INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

3rd Quarter 2007 | The IMPROVE Newsletter | Volume 16 / Number 3

Monitoring update

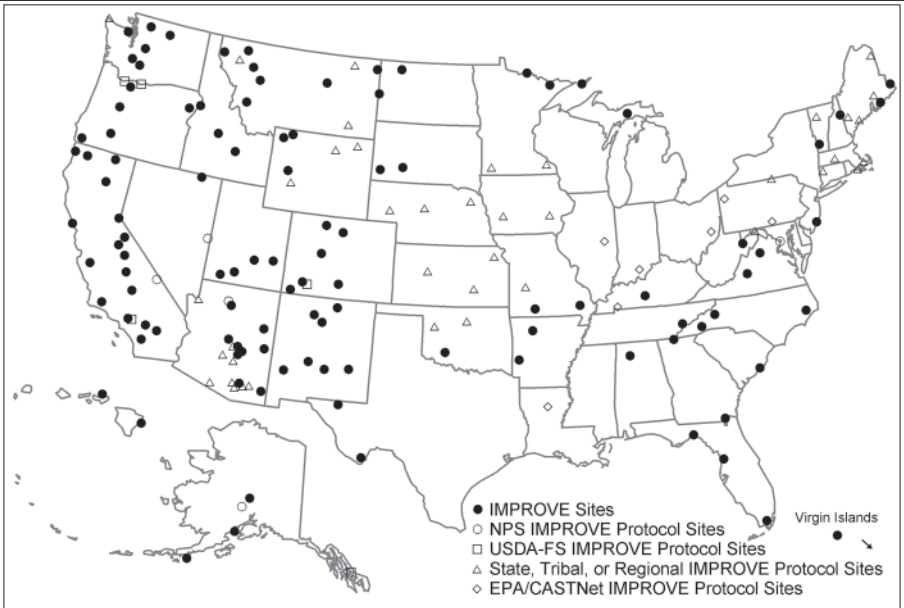
Feature Article:
IMPROVE: The early years, Page 4

Network operation status

The IMPROVE (**I**nteragency **M**onitoring of **Pro**tected **V**isual **E**nvironments) Program consists of 110 aerosol visibility monitoring sites selected to provide regionally representative coverage and data for 155 Class I federally protected areas. Additional instrumentation that operates according to IMPROVE protocols in support of the program includes:

- 58 aerosol samplers
- 6 transmissometers
- 31 nephelometers
- 7 digital or film camera systems
- 57 Webcamera systems
- 5 interpretive displays

IMPROVE Program participants are listed on page 8. Federal land management agencies, states, tribes, regional air partnerships, and other agencies operate supporting instrumentation at monitoring sites as presented in the map below. Preliminary data collection statistics for the 3rd Quarter 2007 (July, August, and September) are:



IMPROVE and IMPROVE Protocol Sites
3rd Quarter 2007

- Aerosol (channel A only) 94% collection
- Aerosol (all modules) 92% completeness
- Optical (transmissometer) 93% collection
- Optical (nephelometer) 96% collection
- Scene (photographic) 97% collection
  (does not include Webcameras)

The Central Regional Air Planning Association (CENRAP) ended nephelometer monitoring at three sites in the region due to funding shortfalls. Cedar Bluff State Park, KS; Nebraska National Forest, NE; and Wichita Mountains National Wildlife Refuge, OK; all ended monitoring September 1, 2007.

Data availability status

Data are available on the IMPROVE Web site, at *http://vista.cira.colostate.edu/improve/Data/data.htm* and on the VIEWS Web site, at *http://vista.cira.colostate.edu/views*. Aerosol data are available through November 2006. Transmissometer and nephelometer data are available through December 2006 and June 2007 respectively.

Photographic slide spectrums are also available on the IMPROVE Web site, under *Data*. Real-time Webcamera displays are available on agency-supported Web sites:

- National Park Service
  http://www2.nature.nps.gov/air/WebCams/index.htm
- USDA-Forest Service
  http://www.fsvisimages.com
- CAMNET (Northeast Camera Network)
  http://www.hazecam.net
- Midwest Haze Camera Network
  http://www.mwhazecam.net
- Wyoming Visibility Network
  http://www.wyvisnet.com
- Phoenix, AZ, Visibility Network
  http://www.phoenixvis.net

***Monitoring update** continued on page 3....*

Visibility news

IMPROVE annual meeting draws crowd to Four Corners region

The IMPROVE Steering Committee met in Durango, CO, in September to discuss the status and operations of the program. The committee meets annually to exchange ideas and learn about monitoring innovations, current data analyses, and research projects.

This year's meeting also included talks from oil and gas industry representatives and local hydrologists during a tour of the Shamrock Mines IMPROVE Protocol monitoring site. The USDA-Forest Service monitors air quality at the site using an IMPROVE four-module aerosol sampler, ozone and nitrogen oxides analyzers, meteorological sensors, and a high-resolution digital camera system. The Weminuche Wilderness and Mesa Verde National Park monitoring sites are also nearby.

Durango was selected as the meeting location due to the fast-growing oil and gas industry in the Four Corners area, the number of existing and proposed power plants in the region, and the increased interest of residents about the local air quality impacts of development.

Meeting minutes and presentations from this and all past meetings can be found on the IMPROVE Web site, at *http://vista.cira.colostate.edu/improve/Activities/activities.htm*.

IMPROVE meeting participants listen to Shamrock Mines site operator Brian Parker discuss current ozone levels. An ambient air quality shelter is on the left and the IMPROVE sampler shelter is on the right.

Aerosol samplers to receive new firmware

UC-Davis will soon deploy a new version of IMPROVE aerosol sampler firmware at all monitoring sites. The controller module firmware is software in the controller module that handles all functions of sampler operation including pump and solenoid control, timing, keypad and display interface, and status log and data file updates.

The primary goals of the development were to increase the operational reliability of the sampler and add additional features useful for future studies. The new firmware addresses memory corruption and datalogging problems present in the previous version, logs the actual sample start and end times, updates the format and content of status and data files, and allows configuration and schedule files to be included on the compact flash cards for running special studies without changing settings from the keypad. The new version uses modular programming techniques to improve reliability and simplify future firmware updates.

For more information contact Chuck McDade at the University of California-Davis. Telephone: 530/752-7119. Fax: 530/752-4107. E-mail: mcdade@crocker.ucdavis.edu.

A&WMA spring specialty conference scheduled with stargazing event

The Air & Waste Management Association (A&WMA) Aerosol & Atmospheric Optics Conference is scheduled for April 28 through May 2, 2008, in Moab, UT. Air Resource Specialists plans to sponsor an astronomy night during the conference with one or more large amateur telescopes. Join us for a night of stargazing and refreshments under the clear, dark skies of Utah -- weather permitting.

Take advantage of this excellent opportunity to catch close-up views of Saturn, the Moon's craters, star clusters, nebulas, and galaxies. More information on when and where will be available as the date draws nearer.

This specialty conference is co-sponsored by the A&WMA and the American Association for Aerosol Research (AAAR).

For more information on the conference contact Kristi Gebhart at the National Park Service. Telephone: 970/491-3684. Fax: 970/491-8598. E-mail: Gebhart@cira.colostate.edu.

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, and November) under National Park Service Contract C2350064025. To submit an article, to receive the IMPROVE Newsletter, or for address corrections, contact:

Gloria S. Mercer, Editor
Telephone: 970/484-7941 ext.221
Fax: 970/484-3423
E-mail: IMPROVEnews@air-resource.com

IMPROVE Newsletters are also available on the IMPROVE Web site at *http://vista.cira.colostate.edu/improve/Publications/news_letters.htm.*

printed on recycled paper

....Of interest to operators

IMPROVE field operations benefit from independent audits of the samplers conducted by the EPA and state and local agencies. Below is an outline of issues that have been identified during audits conducted in 2005 and 2006. It includes only those issues that are under the control of the site operator. By making site operators aware of these findings, they have an opportunity to improve the overall quality of the field operations.

Site Conditions

- Siting issues - generally a tree that has grown beyond the acceptance criteria
- Melting ice on the tops of sampler module boxes

Safety Issues

- Inadequate railings
- Inadequate space to service samplers and modules
- Electrical connections (extension cords) exposed to wet conditions or in standing water (should be permanent service with GFCI protection)
- Vermin present such as venomous spiders and snakes

Operator Errors - Make sure filters are handled with proper procedures, e.g.:

- Keep filter side down when loading and unloading and cap the cassettes immediately upon removal
- If cartridge is dropped, report it on the Field Data Sheet
- Module and controller boxes should be kept clean

Operator Observations

- Insect infestations in spring and summer, e.g., mud daubers in sampler inlet, flies in the module or released from cassette upon removal, and spider webs
- Rodent infestation in fall and winter - chew wires and tubing
- Calibration plug seated (at bottom of T-fitting where the inlet tube comes in) in every module, checked at each filter exchange
- Temperature checked at each setup to assure it is within 10° Celsius of outdoor temperature
- Clocks should be reset when they vary by ±5 minutes or more from a cell phone's time

Monitoring update *continued from page 1....*

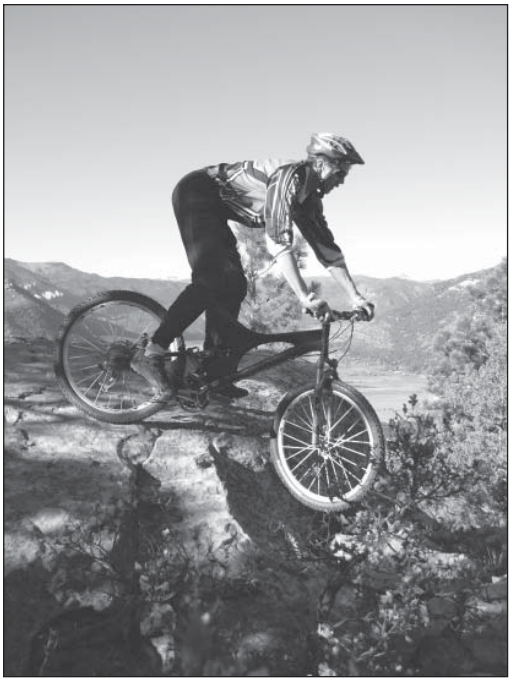
Operators of distinction

IMPROVE operator Brian Parker has worked on many projects during his tenure with the USDA-Forest Service (USDA-FS). His job as a biological science technician in natural resources entails maintaining both the Weminuche Wilderness IMPROVE site and the Shamrock Mines IMPROVE protocol site, near Durango, CO.

Brian helped install the Weminuche site in 1988 and was backup operator when it was one of the first IMPROVE sites in the program. He also assisted with site selection and installation of the Shamrock Mines site, which includes an IMPROVE sampler and other monitoring instrumentation.

While attending college in 1974, Brian began working for the USDA-FS as a seasonal employee. In the early 1980s, he worked for both the USDA-FS and the Bureau of Land Management (BLM) as part of a combined management pattern now used in the San Juan Public Lands Center in Durango. He currently supports air quality programs for the USDA-FS and oil and gas programs for the BLM's Minerals Division.

Brian has lived in the Four Corners area for many years, and loves to explore its various recreation opportunities. Be it mountain biking, hiking/backpacking, or skiing, Brian takes along a digital camera to record his excursions. His wife, Sally, often accompanies him on his expeditions, which also include snowmobiles, motorcycles, or four-wheel-drive vehicles.



Biological Science Technician and IMPROVE operator Brian Parker explores the abundant outdoor recreational opportunities in southwest Colorado, near the Weminuche Wilderness.

Monitoring update continued on page 7....

Feature article

IMPROVE: The early years

A look back at the first years of the IMPROVE Program, from 1985 - 1992

Introduction

Based on founding research, the IMPROVE Program sprouted from an idea and a concept in 1985, and became an operational reality in 1988. This article is the first of four installments that will journey back over the 20 years since the network has been an integral piece of a long-term monitoring effort to protect our nation's visibility resource.

The concept and the acronym

In 1977, amendments to the Clean Air Act stipulated the federal government must begin protecting visibility in federal Class I designated areas. To do this, the U.S. Environmental Protection Agency (EPA) in 1985 established Federal Implementation Plans (FIPs) for states that had no adequate visibility protection in their State Implementation Plans (SIPs). The IMPROVE Program was established as part of these FIPs.

Federal Land Managers (FLMs) first met in July 1985 at the National Park Service offices in Fort Collins, CO. Objectives of this initial meeting were:

- To determine the viability and basis for an interagency visibility program,
- To develop an administrative approach for the program, and
- To review and expand upon the technical approach of the monitoring plan.

The FLMs at the meeting decided they would be responsible for operating such a long-term monitoring program, and the EPA would supplement the program with funding when possible. A steering committee comprised of representatives from each participating agency accepted the responsibility for the overall guidance, design, deployment, and operation of the program.

In 1986, EPA's financial contribution to the fledgling program was $480,000 and only one of the FLMs, the National Park Service had additional funds to contribute. The USDA-Forest Service, U.S. Fish and Wildlife Service (USFWS), and the Bureau of Land Management (BLM) had no funding to offer the program during its first two years, but promised to work on acquiring funding for the coming years. Representatives to the program in 1985 were: Marc Pitchford (EPA), Bill Malm (NPS), James Blankenship (USDA-FS), Ty Berry (USFWS), and Stan Coloff (BLM). Of these initial representatives, Marc Pitchford and Bill Malm still sit on the steering committee today, 20 years later. In 1991, regional organizations were added to the steering committee, including the State and Territorial Air Pollution Program Administrators (STAPPA), the Western States Air Resources Council (WESTAR), and the Northeast States for Coordinated Air Use Management (NESCAUM).

The program's goals and objectives were also set at this first meeting:

- To establish present visibility levels in Class I areas,
- To identify sources of existing human-made visibility impairment, and
- To document long-term trends for assessing progress toward meeting the long-term goal of no human-caused impairment of protected areas.

Because it was clearly apparent that this effort would be an interagency one, the word "interagency" would no doubt be associated with the program's official name and acronym. It was the EPA representative and steering committee chair, Marc Pitchford (who still holds the position), who at the very first committee meeting coined the acronym "IMPROVE: Interagency Monitoring of Protected Visual Environments.

Site selection process

At the initial steering committee meeting in 1985, after the administrative aspects of the newly named program were final, the FLMs then focused on how to get the monitoring program started. A site selection process began and it was widely accepted that only 20 to 50 sites could receive monitoring instrumentation due to available funding. Site selection criteria were made according to the order of importance of various site factors, and additional meetings to fine-tune the initial network were held three to four times during the first two years of the program. Twenty (20) sites were finally selected for monitoring (see Figure 1). The federally funded sites in the program would stay the course until late 1991, when additional funding was available to add 10 sites in the eastern U.S., which were to track the impacts of SO_2 reduction on acid rain levels. In 1992, state and regional organizations and FLMs added several IMPROVE Protocol sites, which supported the program yet were independent of steering committee responsibility (see Figure 2).

Figure 1. Map of the initial 20 sites selected for IMPROVE monitoring in 1988. The Eastern IMPROVE Network was established in 1991.

The network begins

The original 20 sites began collecting data in late 1987/ early 1988 with a 4-module aerosol sampler (see Figure 3). By 1991, 15 sites also had a transmissometer, 2 had a nephelometer, and all 20 had an automatic film camera system (see Table 1). The 10 eastern IMPROVE network sites were configured with aerosol samplers and cameras.

At the onset, the steering committee approved an approach for contracting data operations of the program and divided these responsibilities into four contracts: optical and scene visibility monitoring and analysis, aerosol sampling and analysis, carbon analysis, and ion analysis. The National Park Service assumed responsibility for administering the contracts. Twenty years later, the initial contractors have competitively retained responsibilities for their parts of the program:

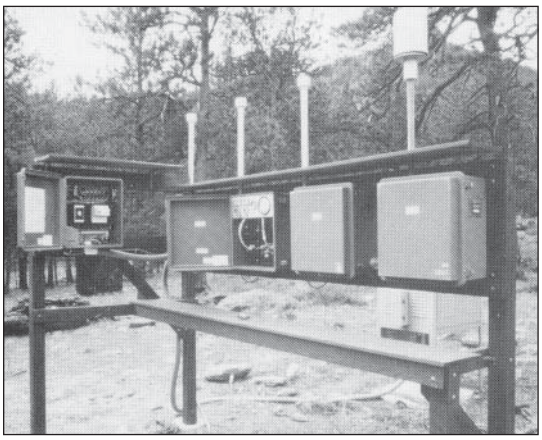
Air Resource Specialists, Inc. in Fort Collins, CO, is the optical and scene contractor; UC-Davis in Davis, CA, is the aerosol monitoring contractor; Desert Research Institute in Reno, NV, is the carbon analysis contractor; and Research Technical Institute in Research Triangle Park, NC, is the ion analysis contractor.

Data were delivered to the IMPROVE committee on a quarterly basis, according to standard meteorological seasons: Winter (December, January, and February), Spring (March, April, and May), Summer (June, July, and August), and Fall (September, October, and November). The National Park Service developed the first comprehensive trends IMPROVE report in 1992, "Spatial and Temporal Patterns and the Chemical Composition of the Haze in the United States: An Analysis of Data from the IMPROVE Network, 1988-1991."

The early years continued on page 6....

Figure 2. Map of the IMPROVE Protocol monitoring sites that joined the network in 1992.

The early years continued from page 5....



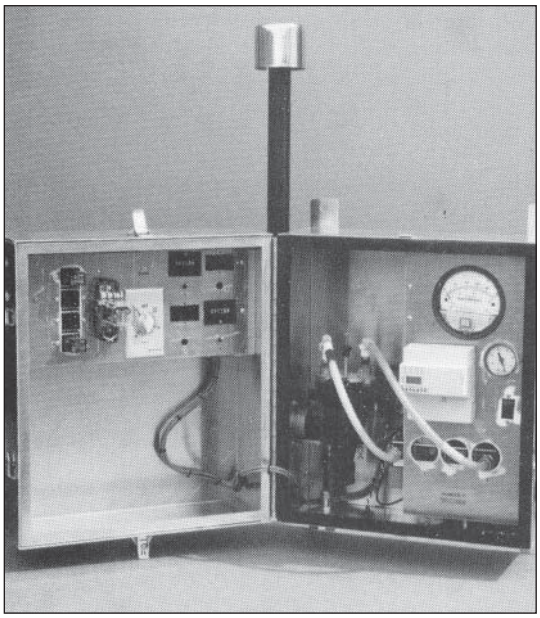


Figure 3 (a, b). The original (Version I) IMPROVE four-module aerosol sampler.

Table 1. IMPROVE Monitoring Site Configuration (as of December 31, 1991)

Site Name	Aerosol Sampler	Transmis-someter	Nephe-lometer	Automatic Cameras	
				35mm	8mm
Original IMPROVE Monitoring Sites					
Acadia NP	1	1		1	
Big Bend NP	1	1		1	
Bridger W	1	1		1	
Bryce Canyon NP	1			3	
Canyonlands NP	1	1		1	
Chiricahua NM	1	1		1	
Crater Lake NP	1	1*		1	
Denali NP	1			1	
Glacier NP	1	1		1	
Grand Canyon NP	1	2		1	
Great Smoky Mountains NP	1		1	1	
Jarbidge W	1			1	
Mesa Verde NP	1	1		1	
Mount Rainier NP	1		1	1	
Rocky Mountain NP	1	1		1	
San Gorgonio W	1	1		1	
Shenandoah NP	1	1		1	1
Tonto NM	1	1		1	
Weminuche W	1			1	
Yosemite NP	1	1		1	
Eastern IMPROVE Network					
Brigantine W	1			1	
Boundary Waters W	1			1	
Cape Romain NWR					
Dolly Sods W	1			1	
Linville Gorge W				1	
Lyebrook W	1			1	
Mammoth Cave NP	1				
Okefenokee NWR	1				
Sipsey W					
Upper Buffalo W	1			1	
TOTAL	27	15	2	28	1

* Summer-only monitoring

Special studies

In addition to operating a long-term, standard monitoring program, the IMPROVE program also was involved in many special research studies to assess visibility impacts on Class I areas. Early special studies during these first years of the program were:

- WHITEX – Winter Haze Intensive Tracer Experiment - an intensive study from 1987-1990 of visibility impacts of emissions from the Navajo Generating Station. Data from this period supported an EPA ruling to require the generating station to install SO_2 controls.
- Moosehorn – a photographic monitoring study involving 35mm still-frame and 8mm movie cameras of plume impacts from a nearby pulp and paper mill on the Moosehorn NWR.
- PREVENT – Pacific Northwest Regional Visibility Experiment using Natural Tracers - an intensive study in 1990 of visibility causes and effects in Washington, west of the Cascades.
- Shenandoah – a study in 1991 of eastern aerosols and their effect on visibility under high relative humidity conditions.
- Project MOHAVE – Measurement of Haze and Visual Effects - an intensive study in 1992 of visibility impacts of emissions from the Mojave Generating Station.

Next time

The Premier Issue of The IMPROVE Newsletter appeared in March 1992, at the end of this initial period in the program. The newsletter has been a source of relevant information, news, and articles of interest on a quarterly basis since then. In the next issue of this newsletter we'll look at the next five years, 1993-1997 and the expansion and development of the program.

Monitoring update *continued from page 3 ....*

Outstanding sites

Data collection begins with those who operate, service, and maintain monitoring instrumentation. IMPROVE managers and contractors thank all site operators for their efforts in caring for IMPROVE and IMPROVE Protocol networks. Sites that achieved 100% data collection for 3rd Quarter 2007 are:

Aerosol (Channel A)

Acadia	Frostburg Reservoir	Organ Pipe
Addison Pinnacle	Great Gulf	Penobscot
Arendtsville	Haleakala Crater	Presque Isle
Badlands	Hawaii Volcanoes	Quaker City
Bliss	Hercules-Glades	Rocky Mountain
Blue Mounds	Hoover	San Gabriel
Bondville	Ike's Backbone	San Rafael
Cabinet Mountains	Isle Royale	Seney
Caney Creek	Kalmiopsis	Sequoia
Canyonlands	Lassen Volcanic	Shenandoah
Cape Romain	Lostwood	Snoqualmie Pass
Cedar Bluff	Makah	St. Marks
Chassahowitzka	Martha's Vineyard	Starkey
Cherokee	Meadview	Three Sisters
Columbia Gorge East	Medicine Lake	Trapper Creek-Denali
Columbia Gorge West	M.K. Goddard	Tuxedni
Crater Lake	Mohawk Mountain	Upper Buffalo
Crescent Lake	Moosehorn	Washington D.C.
Dolly Sods	Mount Baldy	White River
Douglas	Mount Hood	Yosemite
Flathead	Mount Rainier	Zion Canyon
Fresno	New York	

Transmissometer

Cloud Peak	Thunder Basin

Nephelometer

Cloud Peak	Grand Canyon (Hance)	Ike's Backbone
Craycroft	Grand Canyon (Indian Gardens)	Sierra Ancha

Photographic

Agua Tibia	Grand Canyon	Shamrock Mines
Bryce Canyon	Monture	

Monitoring Site Assistance:

Aerosol sites: contact University of California-Davis telephone: 530/752-7119 (Pacific time)

Optical/Scene sites: contact Air Resource Specialists, Inc. telephone: 970/484-7941 (Mountain time)

Sites that achieved at least 95% data collection for 3rd Quarter 2007 are:

Aerosol (Channel A)

Big Bend	Livonia	Quabbin Reservoir
Birmingham	Mammoth Cave	Sac and Fox
Bryce Canyon	Monture	Saguaro
Egbert	Mount Zirkel	San Gorgonio
Ellis	Nebraska	Sikes
Fort Peck	North Cascades	Tallgrass
Glacier	Okefenokee	Theodore Roosevelt
Great River Bluffs	Olympic	Thunder Basin
Great Sand Dunes	Phoenix	Viking Lake
Great Smoky Mtns.	Point Reyes	Voyageurs
Hells Canyon	Proctor Research Cntr	White Pass
James River	Puget Sound	Yellowstone
Linville Gorge		

Transmissometer

Grand Canyon -S Rim	San Gorgonio

Nephelometer

Big Bend	Mount Rainier	Queen Valley
Chiricahua	National-Capital	Shenandoah
Dysart	Central Organ Pipe	Thunder Basin
Estrella	Petrified Forest	Tucson Central
Great Smoky Mtns.	Phoenix	Vehicle Emissions
Mammoth Cave		

Photographic

Gates of the Mountains

Sites that achieved at least 90% data collection for 3rd Quarter 2007 are:

Aerosol (Channel A)

Bandelier	Indian Gardens	Pinnacles
Bridger	Jarbidge	Salt Creek
Bridgton	Joshua Tree	Shamrock Mines
Brigantine	Lake Sugema	Sipsey
Cadiz	Lava Beds	Sula
Capitol Reef	Mesa Verde	Swanquarter
Casco Bay	Mingo	Sycamore Canyon
Chiricahua	Northern Cheyenne	Tonto
Denali	Omaha	Weminuche
Grand Canyon	Pasayten	White Mountain
Guadalupe Mountains	Petersburg	Wichita Mountain
Haleakala	Petrified Forest	Wind Cave

Transmissometer

--none--

Nephelometer

Acadia	Children's Park	Tucson Mountain
Boulder	Greer	Upper Buffalo
Cape Romain	Mount Zirkel	

Photographic

--none--

IMPROVE

The IMPROVE Newsletter

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.

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@epa.gov

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

USDA-FS
Rich Fisher
USDA-Forest Service Air Program
2150A Centre Avenue
Fort Collins, CO 80526
Telephone: 970/295-5981
Fax: 970/295-5988
E-mail: rwfisher@fs.fed.us

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

BLM
Scott F. Archer
USDI-Bureau of Land Management
National Science and Technology Center
Denver Federal Center, Building 50
P.O. Box 25047, ST-180
Denver, CO 80225-0047
Telephone: 303/236-6400
Fax: 303/236-3508
E-mail: scott_archer@blm.gov

MARAMA
David Krask
Maryland Dept. of the Environment
MARAMA/Air Quality Planning and Monitoring
1800 Washington Blvd.
Baltimore, MD 21230-1720
Telephone: 410/537-3756
Fax: 410/537-4243
E-mail: dkrask@mde.state.md.us

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: rich.poirot@state.vt.us

WESTAR
Robert Lebens
715 SW Morrison
Suite 503
Portland, OR 97205
Telephone: 503/478-4956
Fax: 503/478-4961
E-mail: blebens@westar.org

NACAA
Terry Rowles
MO Dept. of Natural Resources
Air Pollution Control Program
P.O. Box 176
Jefferson City, MO 65102-0176
Telephone: 573/751-4817
E-mail: terry.rowles@dnr.mo.gov

NOAA
Marc Pitchford *
c/o Desert Research Institute
755 E. Flamingo Road
Las Vegas, NV 89119-7363
Telephone: 702/862-5432
Fax: 702/862-5507
E-mail: marc.pitchford@noaa.gov
* Steering Committee chair

ASSOCIATE MEMBERS
Associate Membership in the IMPROVE Steering Committee is designed to foster additional comparable 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
Michael Sundblom
Manager, Air Monitoring Unit
ADEQ Air Assessment Section
1110 W. Washington Street
Phoenix, AZ 85007
Telephone: 602/771-2364
Fax: 602/771-4444
E-mail: sundblom.michael@azdeq.gov