INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

4th Quarter 2001 | The IMPROVE Newsletter | Volume 10 / Number 4

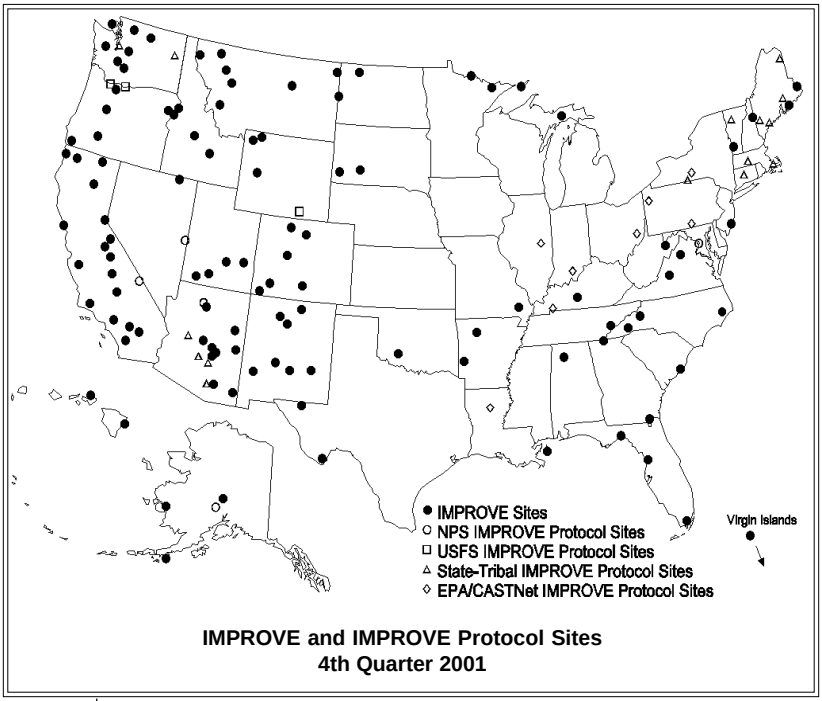
Monitoring update

Data reporting changes for haze ruling

Beginning October 2001, the IMPROVE Program changed its 3-month reporting periods. Historically, visibility data have been reported according to meteorological seasons (winter, spring, summer, and fall) where winter is comprised of December, January, and February. From now on, these data will be reported according to calendar quarters (1st, 2nd, 3rd, and 4th) where 1st Quarter is comprised of January, February, and March. This change will aid States in using IMPROVE data in conjunction with other data to develop their State Implementation Plans, as directed by the 1999 Regional Haze Regulations.

This change will allow IMPROVE data to be more conveniently compared to other air quality data and standards which traditionally have been based on calendar quarters. Preliminary data will be delivered to and made available on the IMPROVE Web site on this calendar quarter schedule. Final data will be made available on a calendar year basis. Past data will also be reprocessed by IMPROVE and reported as calendar quarter and calendar year averages.

This change in reporting periods does not affect the format of available data; persons requesting data may still select and acquire any data period they choose. The IMPROVE Newsletter will also change its production schedule to correspond to the new, quarterly data reporting periods.



IMPROVE and IMPROVE Protocol Sites
4th Quarter 2001

Network operation status

The IMPROVE network operated 110 aerosol samplers, 17 transmissometers, 8 nephelometers, and 5 camera systems during 4th Quarter 2001 (October, November, and December). Preliminary data collection statistics for the quarter are:

- Aerosol (channel A only) 93% collection
- Aerosol (all modules) 92% completeness
- Optical (transmissometer) 92% collection
- Optical (nephelometer) 98% collection
- Scene (photographic) 93% collection

All 110 Class I areas that were designated to receive an aerosol sampler are now operational. In addition, 33 IMPROVE Protocol sites are operating aerosol samplers.

Data availability status

Aerosol data for all measurements including carbon are available through February 2000 and optical data are available through November 2000 on the IMPROVE Web site, at *http://vista.cira.colostate.edu/improve/Data/data.htm.* More recent aerosol data are expected to be available according to the following schedule:

Data Period	Expected Availability Date
Spring 2001	early February 2002
Spring and Summer 2000	late February 2002
Fall 2000	early March 2002
Summer 2001	late March 2002
Winter 2000	late April 2002
Fall 2001	late May 2002
Winter 2001	late July 2002

Photographic slides and digital images are archived but are not routinely analyzed or reported. Complete photographic archives and slide spectrums (if completed) are available at Air Resource Specialists, Inc. Slide spectrums will also soon be available on the IMPROVE Web site.

Visibility news

Midwest Regional Planning Organization announces online visibility camera network

The Midwest Regional Planning Organization (Midwest RPO) has developed a real-time visibility camera network, which is now online. Digital images and air quality measurements from the network of seven air quality monitoring sites are available on the Internet at *http://www.mwhazecam.net*. The Web site is patterned after the CAMNET (the Northeast Real-Time Air Pollution Visibility Camera Network) Web site, and was established to inform the public about visibility in the upper Midwest and concurrent, corresponding air quality conditions. Digital camera images and accompanying air quality data are uploaded to the Web server every 15 minutes, and meteorological data are uploaded every hour.

The camera network is a cooperative effort among the Midwest RPO members (the states of Illinois, Indiana, Michigan, Ohio, and Wisconsin, the tribes in these states, the U.S. National Park Service, U.S. Fish and Wildlife Service, and U.S. EPA).

Four urban and three rural sites are included in the network:

- Chicago, IL
- Cincinnati, OH
- Indianapolis, IN (to come online soon)
- St. Louis, MO (to come online soon)
- Seney National Wildlife Refuge, MI (a Class I area)
- Mayville, WI
- Grand Portage, MN / Isle Royale National Park, MI (a Class I area)

For more information about the Midwest hazecam network, contact Michael Koerber at LADCO. Telephone: 847/296-2181. Fax: 847/296-2958. E-mail: koerber@ladco.org.

Seney NWR, a U.S. Fish and Wildlife Service "supersite" in the rural Midwest

The Midwest Regional Planning Organization (RPO) is leading the effort to better understand the causes of regional haze in the upper Midwest. Air quality monitoring is being expanded and Seney National Wildlife Refuge (NWR), located in Michigan's Upper Peninsula, has been chosen to be a regional haze monitoring "supersite." Monitoring at the refuge will be a cooperative effort among the Midwest RPO, the state of Michigan, and the U.S. Fish and Wildlife Service.

Seney NWR is one of two Class I areas in the Midwest RPO region, and was established in 1935 for the protection and production of waterfowl and other wildlife. In December 1999, Seney began monitoring air quality when an IMPROVE sampler was installed as part of the network expansion called for by the U.S. EPA regional haze regulations. The following year, Seney also began monitoring atmospheric deposition, as part of the National Atmospheric Deposition Program.

After a field trip to the refuge last August, sponsored by the Midwest RPO, a monitoring shelter and instrumentation were installed. Monitoring will include continuous ozone, $PM_{2.5}$ mass (TEOM), light scattering (nephelometer), meteorology (wind speed and direction, temperature, relative humidity, and precipitation), and daily speciated $PM_{2.5}$ (SuperSASS).

In addition, Seney NWR will also be part of the Midwest RPO's visibility camera network. The network is anchored by seven Web-based cameras and provides the public with current information about air quality in the upper Midwest. These images and the near real-time air quality and meteorology data are available on the Midwest Hazecam Web site at *http://www.mwhazecam.net*.

The U.S. Fish and Wildlife Service is pleased to be hosting the monitoring site and contributing to the effort by the Midwest RPO to understand and eventually reduce regional haze in the upper Midwest.

For more information contact Kristi Morris at the Fish and Wildlife Service. Telephone: 303/987-6941. Fax: 303/969-2822. E-mail: Kristi_Morris@nps.gov.

Monitoring "supersite" at Seney National Wildlife Refuge, Michigan.

Critical review of visibility to be held at 95th Annual Conference and Exhibition

Air & Waste Management Association (A&WMA) members and other interested parties are invited to read, attend, and comment on the 32nd annual critical review of *Visibility: Science and Regulation*. This review will be presented by Dr. John G. Watson, Research Professor at the Desert Research Institute of the University and Community College System of Nevada, at the A&WMA Annual Conference and Exhibition, in Baltimore, Maryland, on June 26, 2002.

This review will be published in the June 2002 issue of the *Journal* with a summary of the invited and floor discussion in the September 2002 issue. The topic is important owing to the recent regional haze regulation requiring states to take measures that reduce light extinction to natural levels in many U.S. national parks and wilderness areas by the year 2060. This regulation is potentially the most restrictive air quality rule ever promulgated, obliging future generations to major reduction in particle and precursor gas emissions.

The review will summarize how pollutant emissions are affected by environmental conditions to influence how we perceive the many spectacular vistas in pristine areas across the U.S. It will trace the evolution of visibility as a regulatory indicator since the beginning of air pollution control, and will examine how visibility measurement and modeling technologies have advanced. It will critically examine the assumptions made in the regional haze regulations and the guidance for implementing them. Implications of policies made today for future generations will be delineated.

Topics to be addressed include the adequacy of specified indicators for visibility impairment, accuracy of regional emissions inventories for tracking progress and modeling, methods for defining "natural conditions," measuring and detecting visibility trends, using models to demonstrate progress and attainment in State Implementation Plans, and the scientific evidence for commonly held beliefs about relationships between source emissions and poor visibility. The review's conclusions will be supported by information from many published articles and reports. It will also include original calculations and data analyses where needed as well as the results from interviews with experts who have participated in the scientific and regulatory process.

The review presentation will be followed by comments from invited reviewers, representing industry, national and state regulatory agencies, and researchers from government and academia. Discussion will also be accepted from the floor and from written submissions to the Critical Review Committee Chair.

Suggestions for additional issues treated in this review and advisement of intent to participate in the floor discussion can be addressed to the committee chair, Dr. Judith C. Chow. Telephone: 775/674-7050. Fax: 775/673-3316. E-mail: judyc@dri.edu.

San Juan Island NHP joins IMPROVE with visibility monitoring camera system

San Juan Island National Historical Park (NHP) received its first and only visibility monitoring instrumentation in late November 2001, at its island location in the State of Washington. Park personnel will perform scene monitoring according to IMPROVE protocols, and have committed to monitor visibility for at least one year.

Resource personnel at the park will operate a remote, digital camera system and collect digital images documenting visual conditions and air pollution that may travel in and around the Strait of Juan de Fuca. The waterways and scenic vistas in northwest Washington are both a premier attraction to park visitors, and a major shipping route to the northwest U.S. and southwest Canada.

The digital images, collected three times each day (at 0900, 1200, and 1500 local time), will be databased and archived to CD-ROM. At the end of one year of monitoring, park personnel will re-evaluate their monitoring needs.

The San Juan Island camera site is the latest addition to the network of cameras that operate in the IMPROVE Program. Other monitoring sites that currently take still-frame photographs or digital images include Big Bend, Bryce Canyon, and Grand Canyon National Parks, and Chassahowitzka National Wildlife Refuge. Time-lapse video from Moosehorn NWR documents a plume from a nearby pulp mill. IMPROVE camera sites typically collect 5-years of photographs or digital images; a CD-ROM is then prepared that contains a broad spectrum of images and visual conditions, which can be used for a variety of information dissemination purposes.

For more information contact Bill Gleason at San Juan Island NHP. Telephone: 360/378-2240. Fax: 360/378-2615. E-mail: bill_gleason@nps.gov.

View from IMPROVE camera system at San Juan Island National Historical Park, southward toward the Olympic Peninsula and mainland Washington.

***Visibility news* continued on page 6....**

Feature article

National $PM_{2.5}$ Speciation and IMPROVE Aerosol Networks data comparability project

Introduction

The National $PM_{2.5}$ Speciation Network (TRENDS) and the IMPROVE Aerosol Network (IMPROVE) nominally generate the same aerosol composition data using similar sampling and analytical approaches. State, local, and tribal agencies, with assistance from EPA, deploy and operate the TRENDS network, while the federal land managing agencies, and a few state, local, or tribal air pollution control agencies (with financial and technical support from the EPA) run the IMPROVE and IMPROVE protocol networks.

The data each network collects are used in various assessments and modeling exercises, sometimes with equal weight or utility. The data derived by the two will inevitably be compared by both public and federal, state, and local environmental protection agencies. It is essential that the degree of comparability of the data be established and documented, so that its users will not reach erroneous conclusions based on assumed comparability. The study described here is the first step in an attempt to compare and relate data derived by the two analytical approaches.

Evolution of the networks

The TRENDS network was established by regulation as a companion program to the official, mass-based Federal Reference Method (FRM) system for implementation of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). The NAAQS is a measurement of $PM_{2.5}$ mass concentration, as determined by filtration using the Federal Reference Method sampler. $PM_{2.5}$ speciation data are generated via filter-based sampling using three separate filters at locations that are typically near or above the NAAQS, and should provide valuable information regarding the nature of the sources that contribute to high $PM_{2.5}$ levels.

The regulations called for a network of approximately 300 sites to be operated by various state and local air quality agencies. EPA determined that the program would utilize 54 sites at EPA-designated locations, and approximately 200 filter-based speciation sites, the locations and operating schedules of which would be designated by the operating organizations. In 1999, EPA determined that the balance of the network could be made up of IMPROVE protocol sites. A few rural or background monitoring sites have also been equipped with $PM_{2.5}$ speciation monitors.

The IMPROVE network was designed in 1985 to fulfill EPA's court-ordered requirement for a federal visibility monitoring program to meet its obligations to protect and enhance visibility in 156 Class I areas. The network began operation at 20 remote locations in 1987 and expanded to 30 locations several years later. The monitoring system designed for IMPROVE included $PM_{2.5}$ mass and compositional analysis and PM_{10} mass based upon filter sampling. In 1998 EPA increased its contribution to IMPROVE to permit monitoring of regional aerosol conditions representative of all of the federal Class I areas. This network expansion increased the total number of IMPROVE sites to 110. In 2000 and 2001, several states and tribes requested that additional speciation monitoring be conducted in rural areas and on tribal lands according to IMPROVE protocol. Over 30 of these sites should be operational by the end of 2002.

Procedural comparisons

The TRENDS and IMPROVE networks are similar in that samples are collected on a number of filter substrates chosen for compatibility with specific analysis methods, including: Teflon for gravimetric mass and elements by X-Ray Fluorescence, quartz for carbon by thermal optical method, and nylon for nitrates and other ions by ion chromatography. In 2000, IMPROVE changed its monitoring protocol so that its sampling frequency would coincide with the TRENDS monitoring sites (i.e., every third-day, 24-hour [midnight to midnight] sampling).

The two programs, however, differ in a number of ways. The TRENDS network uses one of three commercially available samplers that are designed to collect samples in urban areas, which typically experience higher concentrations than IMPROVE sites. These samplers were designed to be operated by professional air quality monitoring technicians with sample changes within 48 hours after every sampling period. The IMPROVE network employs a sampler specifically designed to be operated by trained, but not professional field staff, in remote locations that often experience low ambient concentrations. The sampler operates unattended and is serviced once per week. The IMPROVE sampler flow rate is substantially higher than that used in the TRENDS network to collect more mass at the expected lower concentrations.

Shipping protocols for the two networks differ in that TRENDS requires sample retrieval within 48 hours and cold shipment of filters by a commercial carrier. IMPROVE samples are collected weekly and are shipped in specially designed containers through the US mail. Analytical procedures are similar except for the thermal analysis that determines the split of carbon into organic and elemental components.

Project objectives and approach

The project has three basic objectives:

(1) Determine if a relationship can be established between TRENDS and IMPROVE data.

2) If a relationship can be identified, attempt to determine which factors are most influential to the difference between values derived by each sampling technique.

(3) If a relationship cannot be identified, attempt to ascertain the cause and recommend direction for further study to resolve the disparity.

Data will be collected over a period of approximately 1 year, beginning in October 2001. The project plan is comprised of several steps and activities: (1) collocation of monitors from the two programs at urban and rural (Class I area) sites that are within the same geographic vicinity, (2) data acquisition, (3) analytical intercomparison, (4) field audits, (5) special studies of known differences in sample handling or analysis, (6) statistical analyses to assay the data quality and comparability of results, and (7) and reporting of results. Each of these steps are discussed below.

Collocation of monitors

The most direct and ideal approach to determining the comparability of data from the two networks is to examine data collected from a number of monitoring sites that utilize both kinds of monitors. To remedy this study's immediate need for collocated monitors, three currently operating sites in each of the two networks were selected to host equipment from the other (guest) network for at least one year of sampling. The siting strategy was to have one pair in an urban setting and another pair in a more remote location in the same geographic region. Thus the selected sites for the TRENDS/IMPROVE project are:

- Northwest:
  Beacon Hill (Seattle), WA
  Mt. Rainier National Park, WA
- Desert Southwest:
  Phoenix, AZ
  Tonto National Monument, AZ
- Eastern Mid-Atlantic:
  Washington, DC
  Dolly Sods Wilderness, WV

Data acquisition

Filter samples will be retrieved and analyzed in accordance with the prescribed protocols of their respective programs. TRENDS filter modules or cassettes will be shipped to Research Triangle Institute and IMPROVE filters will be shipped to the University of California at Davis.

Analytical intercomparisons

The project is designed with an independent analytical systems audit that includes all laboratory and data related activities, and blind challenges to the analysis systems by known standards, split samples, and the like. The lead organization for analytical laboratory work will be the National Air and Radiation Environmental Laboratory (NAREL) at Montgomery, Alabama, which is managed by EPA's Office of Radiation and Indoor Air. The NAREL laboratory will draft a detailed plan for the analytical systems audit activities, and circulate the resulting plan to EPA-Office of Air Quality Planning and Standards and the TRENDS and IMPROVE managers for comments.

Field audits

As with the analytical procedures, the EPA's OAQPS and Office of Radiation and Indoor Air Laboratories in Las Vegas, will conduct a program of independent field audits to assess all aspects of the field influence on data quality. This includes an evaluation of sampler siting and operating performance as well as the training and capabilities of the operators.

Special studies

Concurrent with the comparison study, the EPA is conducting independent investigations of differences in the two network's equipment and protocols that might yield different data outcomes. Two special studies that have been identified are:

1) Shipping study; to study the effects of shipping samples on sample integrity. TRENDS ships refrigerated and IMPROVE ships without refrigeration.

2) Carbon analysis intercomparison study; TRENDS uses the National Institute of Occupational Safety and Health, Thermal Optical Transmittance, and IMPROVE uses Thermal-Optical Reflectance.

Statistical analyses

Statistical analyses will be performed to assay the data quality and comparability of results. Specific analyses have not yet been determined; the EPA, with input from the project participants, is ascertaining what kinds of tests are suitable for the types of data that are being collected. Site comparisons as well as collection method comparisons will be included in the statistical analyses.

Reporting of results

This activity involves integration, assessment, and documentation of the information developed by the speciation data from the collocated samplers as described above. The primary purpose of this exercise is to afford data users with an authoritative reference concerning the degree of comparability of selected measured parameters that are common to the two networks.

***Comparability project** continued on page 6....*

Comparability project ***continued from page 5....***

The analyses will first compare results between collocated samplers at each site and then results among all samplers in the same geographic vicinity. Seasonal effects and broad geographic effects on species loading will also be analyzed. The site sponsors/operators will review and comment on their own preliminary speciation data and associated statistical analyses results. After a review of the results on the first two series of analyses by each site's respective sponsor/operator, the contractor will perform statistical analyses on all the data. At this time, all participants in the study will have a chance to review the data and statistical analyses. The interagency group will draft a report of conclusions and recommendations based on the results and all the supplemental information from the separate studies and audit procedures. A preliminary data set for an early comparison of gravimetric fine mass will be available in early February 2002. Chemical speciation data takes longer to be prepared (~6 months). Based on an official sample collection start date of October 16, 2001, the first draft report will not be available until early 2003.

For more information contact Dennis Crumpler at the U.S. Environmental Protection Agency. Telephone: 919/541-0871. E-mail: crumpler.dennis@epamail.epa.gov.

Visibility news *continued from page 3 ....*

What's new on the IMPROVE Web site

In the last six months several new features and additional content has been added to the IMPROVE Web site. The major enhancements to the Web site include:

IMPROVE optical data. The raw nephelometer and transmissometer data have been added to the IMPROVE optical data section of the Web site. These data are still preliminary and will be fully quality assured/quality controlled this winter.

Calculated aerosol and haze parameters. The aerosol composite components and their light scattering or absorption have been added to the IMPROVE database. Also, the official regional haze monthly relative humidity data and relative humidity correction factors for converting dry extinction values to ambient extinction have been added to the database. These values can be accessed via the ad-hoc database query tool.

Update of the haze and aerosol trends. The haze trends have been updated following the latest draft regional haze tracking guidance documents. Graphics, data tables, and listing of the 20% best and worst days for each monitoring site/year are available.

Animations of visibility concept. Animations illustrating the basic concepts for light and particle interaction are now available from the educational section of the Web site. These animations are available from a stand-alone application and have been integrated in the Introduction to Visibility document.

For more information or questions regarding the IMPROVE Web site, contact Bret Schichtel at CIRA. Telephone: 970/491-8581. Fax: 970/491-8598. E-mail: Schichtel@cira.colostate.edu.

Regional planning organizations Part 4: Central States Regional Air Planning Association

The Central States Regional Air Planning Association (CENRAP) is one of the five regional planning organizations (RPOs) formed to reduce regional haze and the fine particulate matter contributing to visibility impairment. CENRAP includes the state and tribal areas of Minnesota, Iowa, Nebraska, Missouri, Kansas, Oklahoma, Arkansas, Louisiana, and Texas. CENRAP is comprised of members from these states and tribes along with representatives of federal agencies, stakeholders, and other interested parties.

The CENRAP region has two international borders, and Class I federal areas are in close proximity to both. This means that regional haze issues must consider what is happening in neighboring foreign countries. There are 10 Class I areas unevenly distributed throughout this region resulting in large areas where data or visual air quality does not exist.

STATE	CLASS I AREA
Minnesota	Voyageurs National Park Boundary Waters Canoe Area Wilderness
Missouri	Hercules-Glades Wilderness Mingo Wilderness
Arkansas	Upper Buffalo Wilderness Caney Creek Wilderness
Oklahoma	Wichita Mountains Wilderness
Louisiana	Breton Wilderness
Texas	Big Bend National Park Guadalupe Mountains National Park
Kansas Nebraska Iowa	None

CENRAP encompasses an area that is a potential mixing zone for air sheds, but because of the relatively small number of Class I areas and IMPROVE monitors, as compared to the West; current data are not sufficient to properly characterize the regional haze problem. This is an important area for future work because this central location between the regions may show the greatest impacts from regional haze.

CENRAP's goals are to:

- Promote policies that ensure fair and equitable treatment of all participating members.
- Provide coordination of science and technology to support air quality policy issues in the region.
- Recommend strategies on air quality issues for use by member states and tribes in developing implementation programs, regulations, and laws.
- Conduct research and undertake other activities as necessary for information to support the development of sound state and tribal air pollution policies.

Similar to the other RPOs, CENRAP is comprised of workgroups that focus on specific functions. Current workgroups include: Emissions Inventory, Modeling, Monitoring, Implementation and Control Strategies, International, and Communication.

The ***Emissions Inventory Workgroup*** focuses on emissions data development and coordination issues. Emphasis is placed on emission factor and activity development for those source types or emissions characteristics that are unique to the region and the establishment of an appropriate database. Currently the group is preparing an evaluation of each state's existing inventory and a list of Best Available Retrofit Technology (BART)-eligible sources. Coordination is occurring between other CENRAP workgroups and RPOs to ensure data requirements are considered when future projects are developed. By mid-2004, a base year inventory using 2002 data is planned. This inventory will be used as input to air quality models and to evaluate potential control strategies.

The ***Modeling Workgroup*** is tasked with evaluation and implementation of models to better understand visibility trends. A key element is developing scientifically defensible source-receptor relationships that can support successful and cost-effective control strategies. Training sessions on air quality models and emissions models have been held to learn more about the models, to evaluate resource needs, and to promote interstate coordination. Air quality, meteorological, and emissions data are being incorporated into the contribution assessment due as part of State Implementation Plans (SIPs). This workgroup is supporting an effort to develop annual MM5 meteorological model output for the continental U.S. for 2001 and is working with other workgroups to establish a detailed timeline for SIP development schedules. The modeling workgroup is also engaged in importing existing emission and air quality models into Linux platforms and beginning "practice" modeling to become more familiar with these tools.

The ***Monitoring Workgroup*** works closely with the Modeling Workgroup to ensure adequate monitor deployment throughout the region. Because the region is large but has only 10 Class I areas, it is sparsely covered with IMPROVE monitors. CENRAP has worked with the Environmental Protection Agency to fund 18 additional IMPROVE Protocol monitoring sites that should be deployed during the first half of 2002. These data will help determine if episodes of poor visibility are regional or local in nature, thereby providing more effective control strategies.

The ***Implementation and Control Strategies Workgroup*** has responsibility for identifying feasible strategies to address regional issues. An essential function of this workgroup is to ensure that other CENRAP workgroups are properly addressing SIP/Tribal Implementation Plan (TIP) requirements throughout the planning process. The workgroup will be developing a SIP/TIP guidance document with a sample SIP/TIP for the states and tribes. The workgroup is also evaluating alternatives to conventional source-by-source controls such as market trading systems. Future efforts will focus on predicting the effects of various control strategies.

The ***International Workgroup*** will be addressing the potential impacts from foreign pollutant sources on Class I areas. CENRAP has the unique feature of bordering two foreign nations that have regulations, control strategies, and levels of controls separate and distinct from our own. The International Workgroup is challenged with making sense of these differences and their potential effects. Because of the differences, this workgroup is planning on hosting a meeting among international committees from the various RPOs to ensure that a consistent strategy is developed and may include participation of the U.S. State Department to make sure there are no conflicts with existing treaties or agreements.

The ***Communication Workgroup*** facilitates communications between workgroups, stakeholders, and other RPOs. The workgroup will be assisting with outreach efforts by developing presentations and educational materials. The workgroup has developed and will maintain the Communications Manual for CENRAP. This group also serves as a clearinghouse for all workgroup products that are to be communicated to the public.

For more information regarding CENRAP, see their Web site at http://www.cenrap.org.

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525

TO:

First Class Mail

IMPROVE STEERING COMMITTEE

IMPROVE Steering Committee members represent their respective agencies and meet periodically to establish and evaluate program goals and actions. IMPROVE-related questions within agencies should be directed to the agency's Steering Committee representative. Steering Committee representatives are:

U.S. EPA
Neil Frank
US EPA MD-14
Emissions, Monitoring and Analysis Div.
Research Triangle Park, NC 27711
Telephone: 919/541-5560
Fax: 919/541-3613
E-mail: frank.neil@epamail.epa.gov

USFS
Rich Fisher
Air Specialist, Wash. Office
Central Administrative Zone
2150 Centre Avenue, Building A
Fort Collins, CO 80526
Telephone: 970/295-5981
Fax: 970/295-5959
E-mail: rfisher@lamar.colostate.edu

STAPPA
Ray Bishop
Dept. of Environmental Quality
Air Quality Division
707 North Robinson
PO Box 1677
Oklahoma City, OK 73101-1677
Telephone: 405/720-3162
Fax: 405/720-4101
E-mail: ray.bishop@deq.state.ok.us

NOAA
Marc Pitchford *
c/o Desert Research Institute
755 E. Flamingo Road
Las Vegas, NV 89119-7363
Telephone: 702/895-0432
Fax: 702/895-0507
E-mail: marcp@snsc.dri.edu
* Steering Committee chair

NPS
William Malm
Colorado State University
CIRA - Foothills Campus
Fort Collins, CO 80523
Telephone: 970/491-8292
Fax: 970/491-8598
E-mail: malm@cira.colostate.edu

FWS
Sandra Silva
Fish and Wildlife Service
P.O. Box 25287
12795 W. Alameda
Denver, CO 80225
Telephone: 303/969-2814
Fax: 303/969-2822
E-mail: sandra_v_silva@nps.gov

WESTAR
Robert Lebens
9 Monroe Parkway
Suite 250
Lake Oswego, OR 97035
Telephone: 503/387-1660 ext.6
Fax: 503/387-1671
E-mail: blebens@westar.org

BLM
Scott Archer
Sciences Center (RS-140)
P.O. Box 25047
Denver, CO 80225-0047
Telephone: 303/236-6400
Fax: 303/236-3508
E-mail: sarcher@blm..gov

NESCAUM
Rich Poirot
VT Agency of Natural Resources
103 South Main Street
Building 3 South
Waterbury, VT 05676
Telephone: 802/241-3807
Fax: 802/244-5141
E-mail: richpo@dec.anr.state.vt.us

MARAMA
Charles O. Davis III
North Carolina Division of
Air Quality/Ambient Monitoring
1641 Mail Service Center
Raleigh, NC 27699-1641
Telephone: 919/715-0664
Fax: 919/733-1812
E-mail: charles.o.davis@ncmail.net

ASSOCIATE MEMBERS

Associate Membership in the IMPROVE Steering Committee is designed to foster additional IMPROVE-comparable visibility monitoring that will aid in understanding Class I area visibility, without upsetting the balance of organizational interests obtained by the steering committee participants. Associate Member representatives are:

STATE OF ARIZONA
Darcy Anderson
Arizona Dept. of Environmental Quality
Air Quality Division
3003 North Central Avenue
Phoenix, AZ 85012-2905
Telephone: 602/207-7665
Fax: 602/207-2299
E-mail: anderson.darcy@ev.state.az..us

Government organizations interested in becoming Associate Members may contact any Steering Committee member for information.

PUBLISHED BY:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525

The IMPROVE Newsletter is published four times a year (February, May, August, & November) under National Park Service Contract CX-1270-96-006.

The IMPROVE Program was designed in response to the visibility provisions of the Clean Air Act of 1977, which affords visibility protection to 156 federal Class I areas. The program objectives are to provide data needed to: assess the impacts of new emission sources, identify existing human-made visibility impairments, and assess progress toward the national visibility goals as established by Congress.

To submit an article, to receive the IMPROVE Newsletter, or for address corrections, contact:

Air Resource Specialists, Inc.
Gloria S. Mercer, Editor
Telephone: 970/484-7941 ext.221
Fax: 970/484-3423
E-mail: info@air-resource.com

IMPROVE Newsletters are also available on the IMPROVE Web site at http://vista.cira.colostate.edu/improve/Publications/publications.htm, and on the National Park Service Web site at: http://www.aqd.nps.gov/ard/impr/index.htm

printed on recycled paper