INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

3rd Quarter 2010 | The IMPROVE Newsletter | Volume 19 / Number 3

Monitoring update

Feature Article: IMPROVE celebrates 25 years of monitoring visibility, 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. Instrumentation that operates according to IMPROVE protocols in support of the program includes:

- 57 aerosol samplers
- 20 nephelometers
- 2 transmissometers
- 70 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 2010 (July, August, and September) are:

- Aerosol (channel A only) 94% collection
- Aerosol (all modules) 93% completeness
- Optical (nephelometer) 96% collection
- Optical (transmissometer) 95% collection

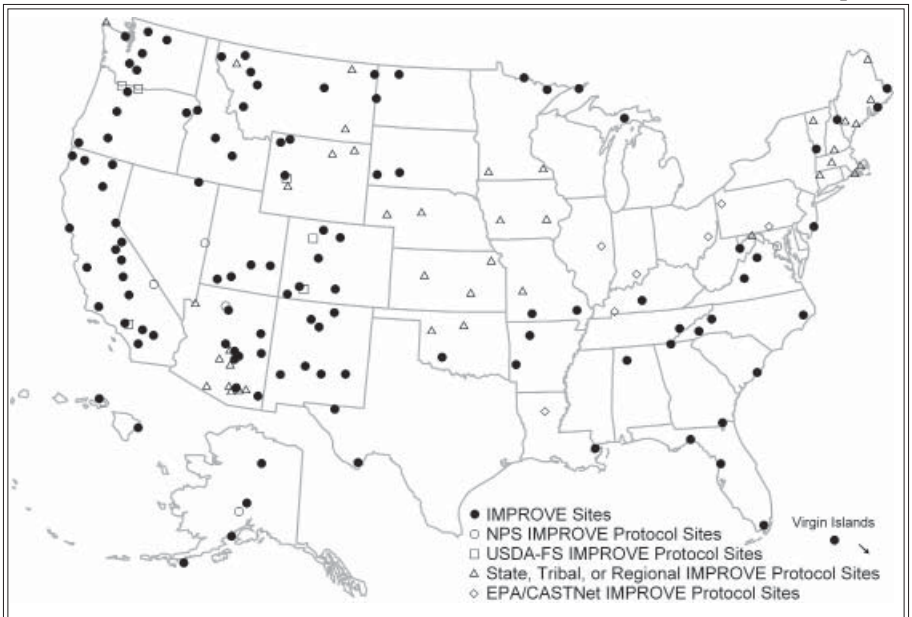
One aerosol monitoring site was decommissioned this quarter; Addison-Pinnacle State Park was an IMPROVE Protocol site operated by the state of New York, and had collected data since 2001.

Data availability status

Data and photographic spectrums 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 September 2009. Nephelometer and transmissometer data are available through June 2010 and December 2009, respectively. Webcamera real-time images and data are available on agency-supported Web sites:

- National Park Service
  http://www.nature.nps.gov/air/WebCams/index.htm
- US 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 Visibility Network
  http://www.phoenixvis.net

The EPA AIRNow Web site *http://airnow.gov* includes many of these as well as additional visibility-related Webcameras. Click on View Other Visibility Webcams.



IMPROVE and IMPROVE Protocol Sites
3rd Quarter 2010

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

Visibility news

Clean Air Act created 40 years ago

The Clean Air Act turned 40 this fall, and was commemorated in Washington D.C. "For 40 years the Clean Air Act has protected our health and our environment, saving lives and sparking new innovations to make our economy cleaner and stronger. The common sense application of the Act has made it one of the most cost-effective things the American people have done for themselves in the last half century," said EPA Administrator Lisa P. Jackson. "Since 1970 we have seen a steady trajectory of less pollution in our communities and greater economic opportunity throughout our nation. We will continue those trends as we face the clean air challenges of the next 40 years, including working to cut greenhouse gases and grow the American clean energy economy. The Clean Air Act proves the naysayers wrong – we can protect our health and environment at the same time we grow our economy."

The Clean Air Act was originally adopted in 1955, but it is popularly known as the Clean Air Act of 1970. The amendments made in 1970 created the basic component of the program as we know it today. Amendments in 1977 and 1990 made significant changes, but continued to build on the air program as designed in 1970.

The Clean Air Act has since:

- Prevented 18 million child respiratory illnesses.
- From 1990 through 2008, reduced emissions of six common pollutants by 41 percent, while the gross domestic product has grown by 64 percent.
- Since 1980, reduced lead levels in the air by 92 percent.
- Made new cars, light trucks, and heavy-duty diesel engines up to 95 percent cleaner than past models thanks to technology such as the catalytic converter.
- Made new, non-road engines used in construction and agriculture with 90 percent less particle pollution and nitrogen oxide emissions than previous models.
- Due to the Acid Rain Program, reduced damage to water quality in lakes and streams, and improved the health of ecosystems and forests. Acid deposition has decreased by more than 30 percent in much of the Midwest and Northeast since 1990 under a cap-and-trade program for power plants.
- Since 1990, reduced toxic emissions from industry by 1.7 million tons a year – many times the reductions achieved in the first 20 years of the Clean Air Act.
- Reduced skin cancer by protecting the ozone layer.

For more information visit: http://epa.gov/oar/caa/40th.html.

Andersson joins steering committee

Gordon Andersson has joined the IMPROVE Steering Committee, filling the National Association of Clean Air Agencies (NACAA) representative slot recently vacated by Terry Rowles, now retired. Andersson has worked in air quality at the Minnesota Pollution Control Agency since 1986, where he wrote state rules addressing abrasive blasting of lead paint on residential, childcare, and school buildings, followed by rules requiring pollution controls concerning lead paint removal from urban infrastructure.

Andersson has more recently worked with fine particulates ($PM_{2.5}$), ozone, and regional haze issues, and was active on the Central Regional Planning Association (CENRAP) Monitoring Committee, as well as the EPA/Regional Planning Organization Monitoring & Data Analysis discussion group. He has worked on prescribed fire and wildfire issues since 2000 and completed the Minnesota Smoke Management Plan in 2001 with state and federal land managers. Since 2009 he has been a NACAA representative on the National Wildfire Coordinating Group Smoke Committee (NWCG SmoC). In addition, he is responsible for state non-attainment designation and is working with Minnesota Pollution Control Agency staff to address $PM_{2.5}$ attainment.

Andersson became familiar with the IMPROVE network while working with the regional haze rules.

Gordon Andersson can be contacted at the Minnesota Pollution Control Agency. Telephone: 651/757-2197. E-mail: gordon.andersson@state.mn.us.

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

Update on PM urban visibility standard

EPA completed their last review of the Particulate Matter (PM) National Ambient Air Quality Standard (NAAQS) in 2006 and are scheduled to complete a new review next year. This nearly completed review includes an assessment of whether a secondary PM NAAQS should be implemented to reduce the welfare effects of poor urban visibility.

This secondary PM NAAQS would have indicator, averaging time, and form that are more appropriate to visibility effects than is the current PM NAAQS, which is based on 24-hour averaged $PM_{2.5}$ mass. The indicator being considered is speciated $PM_{2.5}$ mass-calculated light extinction during daylight hours. One part of the assessment conducted by EPA involved generating an hourly PM light extinction for 15 urban areas over 3 years using PM measurements, with which they showed the effectiveness of PM light extinction versus PM mass concentration as a visibility indicator. One of the primary reasons for this result is that PM light extinction incorporates the effects of relative humidity on the visibility impairment by particle, while PM mass concentration does not.

While EPA recognizes that directly measured PM light extinction would be a superior indicator for a visibility-based PM NAAQS, they do not have a Federal Equivalent Method (FEM) or Federal Reference Method (FRM) for measuring light extinction. Speciated $PM_{2.5}$ mass-calculated light extinction estimates would be determined using a version of the IMPROVE algorithm with hourly $PM_{2.5}$ mass from continuous FEM monitors, hourly relative humidity from continuous instruments, and monthly averaged composition to determine the dry and moist light extinction efficiency from collocated Chemical Speciation Network samplers.

EPA used results from urban visibility studies as the basis for a range of light extinction that would be used in a secondary PM NAAQS. A range from about 65 Mm^{-1} to 190 Mm^{-1} was acceptable by study participants who viewed scenes with a wide range of haze conditions. A proposed rule on the visibility standard is expected February 2011. For more information, see *http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html*.

For more information contact Marc Pitchford at NOAA. Telephone: 702/862-5432. Fax: 702/862-5507. E-mail: marc.pitchford@noaa.gov.

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

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

Operators of distinction

IMPROVE site operator Shannon Reed has been an Air Quality Specialist for Grand Canyon National Park for just under a year, but working with air quality is nothing new to her. She maintains five air quality stations, two of which, Hance and Indian Gardens, operate an IMPROVE aerosol sampler and a nephelometer. The other three, The Abyss, Yavapai Observatory, and Phantom Ranch, are equipped with various instrumentation that includes a transmissometer, a Webcamera, and an air quality exhibit for visitors. Because station operation is her responsibility, Shannon is quick to note a problem and will visit the sites any time needed to attain the highest sample collection possible.

"My site visits to Indian Gardens are always eventful. I tell everybody it is 4-1/2 miles down to Indian Gardens and 4-1/2 back up. I never know what is going to happen on the trail – I've helped a visitor with a broken arm, a visitor with a broken leg, and even a visitor having a heart attack," said Shannon. "Last week it rained the entire trip, the minute I stepped off the trail, the clouds parted and it looked like it didn't even rain," said Shannon.

Before coming to Grand Canyon, Shannon studied air quality at the University of Arizona and maintained two air quality sites. Prior to that she spent 10 years with the Texas Commission on Environmental Quality (TCEQ), where she ran meteorological models in support of the state implementation plans and held various positions as a continuous air monitor auditor for 288 sites, as well as a State Lead Program Manager, managing cleanup of dry cleaners, petroleum storage tanks, and state/federal superfund sites.

Shannon holds a B.S. degree in meteorology from Texas A&M University and is currently working towards an M.S. degree in environmental management from the University of Maryland. Her personal interests parallel her career interests, as she likes to hike and teach others about environmental concerns. She recently taught an air quality class for second-graders, and junior high school and high school students. "I showed them how the instruments worked with hands-on demonstrations. I think the kids really enjoyed going out to the Abyss site and learning about air quality," said Shannon.

Shannon Reed, IMPROVE site operator at Grand Canyon National Park, enjoys protecting the environment and experiencing it outdoors.

Monitoring update *continued on page 7....*

Feature article

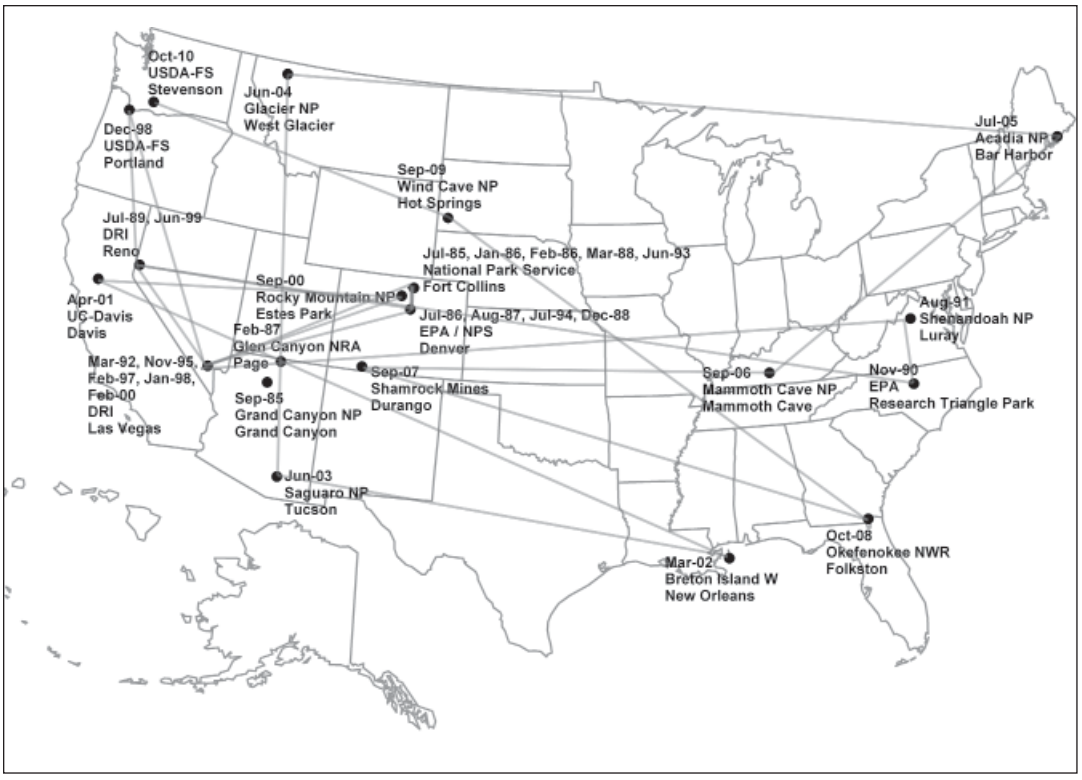
IMPROVE celebrates 25 years of monitoring visibility through interagency program

Introduction

The IMPROVE Steering Committee held their annual meeting in the beautiful Columbia River Gorge National Scenic Area, WA, last month. In addition to presentations and discussions of the regular topics concerning operational status of the program, administrative issues, research elements, and future goals and objectives, the meeting was a celebration of the program's 25-year history.

History of IMPROVE -- initiating a monitoring program

The impetus for the IMPROVE Program lies with the 1977 amendments to the Clean Air Act that lead to Environmental Protection Agency (EPA) promulgation of visibility regulations in 1980, which required 35 states to address visibility impairment in their federal Class I areas (i.e., large national parks and wilderness areas) that is found to be reasonably attributable to individual pollution sources. Most states did not do the requisite planning, so EPA was required to act in their place, and in 1985 they began planning a monitoring program as part of the Federal Implementation Plan for the phase 1 visibility regulations. From the beginning, EPA recognized the advantages of working cooperatively with the Federal Land Managers whose responsibilities included protecting air quality for the lands they managed and have staff in these remote area locations that could operate the monitoring sites. Early discussions among the Federal Land Managers and EPA confirmed the interest by all parties in working jointly to plan, deploy, and operate a visibility monitoring program to support the implementation of Class I area visibility protection, and developed an administrative approach and technical plan. The Steering Committee included representatives from the Bureau of Land Management (BLM), National Park Service (NPS), United States Fish and Wildlife Service (USFWS), United States Forest Service (USFS), and the EPA. After the program operated comfortably for a few years, the Steering Committee approved its own expansion to include state representatives. The Western States Air Resources Council (WESTAR) and the Northeast States for Coordinated Air Use Management (NESCAUM) sought continuing involvement with the program and requested committee voting status.



Steering committee meetings are held in various IMPROVE monitoring locations across the U.S. A site visit is an integral part of each meeting, for the purpose of education and experience with the resources that are local to the area.

During the initial years, resources would only support the operations of a 20-site monitoring program despite there being 156 Class I areas. An important topic of the early Steering Committee meetings was the selection of highest priority locations to have monitoring. Also during this early period, contractors were solicited and selected by a competitive procurement process to operate the program and provide for visibility monitoring, aerosol sampling and analysis, carbon analysis, and ion analysis.

After the basics of a new program were developed, meeting topics switched from focus on the establishment of a network to providing data and related products such as reports and newsletters. Data were now submitted to EPA AIRS (now AQS) and 10 new sites were added to the networks in the eastern U.S. to track the effects of newly mandated SO_2 emission reductions.

The Steering Committee reflected on its 25-year history at the recent meeting in the Columbia River Gorge National Scenic Area, Washington. The Gorge is home to two IMPROVE Protocol sites.

Though never an official part of the routine IMPROVE network, a number of the member federal agencies were also involved in large special studies to attribute visibility to individual sources. As a result the IMPROVE Program became associated with and cooperated with these substantial monitoring and assessment studies. During the early years of IMPROVE these included the Winter Haze Intensive Tracer Experiment (WHITEX), the Pacific Northwest Regional Visibility Experiment using Natural Tracers (PREVENT), and the Measurement of Haze and Visual Effects (MOHAVE).

Meeting attendees at the Columbia River Gorge listen in on two days of technical presentations.

The Nineties in full swing

During the 1990s and well into IMPROVE's 25-year history, the program exploded in size and scope to fulfill new policy, regulation, and needs. It was during this time that the EPA developed an approach to regional haze (using the deciview metric on the 20% most and 20% least hazy conditions to track and report visibility). In support of the anticipated Regional Haze Regulations, EPA also proposed a major expansion of the aerosol network from 30 sites to 110 sites. The sampling schedule was changed from twice weekly to the more conventional every third day used by other EPA programs. This required the development and implementation of a new computer-controlled sampler (IMPROVE Version II).

The steering committee expanded yet again to include the Mid-Atlantic Regional Air Management Association (MARAMA) as a voting party, and the state of Arizona became an Associate Member of the committee.

The millennium brings changes

Beginning in 2000, the committee met regularly on an annual basis, as members acknowledged the importance of face-to-face discussions and relationships with committee members and contracted staff who operate the networks. These meetings also include a monitoring site visit, where local IMPROVE site operators inform the group about their job and the air quality and resource concerns of these areas.

The program formally identified data recovery and completeness goals as dictated by the Regional Haze Regulations, to further improve the collected data and their validity. An independent field and lab audit program was also developed. Film-based cameras have long been gone in the scene network, but the use of digital photography for documenting visibility conditions became widespread. A focus on data analysis methods was studied, and a revision to the algorithm for estimating extinction from aerosol composition was a major discussion topic. Outreach products included development of the IMPROVE Web site and yearly calendars that indicated sample days and provided site operators with valuable information about site and network operations.

Reflection

A portion of the recent meeting was reserved for reflection on the 25 years of the program and how far it has come. Various presentations documented the scope, depth, and breadth of the program, including its development, changing

Anniversary continued on page 6....

Anniversary continued from page 5....

instrumentation, and the many people involved who are vital to the operation of the far-reaching, national network.

To commemorate the program and its milestone, IMPROVE is making available a selection of embroidered and silk-screened wearing apparel. Included in this newsletter is an order form for purchase of a selection of shirts, outerwear, and hats. Have your order sent by December 10, 2010.

To show our appreciation of the essential work the IMPROVE site operators perform in the networks, site operators will be given a voucher in their next shipment of filters to receive a cap or t-shirt of their choice.

For more information contact Gloria Mercer at Air Resource Specialists, Inc. Telephone: 970/484-7941. Fax: 970-484/3423. E-mail: gmercer@air-resource.com.

Visibility news

continued from page 3 ....

There's an app for that -- Scientists develop smartphone visibility app

In the 1970s, historic airport visual range data collected by human observers as far back as the 1940s was the first large scale database examined by researchers to estimate visibility trends in the U.S. In the 1980s, contrast photometry of natural targets using teleradiometers, 35mm color slides, and digital imagery was used to make more accurate visibility measurements. In the 1990s, all these techniques were replaced by much more accurate optical monitoring instrumentation such as transmissometers and nephelometers. However, the systematic adoption of new and more expensive visibility monitoring instrumentation and the complete phasing out of human airport visual range observations has resulted in a massive reduction in locations where visual air quality observations are currently made.

Computer scientists at the University of Southern California (USC) Viterbi School of Engineering have released an Android smartphone application called Visibility, that may enable the general public to create a database that qualitatively documents our nation's visual air quality. App(lication) users snap an image of the sky from their phone's camera. The camera then sends the image to a database at USC, where computers analyze it to estimate visual air quality and aerosol concentration at the time and location of the image. The hope is that as the number and geographic diversity of images collected grows, a database similar to historic airport estimated visibility by human observers will be created.

The USC team developed an algorithm that employs estimates of the calibration (optical and geometric) parameters of the phone's camera to extract an estimated sky radiance profile from the image. The camera's GPS location, compass direction it was pointing, and time the image was captured, are input to a model that generates sky radiance profiles for a range of aerosol concentrations. Ambient aerosol concentration is estimated from the concentration used in the modeled sky radiance that best matches the estimated sky radiance captured by the phone.

To use the Visibility app, the user:

1) Points the camera towards the sky parallel to the ground.

2) Takes a photo and selects sky pixels (cropping out the ground).

3) Rates visibility.

4) Uploads the image (see Figure 1).

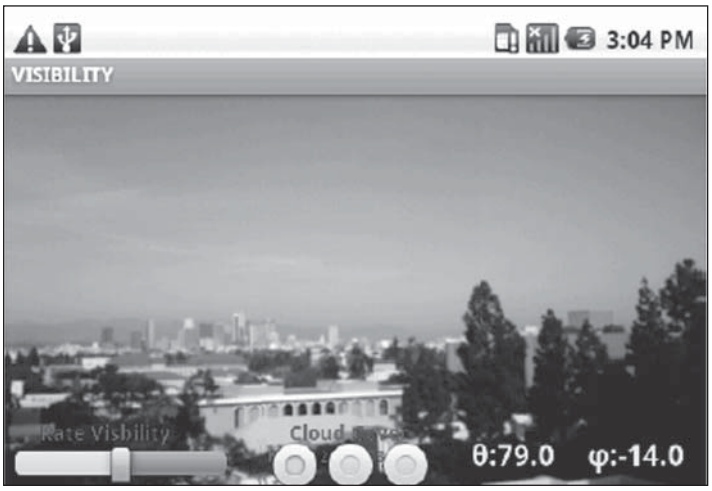


Figure 1. Example Visibility app capture screen with user input options.

Initial results from images gathered in Phoenix, AZ, and the Los Angeles Basin, CA, qualitatively compare favorably to air quality data published by the EPA. However, there are large uncertainties associated with: (1) accurately knowing the camera calibration parameters, (2) how well the aerosol optical properties (size, shape, and composition) and spatial distribution used in the model match true ambient aerosol characteristics, and (3) the effect of cloudy sky conditions on the captured sky image. While the overall quality and utility of the data are yet to be determined, the widespread use of a smartphone visibility app is expected to have the overall benefit of introducing many more people to the topic of visual air quality.

For more information see the complete technical paper at http://robotics.usc.edu/~mobilesensing/visibility/MobileAirQualitySensing.pdf.

Short-sleeve Polo - K420 Pique Knit
100% cotton
Colors: Black, Navy, Dark Green, Stone (pictured) Light Blue, Red, Royal, White
$19.50

Long-Sleeve Polo - K500LS
65/35 poly/cotton
Colors: Black, Cool Gray (pictured), Dark Green, Navy, Stone, White
$21.00

T-Shirt - PC61
100% cotton
EMBROIDERED
Colors: Ash, Black, Cardinal, Charcoal, Dark Green (pictured), Light Blue, Light Sand, Navy, Royal, White
$9.50

T-Shirt - PC61
100% cotton
SILK-SCREENED
Colors: White $7.50
Ash $8.25
Light Blue (pictured) $8.75
Light Sand $8.75
Black, Cardinal, Charcoal, Dark Green, Navy, Royal
$10.00

Baseball cap - CP80
100% cotton twill
Colors: Black, Hunter Green, Khaki, Maroon, Navy, Orange (pictured), Red, Royal
$8.50

IMPROVE logo is embroidered on all items except as noted
(approx. 3"wide x 2 1/4" high).

Logo is silk-screened on t-shirt
(approx. 8" across).

Easy Care Work shirt - S608
55/45 cotton/poly
Colors: Black, Burgandy, Navy, Dark Green, Light Blue (pictured), Royal, Stone, White
$21.00

Sweatshirt - PC90
50/50 cotton/poly
Colors: Ash, Black, Cardinal, Dark Green, Maroon, Navy (pictured), Royal, White
$16.00

Fleece Vest - JP79
100% poly fleece
Colors: Black, Dark Green, Grey Heather (pictured), Midnight Heather, Navy, Red, Royal
$27.00

Hooded Pullover - PC90H
50/50 cotton/poly
Colors: Ash, Black, Cardinal (pictured), Dark Green, Maroon, Navy, Royal, White
$22.00

Full-zip Sweatshirt - P180
50/50 cotton/poly
Colors: Ash, Black, Deep Forest, Deep Navy, Deep Royal (pictured), Maroon
$24.50

Name _____
Address _____
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Item	Color	Quantity	Size	Cost
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Order by December 10, 2010.

Send orders to / Questions? Contact Gloria Mercer at Air Resource Specialists, Inc.
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Telephone: 970/484-7941 Fax: 970/484-3423
E-mail: Gmercer@air-resource.com

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 2010 are:

Aerosol (Channel A) - 44% of all sites

Acadia	Haleakala Crater	Pack Monadnock
Arendtsville	Hawaii Volcanoes	Phoenix
Badlands	Hercules-Glades	Pinnacles
Birmingham	Indian Gardens	Point Reyes
Bliss	Isle Royale	Presque Isle
Boundary Waters	James River	Quaker City
Brigantine	Jarbidge	Queen Valley
Cabinet Mountains	Joshua Tree	Rocky Mountain
Cape Cod	Lake Sugema	Saguaro West
Cape Romain	Lassen Volcanic	Salt Creek
Cloud Peak	Lava Beds	San Gorgonio
Columbia Gorge East	Linville Gorge	Seney
Denali	Livonia	Sequoia
Dolly Sods	Martha's Vineyard	Shining Rock
Douglas	Mesa Verde	Sikes
El Dorado Springs	Mingo	Starkey
Ellis	Moosehorn	Sula
Everglades	Mount Hood	Swanquarter
Flathead	Mount Zirkel	Tallgrass
Fresno	Nebraska	Theodore Roosevelt
Frostburg Reservoir	North Cascades	Viking Lake
Glacier	Northern Cheyenne	White River
Great River Bluffs	Okefenokee	Wind Cave
Great Sand Dunes	Olympic	Yellowstone
Great Smoky Mtns.		Yosemite

Nephelometer - 35% of all sites

Children's Park	Estrella	Mount Rainier
Craycroft	Indian Gardens	Vehicle Emissions
Dysart		

Transmissometer - 50% of all sites

San Gorgonio

Monitoring Site Assistance:

Aerosol sites: contact University of California-Davis telephone: 530/752-1123 (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 2010 are:

Aerosol (Channel A) - 18% of all sites

Bandelier	Lostwood	San Pedro Parks
Boulder Lake	Makah	San Rafael
Bridgton	Mammoth Cave	Shamrock Mines
Cedar Bluff	Medicine Lake	Three Sisters
Chassahowitzka	Mohawk Mountain	Trapper Creek-Denali
Cherokee	North Absaroka	Tuxedni
Chiricahua	Pasayten	UL Bend
Death Valley	Puget Sound	Virgin Islands
Haleakala	Quabbin Reservoir	Voyageurs
Ike's Backbone	Sac and Fox	Wrightwood

Nephelometer - 40% of all sites

Acadia	Great Basin	Mammoth Cave
Big Bend	Great Smoky Mtns.	Shenandoah
Glacier		

Transmissometer - 0% of all sites

-- none --

Sites that achieved at least 90% data collection for 3rd Quarter 2010 are:

Aerosol (Channel A) - 22% of all sites

Big Bend	Kaiser	Sawtooth
Bondville	Kalmiopsis	Shenandoah
Breton	Lye Brook	Sipsey
Bryce Canyon	Meadview	Snoqualmie Pass
Canyonlands	MK Goddard	St. Marks
Casco Bay	Monture	Thunder Basin
Craters of the Moon	Mount Baldy	Tonto
Egbert	Mount Rainier	Trinity
Fort Peck	Organ Pipe	Weminuche
Gates of the Arctic	Penobscot	White Mountain
Guadalupe Mountains	Proctor Research Ctr.	White Pass
Hells Canyon	Saguaro	Wichita Mountain

Nephelometer - 20% of all sites

Cloud Peak	Rocky Mountain	Thunder Basin
Hance		

Transmissometer - 0% of all sites

-- none --

IMPROVE

The IMPROVE Newsletter

Air Resource Specialists, Inc.
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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.

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Fax: 303/969-5444
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BLM
Currently vacant

MARAMA
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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

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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
Currently vacant