INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

Volume 6. No. 1 **Winter 1997** **April 1997**

IMPROVE MONITORING UPDATE

Preliminary data collection statistics for the Winter 1997 season (December, January, and February) are:

Data Type	Collection Percentage
Aerosol Data	91%
Optical (transmissometer) Data	92%
Optical (nephelometer) Data	92%
Scene (photographic) Data	83%

Particulate data through November 1996 have been submitted for all measurements except carbon. Printed seasonal summaries including carbon have been distributed through March 1996.

VISIBILITY NEWS....

Grand Canyon enhances monitoring station

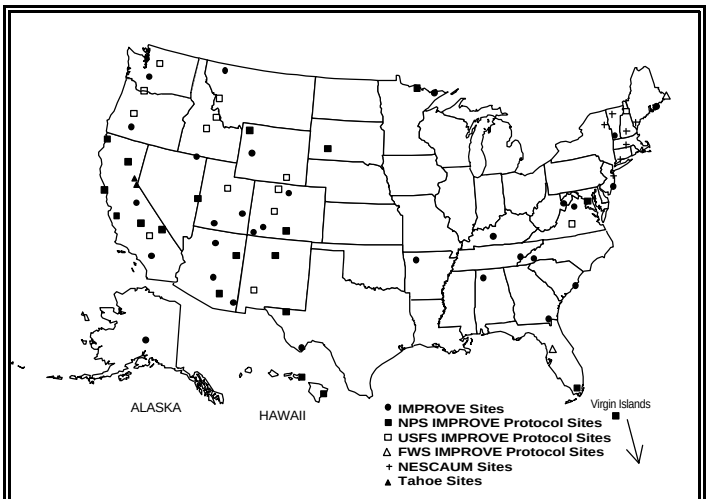
The visibility monitoring station at Grand Canyon National Park, Arizona, is being refurbished to allow for expanded monitoring and intensive study support. The new station, near Grandview Point, is scheduled to be operating by early May and will house an IMPROVE aerosol sampler (to be relocated from the Hopi Fire Tower), a nephelometer, and meteorological instruments. A transmissometer is also located less than ¼ mile away on the canyon's south rim. For more information, contact:

Carl Bowman
Grand Canyon National Park
Telephone: 520/638-7817

New technology basis for air quality exhibit

A new air quality interpretive display will be installed at Great Smoky Mountains National Park, Sugarlands Visitor Center. The unique exhibit will be linked to monitoring equipment at the Look Rock air quality station. The exhibit will include two computer display screens showing current visibility, ozone pollution, and weather conditions, as well as a realtime visibility image taken from the Look Rock Observation Tower. The display will allow park visitors to compare current conditions with long term averages and to better understand air quality issues in the park. The realtime image and data will also be available on NPS and EPA World Wide Web sites. According to park personnel, almost a million people visit the Sugarlands Visitor Center annually. The exhibit is scheduled to be completed by the end of summer. For more information, contact:

Jim Renfro
Great Smoky Mountains National Park
Telephone: 423/436-1708



IMPROVE and IMPROVE Protocol Sites
April 1997

$PM_{2.5}$ monitoring workshop coming soon

WESTAR (Western States Air Resources Council), in cooperation with the EPA, is sponsoring a $PM_{2.5}$ monitoring workshop to help state and local air agencies develop $PM_{2.5}$ monitoring networks. The National $PM_{2.5}$ Monitoring Workshop - Western Edition, will be held May 13-15, 1997, in Las Vegas, Nevada.

EPA staff and equipment vendors will be on hand to discuss the latest monitoring technology and hear about agency monitoring plans and concerns. The registration deadline for the workshop is April 28. For more information, contact:

John Core
WESTAR
Telephone: 503/220-1660

Preliminary FRM aerosol data now available

Preliminary results from the first few studies comparing the $PM_{2.5}$ Federal Reference Method (FRM) particulate sampler to the IMPROVE Module Aerosol Sampler are now available on the EPA World Wide Web site. Studies were performed in Birmingham, Alabama, Phoenix, Arizona, Denver, Colorado, and Bakersfield, California. The Web site is at:

http://134.67.104.12/html/caaa/t1pg.htm

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Feature Article

Evidence against sulfate artifact in desert environments

by Bob Eldred, Ph.D. and Tom Cahill, Ph.D., University of California-Davis

Environmental Science and Technology will publish a paper written by Bob Eldred and Tom Cahill of UC-Davis on the question of sulfate artifact in desert environments. The issue is whether SO_2 passing through a filter will interact with basic particles, such as alkaline soil, to produce a measurable sulfate artifact. Brigham Young University (BYU) has published several papers indicating that a very large artifact exists, based on data collected for Southern California Edison. BYU's conclusions are based on differences observed between two of their samplers, one that first removes SO_2 and one that does not. If true, this artifact would mean that all sulfate measurements using IMPROVE Module A would be too large by 20% to 100%.

Fortunately, IMPROVE measures sulfate on two filters, a nylon filter that follows a denuder that removes SO_2, and a Teflon filter that passes SO_2 through. UC-Davis laboratory measurements indicate that the denuder is about 98% efficient in removing SO_2, even at 25% relative humidity. By comparing these two sulfate measurement methods, UC-Davis was able to directly investigate whether or not a sulfate artifact exists in IMPROVE data. The left side of Figure 1 compares the denuded and non-denuded measurements taken by IMPROVE samplers at 11 desert southwest sites over a two-year period. The measurement uncertainties are displayed in the histogram on the right side of Figure 1. The line indicates that equal concentrations were measured on the denuded and non-denuded filter samples. If an artifact existed, the point would lie to the right of the line. It is evident that no visible artifact exists.

One way to analyze this in more detail is to examine the ratio of the difference divided by the uncertainty in the difference. The distribution of this ratio should follow a Gaussian or normal distribution. The right side of Figure 1 shows that the measured distribution is very close to the predicted distribution. If an artifact existed the distribution would be skewed to the right.

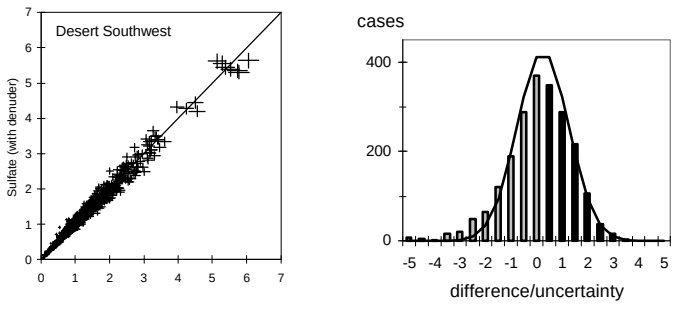

Figure 1. Comparison of sulfate concentrations in $\mu g/m^3$ measured by PIXE on Teflon with no denuder, with that measured by IC on nylon following a denuder that removes SO_2, for 11 sites in the desert southwest, for a two-year period ending in August 1994. The left plot shows the 2,149 points, the calculated precision, and the 1:1 line. The slope of the regression line minimizing the perpendicular deviations is 0.99, and the correlation coefficient (r^2) is 0.98. The right plot shows the normal error distribution of the difference between the two sulfate measurements divided by the uncertainty in the difference. The black area corresponds to a positive artifact. The curve is the predicted Gaussian distribution for a zero mean.

To check how sensitive this method would be to an artifact, UC-Davis considered two possibilities. First, they added an artifact of 200 ng/m^3 randomly to 10% of the Teflon concentrations (the lower end of the range suggested by BYU). The result, shown on the left side of Figure 2, is a visible bulge on the right. Second, they added a very small artifact of 20 ng/m^3, corresponding to 1% of the mean concentration, to every sample. The result, shown on the right side of Figure 2, is a visible shift to the right. This exercise indicates that UC-Davis could have seen an artifact much smaller than that proposed by BYU had it occurred.

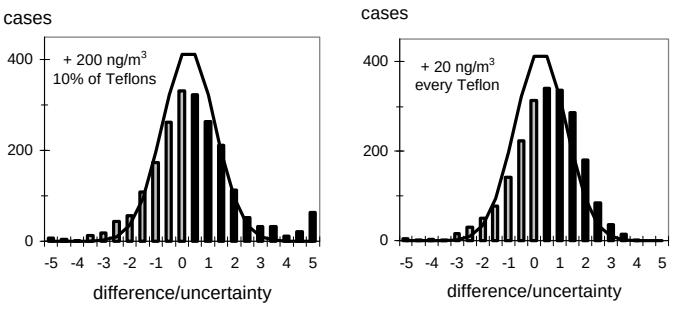

Figure 2. Normal error distributions after adding a constant concentration to all or a fraction of the Teflon concentrations. The left plot adds 200 ng/m^3 to 10% of the concentrations, while the right plot adds 20 ng/m^3 to every concentration. The last bar in both plots includes all values greater than 4.5. The curves are the same predicted Gaussian distributions.

The paper also discusses a special study conducted jointly by UC-Davis and BYU in November 1991 in Meadview, Arizona, to examine this artifact question. UC-Davis used an array of 14 samplers with Teflon filters (6 with no denuders, 6 with IMPROVE denuders, and 2 with a denuder developed for the EPA). They also had a pair of samplers with nylon filters, with and without IMPROVE denuders. Overall they found no significant difference. During this study, BYU used 9 samplers (3 with no denuders and 6 with denuders). One-half of the denuder samples were later exposed to the same amount of SO_2 as was measured for the period. One problem with the BYU data is that it has a large analytical uncertainty, with average standard deviations of over 100%. By normalizing the BYU measurements with the mean of the IMPROVE measurements, however, UC-Davis was able to combine the measurements of different time periods into a single set. This gives adequate precision to show that there were large differences between the BYU denuder and non-denuder samplers, but no change in adding SO_2 later. Thus, the BYU differences were associated with sampler bias and not a sulfate artifact.

VISIBILITY NEWS continued from page 1....

ARS Technologies manufactures IMPROVE aerosol samplers

ARS Technologies, Inc. now manufactures IMPROVE modular aerosol samplers and is incorporating several design changes into the instrument. These changes include improved aluminum enclosures and simplified electrical circuitry. For more information, or to order a sampler, contact:

ARS Technologies, Inc.
Telephone: 1-800/346-5845

Aerosol sampler procedures available

Standard operating procedures for IMPROVE modular aerosol sampler operation have been completed by the University of California-Davis and will be sent to all aerosol site operators in the near future. Additional sampler procedures are available from:

Bob Eldred
University of California-Davis
Telephone: 916/752-1124

Breton Island approved as new IMPROVE site

On February 13, 1997, the IMPROVE Steering Committee approved Breton Wilderness Area as the next IMPROVE network member site. Breton, a Class I area administered by the Fish and Wildlife Service, is in the Gulf of Mexico near the Mississippi Delta. It is affected by air emissions from onshore and offshore sources, including oil and gas production facilities that surround the islands and emit significant amounts of sulfur dioxide and nitrogen oxides.

Breton National Wildlife Refuge, established in 1904, is the second oldest refuge in the National Refuge System. It includes Breton Island and the Chandeleur Islands -- remnants of the Mississippi River's former St. Bernard Delta. Refuge objectives are to provide sanctuary for seabirds and beach habitat for several wildlife species, and to preserve the wilderness character of the islands.

Class I increments for sulfur dioxide and nitrogen dioxide are suspected to be nearly, or perhaps, fully consumed at Breton. Unfortunately, such assessments have been difficult because an effective model that estimates ambient concentrations caused by both onshore and offshore sources has not been applied. John Vimont, of the National Park Service's Air Resources Division, is working with the EPA, states, and industry to develop an advanced modeling protocol for estimating increment consumption at Breton.

Sandra Silva, Chief of the Fish and Wildlife Service's Air Quality Branch and IMPROVE Steering Committee member, hopes an IMPROVE site on Breton Island will provide information that would complement that obtained through the new modeling protocol. Silva said, "an IMPROVE site would provide data not only on visibility impacts, but also on the concentrations of secondary pollutants such as sulfates and nitrates. These data could be used to help us assess the effects of pollutants on the air quality related values, thereby facilitating our permit analyses." For more information regarding the Breton site, contact:

Sandra Silva
Fish and Wildlife Service
Telephone: 303/969-2814

Former president Teddy Roosevelt visited Breton Island, Louisiana, in 1915.

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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:

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The next IMPROVE Newsletter will be published in July 1997.

Please Contact Us: If you know someone who would like to receive the newsletter or if you are no longer interested in receiving a copy, please call us at 970/484-7941. Your ideas and comments are always welcome. We continue to look for ways to improve the newsletter and to provide you with interesting and pertinent information.

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