical Methods for Data Analysis", available at: www.epa.gov/quality/qs-docs/g9-final.pdf

Histogram/Frequency Plots

Two of the oldest methods for summarizing data distributions are the frequency plot and the histogram. Both the histogram and the frequency plot use the same basic principles to display the data: dividing the data range into units, counting the number of points within the units, and displaying the data as the height or area within a bar graph.

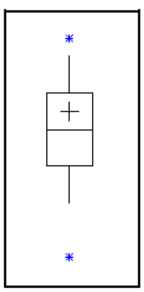
Figure 5. Example of a frequency plot



Box and Whisker Plot

A box and whisker plot or box plot is a schematic diagram useful for visualizing important statistical quantities of the data. A box and whiskers plot is composed of a central box divided by a line and two lines extending out from the box called whiskers. The length of the central box indicates the spread of the bulk of the data (the inter-quartile range, 25^{th} to 75^{th} percentile) while the length of the whiskers show how stretched the tails of the distribution are. The sample median is displayed as a line through the box and the sample mean is displayed using a '+' sign. Any unusually small or large data points are displayed by a '*' on the plot.

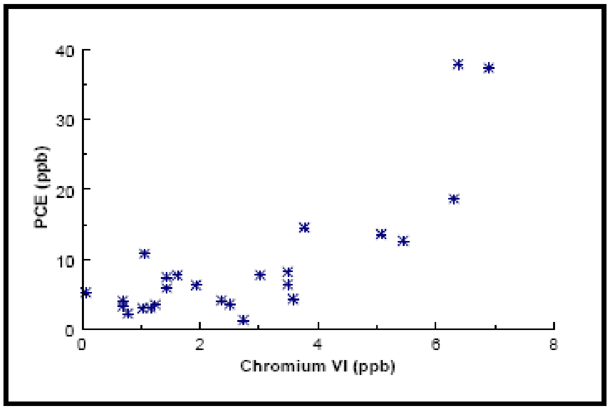
Figure 6. Example of a box and whisker plot



Scatter Plot

For data sets consisting of paired observations where two or more variables are measured for each sampling point, a scatter plot is one of the most powerful tools for analyzing the relationship between two or more variables. A scatter plot clearly shows the relationship between two variables. Both potential outliers from a single variable and potential outliers from the paired variables may be identified on this plot. A scatter plot also displays the correlation between the two variables. Scatter plots of highly linearly correlated variables cluster compactly around a straight line.

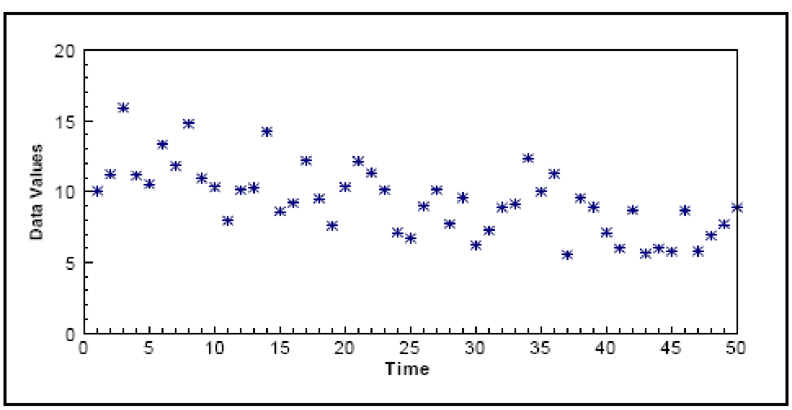
Figure 7. Example of a scatter plot



Time Plot

One of the simplest plots to generate that provides a large amount of information is a time plot. A time plot is a plot of the data over time. This plot makes it easy to identify large-scale and small-scale trends over time. Small-scale trends show up on a time plot as fluctuations in smaller time periods. For example, ozone levels over the course of one day typically rise until the afternoon, then decrease, and this process is repeated every day. An example of a large-scale trend is a multi-year decrease in air pollution resulting from effective air quality control programs. For example, the annual average concentration of NO_x at a particular monitoring site may decline over the course of several years as a result of emissions controls at local industries and the introduction of cleaner cars.

Figure 8. Example of a time plot



8.3.2.4 References, tools, and resources

EPA courses

EPA's Air Pollution Training Institute (APTI) primarily provides technical air pollution training to state, tribal, and local air pollution professionals, although others may benefit from this training. The curriculum is available in classroom, telecourse, self-instruction, and web-based formats. A few potentially useful courses are described below.

Introduction to Environmental Statistics

This series of online lectures was developed for USEPA by the University of Illinois at Chicago School of Public Health, Environmental and Occupational Health Sciences Division. No registration is required to access the archived lectures. The lectures are available at this website: www.epa.gov/air/oaqps/eog/envirostats/index.html

- Module 1: Interpreting Your Monitoring Data
- Module 2: Sampling and Analytical Limitations & Sample Detection Limits
- Module 3: Quality Assurance Quality Control
- Module 4: Analysis of Trends
- Module 5: Language of Data Graphing
- Module 6: Censored Values and Extreme Values
- Module 7: Fundamentals of Trajectory Analysis

Introduction to Environmental Statistics - SI:473B

This course introduces the student to the basic concepts of statistical analysis. The course was designed for students with little formal education in statistics who must apply statistical techniques to analyze environmental data. The package has seven modules, a workbook, and a VHS format video tape. The workbook and video tape are mailed to the student by EPA, but it is necessary to acquire one of the recommended companion texts.
Course information is available at: www.epa.gov/air/oaqps/eog/catalog/si473b.html

Training Courses on Quality Assurance and Quality Control Activities

EPA Quality Staff develops a variety of traditional training courses on quality assurance (QA) and quality control (QC) activities and the EPA quality system. Two subject area of particular interest are “Interpreting monitoring data” and “Introduction to Data Quality Assessment”. Materials are available at: www.epa.gov/quality/trcourse.html

Other tools and resources

Statistics books:

- Basic Statistical Methods for Engineers and Scientists
  Adam Neville, John Kennedy, International Textbook Company (out of print)
- Probability and Statistics for Engineers, Irwin Miller, John Freund, Prentice Hall
- Statistics Concepts and Applications, David Anderson, Dennis J. Sweeney, Thomas A. Williams, West
- Exploring Statistics – A Modern Introduction, Larry J. Kitchens, West
- Engineering Statistics, Robert V. Hogg, Johannes Ledolter, Macmillan
- Introduction to Statistical Thinking, E.A. Maxwell, Prentice Hall
- Statistical Analysis for Decision Making, Morris Hamburg, Harcourt Brace Jovanovich

EPA has a website for Quality-Related Resources which contains links to other sources of information on quality systems available on the web:
www.epa.gov/quality/qa_links.html

Examples of tools and resources available through the EPA quality resources page:

- DataPlot (National Institutes of Science and Technology) is a free, public-domain, multi-platform software system for scientific visualization, statistical analysis, and non-linear modeling. www.itl.nist.gov/div898/software/dataplot.html/
- StatPages.Net (by John C. Pezzullo) contains links to online calculators, free statistical software, online statistics books, tutorials, and related resources. members.aol.com/johnp71/javastat.html
- Statistics Calculators (UCLA Department of Statistics) includes calculators for statistical graphs, power calculations, sample size calculations, etc. calculators.stat.ucla.edu/
- Guide to Statistical Software (George Mason University) provides a comparison of commercially available statistical software. www.galaxy.gmu.edu/papers/astr1.html

8.3.3 Putting monitoring data into context

Criteria pollutants

In addition to determining NAAQS attainment and AQI values, Tribal monitoring agencies may benefit from putting their monitoring data into a broader context. There are a few ways to do this. The Tribe may look up data for the same pollutant at other monitoring sites located in the same State or region to see how the values compare. It may also be helpful to look at a nation-wide summary of data or a list of nonattainment areas. A broader context may also be obtained by learning about national trends in air quality data.

EPA's AirData website provides access to air pollution data for the entire US as submitted to AQS. AirData produces reports and maps of air pollution data based on user-specified queries. For example a Tribal agency located in Arizona may wish to look up last year's ozone data for all monitoring sites in the State. The link below is the interface where the user selects the geographic area for the data search. Subsequent web pages narrow the search to the desired pollutant, year, and report format.
www.epa.gov/air/data/geosel.html

EPA's Air Explorer is a collection of user-friendly visualization tools for air quality analysts. The tools generate maps, graphs, and data tables based on criteria pollutant data reported to AQS. This is a developmental site. Based on user feedback, EPA is continually improving the existing tools and developing new ones.www.epa.gov/mxplorer/index.htm

EPA's "Green Book" lists all nonattainment areas in the US. The user can access a variety of maps and reports for each criteria pollutant at this web site: www.epa.gov/air/oaqps/greenbk/

EPA tracks air pollution trends using two main indicators: ambient air monitoring data and pollutant emissions. EPA estimates nationwide emissions of criteria pollutants and air toxics based on many factors, including actual measurements, levels of industrial activity, fuel consumption, vehicles miles traveled, and other estimates of activities that cause pollution. For EPA's most recent evaluation of air pollution trends, see: www.epa.gov/airtrends/

The Visibility Information Exchange Web System (VIEWS) is an online exchange of air quality data, research, and ideas designed to understand the effects of air pollution on visibility in support of the Regional Haze Rule. http://vista.cira.colostate.edu/views

Air toxics, deposition, and other monitoring data

Air toxics monitoring data from other sites in the U.S., as submitted to AQS, may be accessed through the AirData website. Additionally, some materials are available from nation-wide air toxics data analyses. The following links may be useful for putting toxics data into context:

- Geographic Variability in Air Toxics
  www.epa.gov/ttn/amtic/files/ambient/airtox/2005%20workshop/spatial.pdf
- Temporal Trends in Air Toxics
  www.epa.gov/ttn/amtic/files/ambient/airtox/2005%20workshop/temporal.pdf

The Clean Air Status and Trends Network (CASTNET) is the nation's primary source for data on dry acidic deposition and rural, ground-level ozone. CASTNET consists of over 80 sites across the eastern and western United States and is cooperatively operated and funded with the National Park Service. Data are available for download for ambient air pollutants and wet/dry deposition at this site: www.epa.gov/castnet/data.html

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) is a nationwide network of precipitation monitoring sites. The network includes over 200 monitoring sites, including those operated by 9 Tribal agencies. Data are available for download at: http://nadp.sws.uiuc.edu/sites/ntnmap.asp

The Mercury Deposition Network (MDN) is intended to develop a national database of weekly concentrations of total mercury in precipitation and the seasonal and annual flux of total mercury in wet deposition. http://nadp.sws.uiuc.edu/sites/mdnmap.asp

EPA established the National Dioxin Air Monitoring Network (NDAMN) to is determine the temporal and geographical variability of atmospheric CDDs, CDFs and coplanar PCBs at rural and nonimpacted locations throughout the United States. Summary reports are available: www.epa.gov/glnpo/monitoring/air2/bio_toxics.html

The Integrated Atmospheric Deposition Network (IADN) was established by the United States and Canada for conducting air and precipitation monitoring in the Great Lakes Basin. PAHs, PCBs, and organochlorine compounds are measured in air and precipitation samples in the U.S. and Canada. See: www.msc.ec.gc.ca/iadn/index_e.html

The USDA Forest Service, Forest Health Monitoring (FHM) is a national program designed to determine the status, changes, and trends in indicators of forest condition on an annual basis. The FHM program uses data from ground plots and surveys, aerial surveys, and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. See: http://fhm.fs.fed.us/

The USDA - Forest Service's Forest Inventory and Analysis (FIA) uses biomonitoring to monitor the potential impact of tropospheric ozone (smog) on forests. This program involves using bioindicator plants to detect and quantify ozone stress in the forest environment. A nationwide network of ozone biomonitoring sites has been established across the forested landscape. Each year these sites are evaluated for the amount and severity of ozone injury on sensitive plants. The foliar injury data is used to monitor changes in relative air quality over time and to examine relationships between ozone stress and tree health. See: www.fiaozone.net/

8.3.4 Source apportionment

In the absence of air monitoring, pollutant emissions data may be used to help characterize air quality. This approach is discussed in more detail elsewhere in this document. In this Section we focus on evaluating air monitoring data in the context of emissions sources that may be impacting the monitor site. Different approaches are described to identify pollution sources and to estimate their potential to affect local air quality.

8.3.4.1 Using emissions inventories

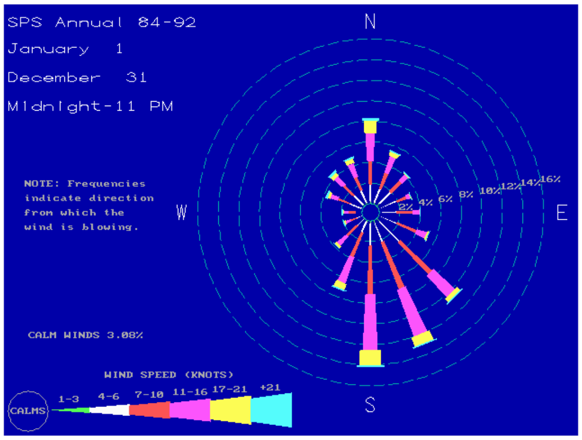
If monitoring data show that a specific pollutant is exceeding air quality standards, or is otherwise causing concern, then emission inventories can identify potential sources. Summary emission data are most easily accessed on EPA’s website: www.epa.gov/air/data. By searching in the state or county of interest in AirData, the user can access the National Emission Inventory (NEI) for data on point, nonpoint, and mobile sources. NEI contains information about sources that emit criteria air pollutants and their precursors, and hazardous air pollutants. The AirData website generates reports based on facility-specific and county aggregate emissions data.

Tribal agencies may want to find more detailed information or identify smaller sources that might not be included in the NEI. They can contact their respective state environmental agency to get more detailed emissions data.

8.3.4.2 Wind direction analysis

Meteorological data collected at an air monitoring site can be used to further interpret pollutant measurements and potential impact from emissions sources. Wind data can be summarized over a year or multiple years to show prevailing wind direction at a given site. A diagram called a “wind rose” characterizes the wind conditions over time. The example below is a wind rose produced by the Texas Commission on Environmental Quality for Wichita Falls. The figure shows the frequency of winds coming from each direction, broken out by wind speed category.

Figure 9. Wichita Falls, Texas wind rose



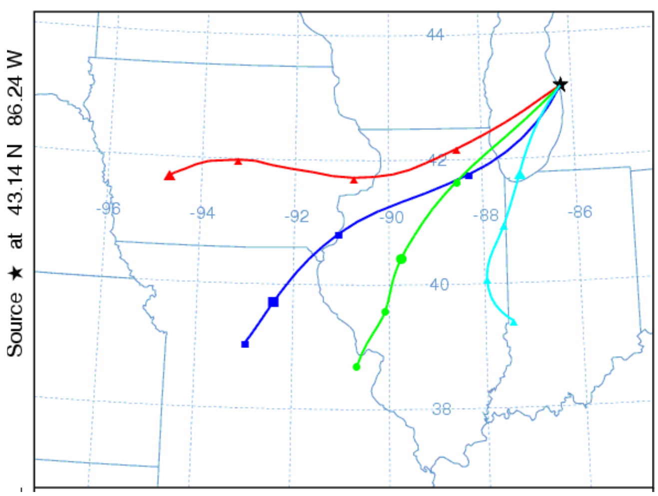
If a major pollution source is identified near Tribal land, then a wind rose can show whether the air monitor site is likely to be downwind of the emission source on an occasional or frequent basis. An industrial facility that is predominantly upwind of Tribal land is more likely to impact the air monitor than a facility that is generally downwind. A wind rose program called WRPLOT View is available from Lakes Environmental Software for free download at this site: www.weblakes.com/lakewrpl.html

To investigate further, the data analyst may conduct a wind-direction analysis. This approach requires finding daily wind data that is reported concurrently with air sampling events. Monitoring data may be divided into “high pollution days” and “low pollution days”, and the meteorological data consulted to see whether higher concentrations occur on days when the winds come from a certain direction. Alternatively, each hourly or daily pollutant measurement can be divided into one of 16 categories according to the predominant wind sector (north, north-northeast, northeast, east-northeast, etc.) and the average concentrations for all sectors compared with one another.

Tribal agencies may generate wind roses or conduct wind-direction data analysis using their own on-site meteorological data. If the Tribe does not have a met station, data may potentially be obtained from other agencies that have a nearby meteorological station, for example another environmental or meteorological agency. In some cases, the data may be downloaded from AQS. Technical staff at the state agency may have some insights about how to locate data from other sources. Historic wind data for many communities (useful for wind roses) is available for free download at this website: www.webmet.com. Recent meteorological data is considerably more difficult to find and often must be purchased from a private company.

If long-range transport of pollutants is a concern then another approach to consider is the HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) model developed by NOAA. Hysplit can be used to map a back trajectory which shows where an air parcel passed before reaching the air monitor. The example below shows the back trajectory of different air parcels that may have reached a monitor in western Michigan over a 24-hour period. The air parcels originated in several different states (Iowa, Missouri, Illinois and Indiana) however they all passed through northern Illinois before reaching the monitor in Michigan. If this particular date had been a high ozone day, then the Hysplit results would suggest that precursor pollutants from the greater Chicago area contributed to ozone formation. Hysplit can be downloaded for free or used on-line on the NOAA website: www.arl.noaa.gov/ready/hysplit4.html

Figure 10. Example of Hysplit backward wind trajectory



8.3.4.3 Receptor modeling

Receptor models are mathematical or statistical procedures for identifying and quantifying the sources of air pollutants at a receptor (air monitor) location. Unlike dispersion models, receptor models do not use pollutant emissions, meteorological data and chemical transformation mechanisms to estimate the contribution of sources to receptor concentrations. Instead, receptor models use the chemical and physical characteristics of gases and particles measured at source and receptor to both identify the presence of and to quantify source contributions to receptor concentrations. These models are used as part of State Implementation Plans (SIPs) for identifying sources contributing to air quality problems. The EPA has developed the Chemical Mass Balance (CMB) and UNMIX models as well as the Positive Matrix Factorization (PMF) method for use in air quality management. CMB fully apportions receptor concentrations to chemically distinct source-types depending upon the source profile database, while UNMIX and PMF internally generate source profiles from the ambient data.

Receptor models have been used most often to identify the sources of $PM_{2.5}$ and ozone. $PM_{2.5}$ modeling requires a speciated dataset (carbon, ions, and trace elements) whereas ozone precursor modeling calls for speciated VOC data. Receptor models require some training and experience to operate effectively. Monitoring agencies may prefer to hire a contractor or partner with another agency or university to get this work done. EPA approved models and supporting materials are available at: www.epa.gov/scram001/receptorindex.htm

8.3.5 Exposure assessment for hazardous air pollutants

Air toxics, or HAPs, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. Examples of toxic air pollutants include benzene, which is found in gasoline; perchlorethlyene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries. Other listed air toxics include dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds.

Links to more information about air toxics are provided below.

- EPA's Health Effects Notebook provides fact sheets about the 188 HAPs: www.epa.gov/ttn/atw/hlthef/hapindex.html
- Air Pollution and Health Risk www.epa.gov/ttn/atw/3_90_022.html
- Evaluating Exposures to Toxic Air Pollutants: A Citizen's Guide www.epa.gov/ttn/atw/3_90_023.html
- Risk Assessment for Toxic Air Pollutants: A Citizen's Guide www.epa.gov/ttn/atw/3_90_024.html

Risk assessment is a tool used by environmental specialists to estimate the increased risk of health problems in people who are exposed to different amounts of toxic substances over a long period of time. The risk assessment process has four steps, which are described below.

- Hazard assessment – what health problems are caused by the pollutant?
- Dose-response assessment – what are the health problems at different exposures?
- Exposure assessment – how much of the pollutant do exposed people inhale?
- Risk characterization – what is the extra risk of health problems in the exposed population?

Air toxics monitoring data may be used in the exposure assessment step of risk assessment. If sufficient data exist for the pollutants of concern, then monitoring data may be used instead of, or in addition to, dispersion modeling outputs.

Using monitoring data in a risk assessment can be a very complex process, requiring assistance from a statistician and toxicologist, among other specialists. To decide whether a fullblown risk assessment is warranted, EPA Region 4 scientists developed a screening procedure that can help monitoring staff do a preliminary evaluation of their air toxics data. The document is available at this website:

A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets
www.epa.gov/region4/air/airtoxic/athera1.htm

EPA has also developed a Community Air Screening How-to Manual for use by groups that includes non-technical community residents and leaders as well as technical experts. The Manual describes a process that uses input from a wide variety of community stakeholders.
www.epa.gov/oppt/cahp/howto.html

If the Tribal agency has determined that a complete technical risk assessment is needed, then EPA guidance documents are available for use by Tribal staff or contractors. The Air Toxics Risk Assessment Reference Library is located at: www.epa.gov/ttn/fera/risk_atra_main.html. The library provides information on the fundamental principles of risk-based assessment for air toxics and how to apply those principles in different settings as well as strategies for reducing risk at the local level.

EPA has compiled dose-response data for air toxics for use in risk assessments, including values for long-term (chronic) inhalation short-term (acute) inhalation exposures. This information is regularly updated as new information becomes available about the toxicity of specific HAPs. The dose-response values provided at this site are recommended by EPA as the most appropriate for use in air toxics risk assessment.
www.epa.gov/ttn/atw/toxsource/summary.html

8.3.6 Multi-media risk assessment using ambient and deposition monitoring data

For a limited subset of HAPs, it is important to consider deposition from air to soil, vegetation, or water bodies. Many studies indicate that some pollutants emitted into the atmosphere (e.g., mercury) are passed to humans or wildlife through non-inhalation pathways. An example would be an air pollutant depositing from the air onto the soil, followed by ingestion of the soil by people or by other living things in an ecosystem. These air pollutants typically are persistent in the environment, have a strong tendency to bioaccumulate, and exhibit moderate to high toxicity.

A variety of computer models are available to describe the multimedia transport and fate of pollutants released to the atmosphere. EPA developed TRIM.FaTE, a model that can estimate pollutant concentrations in multiple environmental media and biota, for use in ecological risk assessment. The model is available at: www.epa.gov/ttn/fera/trim_fate.html

Other multi-media models are available here: www.epa.gov/ttn/fera/multi_related.html

8.4 Attachment 1. Excerpts from CFR on NAAQS Monitoring

8.4.1 O_3 (8-Hour)

§ 50.10 National 8-hour primary and secondary ambient air quality standards for ozone.

(a) The level of the national 8-hour primary and secondary ambient air quality standards for ozone, measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter, is 0.08 parts per million (ppm), daily maximum 8-hour average.

(b) The 8-hour primary and secondary ozone ambient air quality standards are met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.08 ppm, as determined in accordance with appendix I to this part.

8.4.2 PM_{10}

§ 50.6 National primary and secondary ambient air quality standards for PM_{10}.

(a) The level of the national primary and secondary 24-hour ambient air quality standards for particulate matter is 150 micrograms per cubic meter (µg/m 3), 24-hour average concentration. The standards are attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m 3 , as determined in accordance with appendix K to this part, is equal to or less than one.

(b) The level of the national primary and secondary annual standards for particulate matter is 50 micrograms per cubic meter (µg/m 3), annual arithmetic mean. The standards are attained when the expected annual arithmetic mean concentration, as determined in accordance with appendix K to this part, is less than or equal to 50 µg/m 3.

(c) For the purpose of determining attainment of the primary and secondary standards, particulate matter shall be measured in the ambient air as PM10 (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers) by:

(1) A reference method based on appendix J and designated in accordance with part 53 of this chapter, or

(2) An equivalent method designated in accordance with part 53 of this chapter.

8.4.3 $PM_{2.5}$

§ 50.7 National primary and secondary ambient air quality standards for PM2.5.

(a) The national primary and secondary ambient air quality standards for particulate matter are 15.0 micrograms per cubic meter (µg/m3) annual arithmetic mean concentration, and 65 µg/m3 24-hour average concentration measured in the ambient air as PM2.5 (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers) by either:

(1) A reference method based on appendix L of this part and designated in accordance with part 53 of this chapter; or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(b) The annual primary and secondary PM2.5 standards are met when the annual arithmetic mean concentration, as determined in accordance with appendix N of this part, is less than or equal to 15.0 micrograms per cubic meter.

(c) The 24-hour primary and secondary PM2.5 standards are met when the 98th percentile 24-hour concentration, as determined in accordance with appendix N of this part, is less than or equal to 65 micrograms per cubic meter.

8.4.4 Pb

§ 50.12 National primary and secondary ambient air quality standards for lead.

National primary and secondary ambient air quality standards for lead and its compounds, measured as elemental lead by a reference method based on appendix G to this part, or by an equivalent method, are: 1.5 micrograms per cubic meter, maximum arithmetic mean averaged over a calendar quarter.

8.4.5 NO_2

40 CFR § 50.11 National primary and secondary ambient air quality standards for nitrogen dioxide.

(a) The level of the national primary ambient air quality standard for nitrogen dioxide is 0.053 parts per million (100 micrograms per cubic meter), annual arithmetic mean concentration.

(b) The level of national secondary ambient air quality standard for nitrogen dioxide is 0.053 parts per million (100 micrograms per cubic meter), annual arithmetic mean concentration.

(c) The levels of the standards shall be measured by:

(1) A reference method based on appendix F and designated in accordance with part 53 of this chapter, or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(d) The standards are attained when the annual arithmetic mean concentration in a calendar year is less than or equal to 0.053 ppm, rounded to three decimal places (fractional parts equal to or greater than 0.0005 ppm must be rounded up). To demonstrate attainment, an annual mean must be based upon hourly data that are at least 75 percent complete or upon data derived from manual methods that are at least 75 percent complete for the scheduled sampling days in each calendar quarter.

8.4.5 SO_2

40 CFR § 50.4 National primary ambient air quality standards for sulfur oxides (sulfur dioxide).

(a) The level of the annual standard is 0.030 parts per million (ppm), not to be exceeded in a calendar year. The annual arithmetic mean shall be rounded to three decimal places (fractional parts equal to or greater than 0.0005 ppm shall be rounded up).

(b) The level of the 24-hour standard is 0.14 parts per million (ppm), not to be exceeded more than once per calendar year. The 24-hour averages shall be determined from successive nonoverlapping 24-hour blocks starting at midnight each calendar day and shall be rounded to two decimal places (fractional parts equal to or greater than 0.005 ppm shall be rounded up).

(c) Sulfur oxides shall be measured in the ambient air as sulfur dioxide by the reference method described in appendix A to this part or by an equivalent method designated in accordance with part 53 of this chapter.

(d) To demonstrate attainment, the annual arithmetic mean and the second-highest 24-hour averages must be based upon hourly data that are at least 75 percent complete in each calendar quarter. A 24-hour block average shall be considered valid if at least 75 percent of the hourly averages for the 24-hour period are available. In the event that only 18, 19, 20, 21, 22, or 23 hourly averages are available, the 24-hour block average shall be computed as the sum of the available hourly averages using 18, 19, etc. as the divisor. If fewer than 18 hourly averages are available, but the 24-hour average would exceed the level of the standard when zeros are substituted for the missing values, subject to the rounding rule of paragraph (b) of this section, then this shall be considered a valid 24-hour average. In this case, the 24-hour block average shall be computed as the sum of the available hourly averages divided by 24.

8.4.6 CO

40 CFR § 50.8 National primary ambient air quality standards for carbon monoxide.

(a) The national primary ambient air quality standards for carbon monoxide are:

(1) 9 parts per million (10 milligrams per cubic meter) for an 8-hour average concentration not to be exceeded more than once per year and

(2) 35 parts per million (40 milligrams per cubic meter) for a 1-hour average concentration not to be exceeded more than once per year.

(b) The levels of carbon monoxide in the ambient air shall be measured by:

(1) A reference method based on appendix C and designated in accordance with part 53 of this chapter, or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(c) An 8-hour average shall be considered valid if at least 75 percent of the hourly average for the 8-hour period are available. In the event that only six (or seven) hourly averages are available, the 8-hour average shall be computed on the basis of the hours available using six (or seven) as the divisor.

(d) When summarizing data for comparision with the standards, averages shall be stated to one decimal place. Comparison of the data with the levels of the standards in parts per million shall be made in terms of integers with fractional parts of 0.5 or greater rounding up.

9. Assessment of Ambient Air Quality in Indian Country in the Absence of Air Monitoring

In Tribal Country where air monitoring has not been conducted, Tribes may want to use non-monitoring methods to determine approximate concentrations of air pollutants in order to decide if air monitoring is necessary. Several methods, requiring various degrees of technical expertise and financial resources, are identified in this section. These methods include: 1) Internet-Based Tools, 2) Spatial Interpolation of Existing Data, 3) Plume Dispersion Models, 4) Large-Scale, Multi-Pollutant Models, and 5) Smoke Dispersion Models.

The usefulness of the first two of these methods is that for some air pollutants, concentrations typically do not vary sharply across fairly large distances, so data collected at monitoring sites off the tribal land can be informative of what the situation is within the tribal boundary. This approach is best suited to ozone, PM2.5, and a few air toxics that have such long residence times in the atmosphere and have relatively constant concentrations over a large scale (e.g., carbon tetrachloride and choloroform). Relying on data from monitors in other areas is less reliable for other pollutants such as PMcoarse, CO, and most air toxics. The Internet-Based Tools are ways to see data from individual monitoring sites of interest. In addition to monitoring data available through the Internet, industrial sources sometimes monitor for certain pollutants to fulfill permit conditions or to meet PSD requirements. The purpose of this monitoring is for sources to verify modeling predictions that fenceline concentrations of these pollutants will not exceed a certain level. Sources may be willing to share this monitoring data with local tribes. These data could give tribes a rough idea of the pollutant concentrations that exist in the area. These data may also be available through the permitting agency to whom the data is reported.

The third through fifth of the methods listed above are ways to estimate air pollutant concentrations if emissions are known or can at least be estimated. Plume Dispersion Models and Smoke Dispersion Models are appropriate when the emission sources are relatively close to the area where estimates of concentrations are needed, for example, when an industrial plant is on tribal land or near its border. Large-scale, multi-pollutant models are used to estimate the combined effects of mobile, area, and stationary point sources over a large area, and are referred to as "regional scale" models. They are most useful for estimating ozone, PM2.5, and impacts of air pollutants on visibility. Their advantage over using monitoring data from sites off the tribal land is that it is possible to make projections into the future to see how future emissions controls may improve air quality compared to current concentrations

9.1 Internet-Based Tools for Ambient Air Quality Assessment

There are Internet based tools that can be useful when conducting ambient air quality assessments in Indian country. These tools provide information on the locations and types of current and historical ambient air monitoring networks, monitoring data, emissions data from point and area sources, and meteorological data. In addition, Internet tools are available that assist with interpreting data. Web sites include a wide variety of interactive maps and graphs. Modeling tools are also available on the Internet that provide backward trajectories to determine transport paths, and to model the dispersion of pollutants released from a source on a particular day. These tools are accessible to the public and are fairly easy to use. Becoming familiar with these tools enables the tribal environmental professional to better understand the local and surrounding airsheds, and to assess the potential for pollution transport into Indian country. Much of the data obtained from these tools have associated geospatial coordinates available on the Web sites. When data are downloaded with geospatial coordinates they can be integrated into a GIS map. GIS integration allows for a more comprehensive and visual assessment. GIS integration is encouraged for ambient air quality assessments. GIS software is available to federally recognized tribes through the Bureau of Indian Affairs.

This section is intended to provide information that tribal environmental professionals may find useful in determining issues that may be of concern to them in the absence of monitoring data obtained directly from their jurisdictional area. The information in this section is not intended to be comprehensive. This section does not provide all the information available from a particular Web site, or list all Web sites that may be useful in assessing ambient air quality. Tribal professionals are encouraged to explore beyond what is listed in this document.

An initial air quality web based assessment should include:

- Identifying existing and historical ambient air monitoring networks and their locations, as well as areas where data gaps exist
- Obtaining all available air monitoring data from the surrounding areas
- Identifying criteria and toxic emissions from area and point sources, and understanding the potential for transport of primary and secondary pollutants from those sources
- Characterizing prevailing and seasonal wind patterns for both local and surrounding areas,
- Determining wind transport paths on days when high pollutant concentrations were observed at monitoring sites (backward trajectories)
- Determining pollutant dispersion from sources in the transport path on days when high concentrations were observed at monitoring sites
- Identifying any health data that may indicate air quality problems
- Integrating data into a GIS program

Recommended Web Sites

http://www.epa.gov/air/data (EPA's AirData)

EPA's AirData Web site is one of the most useful sites to begin an initial assessment. AirData provides summary monitoring data and emission inventories data and gets most of its information from the Air Quality System (AQS) and National Emissions Inventory (NEI) databases. The site provides the information in both report and map format. Most reports can be downloaded with map coordinates (latitudes, longitudes) making data downloads GIS friendly. Emission Inventories for one or several states can be downloaded and integrated into GIS maps. The same is true for monitoring sites and summary monitoring data. You can also get national/state/county on-line maps showing attainment/non-attainment areas, source emissions by density or quantity, summary ambient air monitoring data for criteria pollutants, AQI, and more.

http://airnow.gov (AIRNow)

The EPA, NOAA, NPS, tribal, state, and local agencies developed the AIRNow web site to provide the public with easy access to national air quality information. This web site offers daily AQI forecasts as well as real-time AQI conditions for over 300 cities across the country, and provides links to more detailed State and local air quality web sites.

http://www.airnowtech.org (AIRNow-Tech)

Since 2002, the AIRNow-Tech web site has been used by local and state agencies to query AIRNow observational data, issue forecasts, and manage AIRNow program information. It is a one-stop portal to AIRNow data, information, and events. Significant site enhancements have recently been implemented to provide easier use and increased functionality. The enhancements allow each authorized user from a particular agency to manage personal information and customize settings to their individual preferences and needs.

http://www.epa.gov/AirExplorer/ (AirExplorer)

EPA's AirExplorer Web site provides access to detailed monitoring data from monitoring sites that submit their data to AQS. For example, AirData will provide the four highest concentrations and the annual mean each year for PM-2.5 at a particular monitoring site. AirExplorer provides access to all the 24-hour averages gathered throughout the years at that same site. The data can be downloaded or viewed on-line. Data has latitudes and longitudes and other information about how the data was collected. AirExplorer also provides on-line interactive mapping tools, air quality graphing tools, and benzene and PM-2.5 speciation data.

http://vista.cira.colostate.edu/views/ (VIEWS)

The Visibility Information Exchange Web System (VIEWS) Web site provides information obtained from the Interagency Monitoring of Protected Visual Environments (IMPROVE) and other monitoring networks such as the Clean Air Status and Trends Network (CASTNet). They are also integrating AQS data into VIEWS. A typical IMPROVE site will collect data on PM10 concentrations, PM2.5 total concentrations, and concentrations of metal and organic species bound to PM2.5 particles. CASTNet sites are related to deposition and acid rain issues, but often have ozone analyzers included. Data can be downloaded or viewed on-line. Although VIEWS is primarily related to visibility issues, the site is also a tool for air quality assessment outside of urban areas. Much of the regulatory monitoring network data that are entered into AQS are focused in urban areas. The IMPROVE and CASTNet systems are focused in rural areas, national parks and wilderness areas. The VIEWS site also has tools that allow intuitive and quantitative analysis. For example, in the annual summary, backward trajectories section, you can select an IMPROVE site. A chart will show up at the bottom of the page showing the particulate concentrations in the selected year. You can click on the highest concentrations and the Web site will provide backward trajectories for that site on that day. Backward trajectories show the path the air took prior to the high concentrations and are useful for determining transport sources that may be adversely impacting air quality in an area. There are several other summary/analytical tools available at this site.

http://www.arl.noaa.gov/ready.html (HYSPLIT)

The National Oceanic and Atmospheric Administration (NOAA), Air Resources Laboratory (ARL), Real-Time Applications and Display System (READY) web site has a variety of tools available including backward trajectories modeling software (HYSPLIT) and dispersion modeling software (HYSPLIT), as well as tools that model meteorological conditions at a selected latitude and longitude at the ground surface and at elevations above the ground. The backward trajectories can be integrated into GIS by downloading the endpoints file, modifying the file slightly and using the right-click "Create Feature Class from XY Table" function in ArcCatalog. Specific instructions are available at the TAMS Center Web site. Backward trajectories are useful in understanding transport issues by mapping the path air took prior to entering the monitor.

http://www.datafed.net/ (DATAFED)

The goals of the DataFed site are to facilitate the access and flow of atmospheric data from providers to users, support the development of user-driven data processing value chains, and participate in specific application projects. Tools provided by DataFed include browsers and analysis tools for distributed monitoring data. DataFed also serves as data gateway for user programs (web pages, GIS, science tools). Currently DataFed is focused on the mediation of air quality data. Software provided for users include:

1) Data Catalog for finding and browsing the metadata of registered datasets,
2) Dataset Viewer/Editor for browsing specific datasets, linked to the Catalog,
3) Data Views - geo-spatial, time, trajectory etc. views prepared by the user,
4) Consoles, collections of views on a web page for monitoring multiple datasets, and
5) Mini-Apps, small web-programs using chained web services (e.g. CATT, PLUME)

http://www.epa.gov/ttn/amtic (AMTIC)

The Ambient Monitoring Technology Information Center (AMTIC) is operated by EPA's Ambient Air Monitoring Group (AAMG). AMTIC contains information and files on ambient air quality monitoring programs, details on monitoring methods, relevant documents and articles, information on air quality trends and non-attainment areas, and federal regulations related to ambient air quality monitoring.

http://www.epa.gov/ttn/airs/aqdatamart (AQS Data Mart)

The AQS Data Mart is a project to make air quality data more accessible and useful to the scientific and technical community. The Data Mart will contain all of the raw and summary data from AQS for the previous 25 years. Also, it will contain AirNow data for AQS monitors for time periods when AQS data is not available. All AirNow data will be purged when it becomes one year old. The Data Mart will be accessible via the internet in a variety of ways. The first will be via a commercial business intelligence tool called Business Objects. This software allows users to explore the database, build queries, and (to a limited extent) export data. We have a limited number of licenses for this software, and it is not the ideal way to export large amounts of data. For that reason, we will also deploy web service query capabilities. The EPA's Central Data Exchange (CDX) will host web services that allow users to query the Data Mart. We will also provide a web-page interface for you to build queries and identify where you would like results returned. You can use the CDX web services specifications to build the consumption of the Data Mart web services directly into your own application. All web service requests will be authenticated so users must be registered with CDX. We will post more detailed instructions on how to register for and use the web services as they become available. Finally, EPA is planning to connect some of our already existing data retrieval web pages to the Data Mart. That is, in the future AirExplorer, AQS Query, and perhaps AirData will all use the Data Mart as their source for air quality data. OAQPS expects a general release of Data Mart at the end of March 2006.

9.2 Spatial Interpolation of Existing Data

The need for spatial (geostatistical) interpolation models in the regulatory environment has grown in the past few years. Spatial interpolation as applied to air monitoring data is loosely defined as the procedure for estimating ambient air concentrations at unmonitored locations in a certain area based on available observations within the proximity of the area. The justification underlying spatial interpolation is the assumption that points closer together in space are more likely to have similar values than points more distant. EPA and States use spatial interpolation to review decisions on monitoring network design and to predict the efficacy of emission control programs. Due to the limited number of monitoring sites across the country, especially for pollutants that cover a large area, such as ozone and fine particles, there is a need to use spatial interpolation to predict ambient concentrations in unmonitored locations.

Geostatistical interpolation methods are stochastic methods, with kriging being the most well-known representative of this category. Conceptually, the goal of kriging is to find linear combinations of the data that are optimal and consistent with the observed data points. In particular, kriging is a statistical model that produces both a spatial surface of predictions for the process of interest as well as the uncertainty associated with those estimates. Kriging calculates weights for measured points in deriving predicted values for unmeasured locations. With kriging, however, those weights are based not only on distance between points, but also on the variation in measured concentrations as a function of distance. A major benefit of the various forms of kriging is that estimates of the model’s prediction uncertainty can be calculated, considered in the analysis, and plotted along with the predicted values. Such uncertainty information is an important tool in the spatial decision making process.

There are three main kriging methods and each has unique assumptions that must be met. “Simple” kriging assumes that there is a known constant mean, that there is no underlying trend, and that all variation is statistical. “Ordinary” kriging is similar except it assumes that there is an unknown constant mean that must be estimated based on the data. “Universal” kriging differs from the other two methods in that it assumes that there is a trend in the surface that partly explains the data’s variations. This should only be utilized when it is known that there is a trend in the data.

Ordinary kriging, which is addressed in this section, is a version of kriging that assumes the mean is constant but unknown across the spatial domain of interest. Ordinary kriging defines the process as follows:

$$\mathbf{Z(x,y) = u + e(x,y)}\ ,$$

u = the overall, large-scale mean of the process across the spatial domain; and
e(x,y) = the small-scale random fluctuation of the process within the spatial domain.

In practice, ordinary kriging, for the purpose of spatial interpolation, is implemented via the following five steps:

Step 1: Build the Data Set

Often it is the case that an initial data set will require pre-processing to generate analysis data that better match the spatial process of interest with respect to temporal scale. This can be accomplished via some sort of temporal averaging of the initial data. For example, a data set of 1-hour ozone concentrations might be averaged in some manner to yield 8-hour concentrations for analysis. When pre-processing an initial data set via temporal averaging, some consideration must be given to the temporal completeness of the resulting average. If the initial data used to generate an endpoint such as an annual average are somehow temporally incomplete, the calculated endpoint may be biased in some manner. For example, many air pollutants exhibit significant seasonal fluctuations, so an annual average estimated from only a single quarter’s worth of data (e.g., January through March) may not be representative of the true year-long average.

Step 2: Summarize and Understand the Data

Once the spatial analysis data set has been built, it is important to generate some initial summaries of the available data prior to analysis in order to obtain a better understanding of its empirical structure and behavior. Reasonable summaries include, but are not limited to, graphical information systems (GIS) maps of the spatial domain and available data locations, a histogram of the overall data distribution, and summary statistics such as the data’s mean, standard deviation, and various percentiles (e.g., minimum, median, maximum, etc.).

Step 3: Conduct a Variogram Analysis

Once the analysis data set has been built and explored to gain some basic understanding, the kriging modeling exercise can begin. The exercise begins by conducting a variogram analysis. This analysis typically consists of first generating an empirical variogram and then fitting a parametric model that adequately captures the structure of the empirical variogram. Ultimately, the estimated parameters of the variogram will be input into for the kriging spatial prediction and uncertainty formulas from which a spatially interpolated surface is generated. In other words, once you have chosen a satisfactory variogram model, you then use that model as an input to the actual kriging process.

The most common models used in the variogram modeling process are: linear, spherical, exponential, rational quadratic, wave (or hole-effect), power, and Gaussian. Of these seven variogram models, three are used most commonly: spherical, exponential, and Gaussian. Exponential models fit best when the spatial autocorrelation decreases exponentially with increasing distance. Spherical models provide a better fit when spatial autocorrelation decreases to a point after which it becomes zero. Gaussian variograms tend to have an "S" shape, with a gradual upward slope at short distances, followed by a sharper upward slope at middle distances and, finally, by another gradual upward slope at long distances. To determine which of these models best fit the data, attempt to fit the data using all of these models. If the fitting procedure fails to converge for a given covariance function, remove it from consideration. By considering several variogram models, one can choose the model that best fits the data.

Various software packages, including Surfer, GMS, SAS, S-Plus, and others will compute the empirical variogram and assist in the modeling process. Among these, two statistical packages are noteworthy: SAS and S-Plus. Both packages have different strengths and weaknesses. SAS, in general, appears to be more flexible than S-Plus, but it requires understanding of SAS programming. SAS does not provide much in the way of automatic defaults or computation of parameters, though standard parameter estimation functions can be used, in conjunction with the variogram functionality, to model the process. S-Plus, on the other hand, with the addition of its spatial module, has been designed to minimize the level of technical knowledge required on the part of the user. S-Plus provides a series of menu-accessed functions to process a data set. In many cases, these functions will cause parameters to default to functional values if they are not specified by the user.

Step 4: Apply Spatial Prediction and Uncertainty Formulas

In the previous step, the spatial structure associated with the data was modeled using a variogram analysis. That variogram model is now applied to the task of spatial prediction. The current step of applying the variogram analysis results is relatively straightforward, if appropriate software is available for applying the equations. Surfer, GMS, S-Plus, SAS, and several other software packages have the capability to compute kriging estimates given data and a variogram function. Using these software packages, kriging predictions and standard errors can be generated everywhere in either a default or user-defined grid.

Step 5: Evaluate Model Performance

There are two primary ways to evaluate model performance. The first method is to map the interpolated concentrations and compare them to observed monitored values. Observed and estimated values at monitor sites should be close but do not need to match exactly. Allowing some variation between observed and estimated values at monitoring locations may give better results for unmonitored areas. The second method is to review the uncertainty estimates generated by the model. The output from the kriging model consists of both estimated values as well as uncertainty of the estimated values (e.g., standard errors). Locations within the vicinity of several monitors should have lower standard errors than areas with a sparse set of monitors. Also, there may be higher standard errors along the boundaries of the local domain. Including additional monitoring information outside the local domain should improve the standard errors along the boundaries of the domain.

A more detailed description of the kriging process can be found in the EPA report titled "Developing Spatially Interpolated Surfaces and Estimating Uncertainty", EPA-454/R-04-004, November 2004.

Spatial Interpolation Contact: Glenn Gehring, TAMS, (702) 784-8269

9.3 Plume Dispersion Models

These types of models would be useful to tribes in estimating the concentrations of pollutants impacting air quality on their reservations from nearby large stationary sources. In order to run these models, a tribe needs to know the emission rates of pollutants of concern (e.g., NOx, SO2, and PM) from each source, and needs to have the appropriate meteorological data required by the model. These models can also be used to determine the improvements in air quality which could be achieved by placing emission controls on stationary sources.

9.3.1 AERMOD

The AERMOD Modeling System (AERMOD) is a steady state Gaussian plume dispersion model whose formulation is based on planetary boundary layer principles. The modeling system consists of three program - a dispersion program (AERMOD), a terrain processor program (AERMAP), and a meteorology processor program (AERMET). AERMET reads in hourly surface meteorological data, upper air data and surface characteristics and generates a surface file and a profile file. AERMAP extracts terrain elevations from U.S. Geological Survey Digital Elevation Model (DEM) files (e.g., 10-meter and 7.5 minute) and calculates height scales based on a user provided location coordinates (i.e., Universal Transverse Mercator [UTM], NAD27). Using the files generated from AERMAP and AERMET, source information, and specific model run options within the AERMOD dispersion program, inert air pollutant concentrations are estimated at designated locations and for specified averaging periods.

The AERMOD dispersion program simulates transport and dispersion for point, area and volume sources. Sources may be located in a rural or urban area. The dispersion model also accounts for wake effects using the PRIME building downwash algorithm. An estimate of concentration should only be made for a source-to-receptor distance of less than 50 kilometers. The AERMOD Modeling System is expected to be promulgated as an U.S. EPA recommended model and codified in the Guideline on Air Quality Models, Appendix W to 40 CFR Part 51. With AERMOD promulgation, the Industrial Source Complex Short Term 3 (ISCST3) dispersion model will no longer be recognized as a preferred model.

9.3.2 AERSCREEN

A screening version of the AERMOD Modeling System is under development. Unlike AERMOD, AERSCREEN will use a screening meteorological data set with the dispersion program to estimate maximum hourly concentrations. The AERSCREEN predicted hourly concentrations are expected to be higher than the maximum 1-hour concentrations predicted by the AERMOD dispersion program. Scaling factors are applied to the AERSCREEN 1-hour concentration to obtain concentrations for other averaging periods. AERSCREEN will replace the SCREEN3 Model.

9.3.2 CALPUFF

The CALPUFF Modeling System (CALPUFF) is a multi-layer, multi-species non-steady-state puff dispersion modeling system that simulates the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and removal. CALPUFF contains three primary programs - CALMET, CALPUFF and CALPOST. CALMET reads in mesoscale meteorology from observations and/or from predictions by prognostic meteorological models (e.g. MM5 and RUC) and develops hourly meteorological variables on a three-dimensional gridded modeling domain. With the output from CALMET, source information, and specific model run options, CALPUFF is used to generate hourly concentration or deposition flux files. CALPOST is employed to process the CALPUFF output files to estimate concentration impacts at Federal Class I area and impacts to Air Quality Related Values (AQRV) such as visibility.

The U.S. EPA recommends the use of the CALPUFF Modeling System for source-to-receptor distances greater than 50-kilometers. CALPUFF is also recommended by the Inter Agency Workgroup on Air Quality Modeling (IWAQM) for use in evaluating impacts on visibility and deposition in Federal Class I areas. On case-by-case basis, the CALPUFF Model can be used in a near field application, and during stagnant or complex wind conditions. The CALPUFF Modeling System has been promulgated for regulatory application in the Guideline on Air Quality Models, Appendix W to 40 CFR Part 51. Appendix A contains more information on the AERMOD and CALPUFF models.

Plume Dispersion Model Contact: Herman Wong, EPA Region 10, (206) 553-4858

9.4 Large Scale Multi-Pollutant Models

Large-scale, multi-pollutant models are used to estimate the combined effects of many emission mobile, area, and stationary point sources over a large area, and are referred to as “regional scale” models. They are most useful for estimating ozone, PM2.5, and impacts of air pollutants on visibility. These types of models require large amounts of source emissions data and meteorological data, and require specialized technical expertise. More relevant to the tribes is that these models have been used by the Regional Planning Organizations, EPA, and some individual states. As an alternative to running these models, tribes should consider accessing the modeling results generated by other agencies that cover their reservations.

9.4.1 Community Multi-scale Air Quality (CMAQ) Model

The CMAQ modeling system has been designed to approach air quality as a whole by including state-of-the-science capabilities for modeling multiple air quality issues, including tropospheric ozone, fine particles, toxics, acid deposition, and visibility degradation. Hence, CMAQ combines the scientific expertise from each of these areas into one ‘community model’. In addition to being a multi-pollutant model, CMAQ was also designed to have multi-scale capabilities so that separate models were not needed for urban and regional scale air quality modeling. The target grid resolutions and domain sizes for CMAQ range spatially and temporally over several orders of magnitude. With the temporal flexibility of the model, simulations can be performed to evaluate longer term pollutant transport, as well as short-term transport from localized sources. With the model’s ability to handle a large range of spatial scales, CMAQ can be used for urban and regional scale model simulations.

The CMAQ modeling system simulates various chemical and physical processes that are thought to be important for understanding atmospheric trace gas transformations and distributions. The CMAQ modeling system utilizes three separate modeling components: a meteorological model (typically MM5) for the description of atmospheric states and air mass motions, an emissions model (typically SMOKE) for man-made and natural emissions that are injected into the atmosphere, and a chemistry-transport model for simulation of the chemical transformation and fate (the CCTM model). The meteorological and emissions model outputs are required inputs into the CMAQ chemistry-transport model, hence this is viewed as a modeling system.

CMAQ’s current structure is based on a modularity level that distinguishes between its main driver, science modules, data estimation modules, and control/utility subroutines in the model. This enables the attainment of higher resolution than commonly seen in previous models. The distinction remains at a division between the science models (including submodels for meteorology, emissions, chemistry-transport models), and analysis and visualization subsystems. Typically the CMAQ modeling system is run on a multi-processor Linux or UNIX computer cluster environment and usually requires at minimum over 1 terabyte of storage capacity.

Current CMAQ and SMOKE model codes and training are available from the CMAS Center at: http://www.cmascenter.org/

Current MM5 model code and training is available from UCAR at: http://www.mmm.ucar.edu/mm5/

CMAQ Contact: Robert Kotchenruther, EPA Region 10, (206) 553-6218

9.4.2 The NATA Model

The 1999 National Air Toxics Assessment (NATA) is a nationwide study of potential inhalation exposures and health risks associated with 133 air toxics and diesel particulate matter (diesel PM), based on emissions data for 1999. The initial national-scale assessment is comprised of four major technical components: 1) compiling a national emissions inventory of air toxics and diesel PM for the year 1999 from outdoor sources; 2) estimating 1999 air toxics and diesel PM ambient concentrations; 3) estimating 1996 population exposures; 4) characterizing potential public health risks.

The purpose of the NATA is to gain a better understanding of the air toxics problem. Specifically, the goal of the assessment is to assist in: 1) identifying air toxics of greatest potential concern in terms of contribution to population risk; 2) characterizing the relative contributions of various types of emission sources to air toxics concentrations and population exposures; 3) setting priorities for collection of additional air toxics data and research to improve estimates of air toxics concentrations and their potential public health impacts; 4) tracking trends in modeled ambient air toxics concentrations over time; and, 5) measuring progress toward meeting goals for inhalation risk reduction from ambient air toxics.

The NATA website: www.epa.gov/ttn/atw/nata1999
(This needs to be updated for the public access site)

NATA Contact: Ted Palma, OAQPS, (919) 541- 5470

9.5 Smoke Dispersion Models

9.5.1 BlueSky Model

BlueSky is a modeling framework which brings together the latest state of the science for modeling fuels, fire, smoke, and weather into one centralized processing system. It makes sophisticated emission, dispersion and weather prediction models and model output easily accessible to the operational fire and air quality management communities. The modeling framework is designed to predict cumulative impacts of smoke from forest, agricultural, and range fires, including both prescribed fire and wild fire. To view BlueSky output and publications go to http://www.fs.fed.us/bluesky.

The BlueSky system was designed as a tool to aid land managers using fire on the landscape in making go/no-go/go slow decisions with regard to smoke management. BlueSky provides hourly predictions of PM2.5 concentrations based on information available from multi-agency tracking systems such as FASTRACS and RAZU, and from wildfire 209 reports. Trajectory predictions available in BlueSky RAINS indicate the direction and height of smoke plumes 12 hours out in time.

Centralized collection and processing of model data relieves the user of the need to download data and learn complex modeling systems. It also allows for analysis of multiple burns and wildfires so that air quality managers can see the combined impacts within shared airsheds. Output is posted to the web daily for easy access by burners, air resource specialists, and the public. In order to provide quality output, the BlueSky system relies on the collaboration of many agencies at the federal, state, and local level.

The BlueSky modeling framework has 5 components. Although the specific models used within each component may change over time as the modeling science advances, the basic structure will remain the same. As of June 2005, fire characteristics are processed through the Emissions Production Model (EPM) to give emission estimates of particulates ($PM_{2.5}$, PM_{10}, and total PM), carbon compounds (CO, CO_2, CH_4, non-methane hydrocarbons), and heat generated. The emission estimates from EPM, along with meteorology from MM5, are input data to the CALPUFF dispersion model and the HYSPLIT trajectory model. The BlueSky system framework merges meteorology with emission estimates to yield an integrated regional-scale analysis of smoke dispersion and aerosol concentrations.

The BlueSky concentration fields and trajectories are displayed on the website in the Rapid Access INformation System (RAINS); a Geographic Information System (GIS) application developed by the US EPA. Integrating BlueSky with RAINS, allows the user to zoom in on areas of interest, step through time, and overlay GIS data layers such as sensitive receptors, boundaries, roads, rivers and topography. Primary inputs to BlueSky include weather, fire characteristics, and fuels. This section briefly describes the sources for each of these input parameters.

Weather **–** Predictions of wind speed and direction as well as mixing height are required to determine smoke trajectories and PM2.5 concentrations. Weather inputs come from the MM5 mesoscale meteorological model. See Appendix X for more detail on the MM5.

Fire Characteristics **–** In order to arrive at an accurate prediction of smoke emissions it is necessary to get detailed information about the size, location and timing of a prescribed burn or wildfire. This information is retrieved from interagency reporting systems such as FASTRACS in the Pacific Northwest, RAZU in Montana and Idaho and will soon be available from ***PFIRS*** in California. Alternative ways of providing input on prescribed burns for BlueSky are also being developed. Wildfire information is also accessed automatically each day from 209 reports available from the National Interagency Fire Center (NIFC).

Fuels **–** Fuel model and fuel loading information is essential to emissions modeling. BlueSky uses fuel characteristics derived from the Fuel Characteristic Classification System (FCCS) to arrive at this information. For more information about FCCS go to http://www.fs.fed.us/pnw/fera/fccs/index.html.

Emissions and Dispersion Modeling
Emissions are computed using Consume/EPM v1.03 which calculates the heat release rate and emissions for particulate matter and carbon compounds as a function of time since fire ignition. These emission values are input data for CALPUFF v5.711 which calculates the dispersion and plume rise. Trajectories are computed using the HYSPLIT model. HYSPLIT uses the full 3-dimensional wind field for computational purposes but does not include any heat or buoyancy effects from the fire.

Web Products
BlueSky output products can be viewed as animations or as static hourly images using BlueSky RAINS. BlueSky output can be viewed as either a Java Script animation (recommended for high speed internet connections) or Gif animation (recommended for dial up internet connections). Users must select a resolution and the type of animation then click on the appropriate square.

The animations show model predicted PM2.5 concentrations and wind flow patterns at the surface. Animations are useful for getting a big picture look at predicted PM2.5 over time for all the fires and burns in the system for a given run. While it is possible to stop the loop and look at individual frames, it is not possible to zoom in or add information to the images. At the bottom of the Animation page is a dropdown menu which allows the user to select animations from any BlueSky run going back to September of 2002.

BlueSky Contact: Sim Larkin, USFS, (206) 732-7849

9.5.2 BlueSky/RAINS

RAINS is the Rapid Access Information System developed by EPA Region 10. RAINS takes advantage of Geographic Information System (GIS) technology to display maps and data via the internet. BlueSky/RAINS builds on the RAINS concept as an avenue for making BlueSky model output available to users in an interactive ***ArcIMS*** format. BlueSky/Rains brings the output from the modeling framework into an interactive GIS environment so that the user can optimize the display for his or her needs. Displays can be zoomed in to the individual project level or out to the regional level. In addition to PM2.5 concentrations, trajectories showing the direction, height, and timing of smoke movement can be shown. Meteorological output for a number of parameters is also available. Maps showing roads, rivers, boundaries, and a variety of smoke sensitive receptors can be selected. To access BlueSkyRAINS go to http://www.blueskyrains.org .

BlueSky/RAINS Contact: Rob Wilson, EPA Region 10, (206) 553-1675

10. Other Air Quality Management Program Elements

[This section is intended to give first steps and other information regarding development of emissions inventories and source reporting, adoption of source emissions standards, adoption and operation of permitting programs, etc. for the benefit of tribes that are considering or are in the early stages of involvement in such programs.]

(to be completed)

Appendix A. Examples of Tribal Air Monitoring Projects

Name of Project	Tribe	Project Objectives	Pollutants Monitored	Description of Project/Budget	QA Plan?	Location of Data	Data Analysis/ Assessment	Results/Conclusions/ Outcomes
Sioux Manufacturing Air Toxics Monitoring Project	Spirit Lake Tribe, Fort Totten, ND	Measure ambient air toxics in proximity of manufacturing plant and community	VOCs and Carbonyls using UATMP canisters and Puf sampler, met monitor		Yes		EPA reviewed data that was supplied by monitoring completed by Tribe and analyzed by EPA contractor, compared values to IRIS RfC	Monitored HAPs were far below RfCs for inhalation. Tribe wishes to conduct follow-up short-term project after installation of controls at source.
Aquinnah, MA (Martha's Vineyard) Ambient Air Monitoring site	Wampanoag Tribe of Gay Head Aquinnah, MA	Long term measurement of air pollutants and regional haze	Ozone; IMPROVE monitor; met		Yes	AIRS IMPROVE web page		
Indian Island, ME Ambient Air Monitoring site	Penobscot Nation, Indian Island, ME	Long term measurement of air pollutants and regional haze	Ozone; SO2; IMPROVE monitor; met		Yes	AIRS IMPROVE web page		
Carrabassett Valley, ME NADP site	Penobscot Nation, Indian Island, ME	to collect data on the chemistry of precipitation for monitoring of long-term trends	NADP monitor			NADP web page		

Baseline air vs. Fort James BioMass Boiler		Measure ambient air before and after new BioMass boiler at nearby paper making plant begins to burn demolition debris	Two IMPROVE monitors run concurrently one off-island, one on-island, SO2 and Ozone monitors co-located with Met station on the reservation	These monitoring devices are currently being operated by the tribe via previous grant awards	Yes:	Monitors began collecting comparison data on 01/12/06. Study will conclude on 07/24/06.EPA and Penobscot will review data at that time.	Expectations: The reason for this study is due to the nature of demolition debris: allowable percentage of toxins to be included in 500 tons per day combustion is 5%. Lead-based paint alone may cause emissions to exceed EPA allowable levels.	
Real Time Air Monitoring Site, Presque Isle , ME	Aroostook Band of Micmac Indians, Presque Isle, ME		Ozone, Sulfur Dioxide, Nitrogen Dioxide, Carbon Monoxide, Carbon Dioxide, PM2.5, Haze Camera, Met	EPA Grant	In Draft	AIRS, Tribal web page, CamNet web page		
Air Monitoring Site Route 190 Perry, ME	Passamaquoddy Pleasant Point	Long term measurement of air pollutants	Ozone, Met		Yes	AIRS		

Wolapomomq ot Ciw Wocuk air monitoring site	Passamaquo ddy Indian Township	to collect data on the chemistry of precipitation and mercury for monitoring of long-term trends	NADP monitor; MDN monitor			NADP web page		
ITEC	Criteria pollutant monitoring	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	O3, NOy, NOx, CO, SO2, PM10 (lo vol) and PM10 continuous, PM2.5 (lo vol) and PM2.5 continuous (including FDMS), and met monitoring data	7 various pollutant monitoring sites in OK and NM	3 ambient air monitoring QAPPs	EPA AQS	ITEC and EPA-R6	Ongoing with annual EPA-R6 review

ITEC	IMPROVE and NH3 monitoring	Collect IMPROVE and NH3 air monitoring data meeting IMPROVE and NH3 monitoring and QA requirements	IMPROVE and NH3 monitoring data	1 IMPROVE monitoring site and 1 NH3 monitoring site	1 IMPROVE monitoring QAPP? and 1 NH3 monitoring QAPP	VIEWS and EPA AQS	ITEC and CENRAP	Ongoing with 5 year EPA-R6 review
ITEC	CASTNET and Hg monitoring	Collect CASTNET and Hg monitoring data respectively meeting CASTNET and Hg monitoring and QA requirements	CASTNET and Hg monitoring data	1 CASTNET monitoring site and 2 Hg monitoring sites	1 CASTNET monitoring QAPP and 1 Hg monitoring QAPP	EPA CAMD CASTNET and NADP Hg	ITEC, CAMD, NADP and EPA-R6	Ongoing with 5 year EPA-R6 review
Quapaw Tribe	Tar Creek (Superfund Site) Air Monitoring Project (TCAMP)	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	Pb (hi vol), PM10 (hi vol), PM10 continuous, PM2.5 continuous and silica (SiO2) PM10 (lo vol) monitoring data	4 sites	1 ambient air monitoring QAPP	EPA AQS	Quapaw Tribe and EPA-R6	Temporarily ongoing with ongoing EPA-R6 review

Quapaw Tribe (TCAMP Background Site)	Criteria pollutant monitoring	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	O3, NOy, PM2.5 FRM and continuous, PM10 continuous and met monitoring data	1 site	1 ambient air monitoring QAPP	EPA AQS	Quapaw Tribe and EPA-R6	Ongoing with annual EPA-R6 review
Jemez Pueblo	Criteria pollutant monitoring	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	O3, CO, PM10 continuous, PM2.5 (lo vol) and continuous (FDMS), and met monitoring data	1 site	2 ambient air monitoring QAPPs	EPA AQS	Jemez Pueblo and EPA-R6	Ongoing with annual EPA-R6 review
(Western) Delaware Nation	Criteria pollutant monitoring	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	O3, PM10 (lo vol), PM2.5 (lo vol) and met monitoring data	1 site	2 ambient air monitoring QAPPs	EPA AQS	Delaware Nation and EPA-R6	Ongoing with annual EPA-R6 review
Sac and Fox Nation	Criteria pollutant monitoring	Collect ambient air monitoring data meeting EPA monitoring and QA requirements	O3, PM2.5 (lo vol) and met monitoring data	1 site	2 ambient air monitoring QAPPs	EPA AQS	Sac and Fox Nation and EPA-R6	Ongoing with annual EPA-R6 review

Alabama Coushatta Tribe	CASTNET monitoring with future regulatory O3 and NOy monitoring	Collect CASTNET monitoring data meeting CASTNET monitoring and QA requirements	CASTNET monitoring data	1 CASTNET monitoring site	1 CASTNET monitoring QAPP	EPA CAMD CASTNET	Alabama Coushatta Tribe, CAMD and EPA-R6	Ongoing with 5 year EPA-R6 review