INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

Volume 3, No.2 **Spring 1994** **July 1994**

IMPROVE MONITORING UPDATE

Preliminary data collection statistics for the Spring 1994 season (March, April, and May) are:

Data Type	Collection Percentage
Aerosol Data	94%
Optical (transmissometer) Data	91%
Scene (photographic) Data	79%

Figure 1 is a map of the current IMPROVE and IMPROVE Protocol sites. The CASTNet program has adopted IMPROVE optical and scene monitoring protocols, but is using different aerosol monitoring techniques.

The USFS has expanded its IMPROVE Protocol monitoring network. Two sites, Gila Wilderness, New Mexico, and Shining Rock Wilderness, North Carolina, were reconfigured to include IMPROVE aerosol samplers, nephelometers, and cameras. One additional site, Great Gulf Wilderness, New Hampshire, is scheduled to be reconfigured with the same instrumentation.

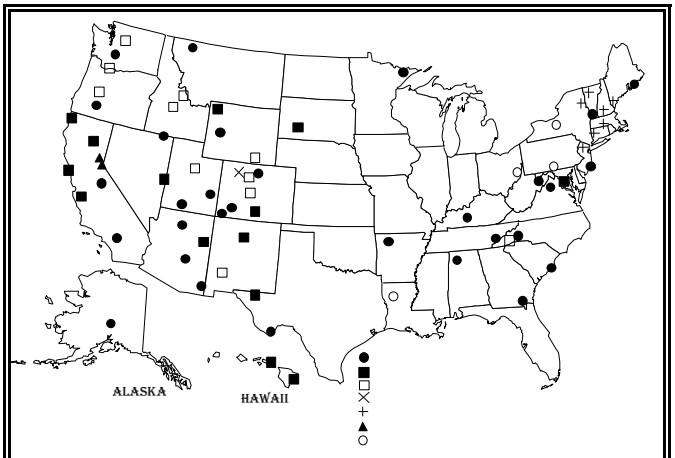

Figure 1. IMPROVE and IMPROVE Protocol Sites
July 1994

VISIBILITY NEWS....

IMPROVE STEERING COMMITTEE MEETS

An IMPROVE Steering Committee meeting was held in Denver, Colorado, on July 12, 1994. The agenda included discussions on current and future IMPROVE budgets as derived from supporting agencies, monitoring priorities, monitoring guidelines, reporting procedures, and a range of other topics.

To better accommodate and more directly involve all participating agencies, the IMPROVE Steering Committee decided to convene more frequently than in the past. Conference calls or teleconferencing approaches were discussed as an alternative to traveling to more frequent sessions.

Ann Acheson was designated the Forest Service's representative to IMPROVE for the coming year. Her telephone number is (303) 329-3493.

AEROSOLS AND ATMOSPHERIC OPTICS SPECIALTY CONFERENCE

Make your reservations now for the AWMA/AGU International Specialty Conference:

Aerosols and Atmospheric Optics:

Radiation Balance and Visual Air Quality

Snowbird, UT

September 26-30, 1994

This 1994 specialty conference will bring together scientists from the fields of visibility and global climate who have common interests in aerosols and atmospheric optics. A full schedule of technical papers and special events is planned from Monday through midday Friday. Preconference short courses and both pre- and post-conference tours will supplement the primary conference program.

For more information on the conference, call 801-378-5474.

EFFECTS OF AMMONIA ON EASTERN AMBIENT AEROSOLS

The NPS is sponsoring a preliminary field test of a newly configured measurement system to better understand the acidity, particle scattering, and size distributions of eastern aerosols. The system will be field tested during August and September in Great Smoky Mountains National Park.

Simultaneous experiments will include:

- Measuring the change in the scattering coefficient between ambient aerosols and fully neutralized ambient aerosols. Ambient aerosols will be neutralized by injecting ammonia gas into the sampling stream. Ambient nephelometers will measure the difference in scattering between the ambient aerosols and neutralized sulfate aerosols.
- Measuring the size distribution of ambient and fully neutralized aerosols. Differential mobility analyzers (DMA) will be used to monitor the size distributions.
- Examining the effect of relative humidity on sulfate particle size. Aerosol filter samples collected with humidity controlled drum impactors will be analyzed for sulfur by PIXE.

The field experiments will be conducted at the Look Rock monitoring site where a transmissometer, nephelometer, IMPROVE aerosol sampler, ambient gas analyzers and meteorological instruments will support the special study experiments.

Feature Article

PARTICULATE SELENIUM MEASUREMENT IN THE IMPROVE NETWORK

The prime contractor for IMPROVE aerosol monitoring and data analyses is the University of California, Davis (UCD). Over the years, IMPROVE participants, in concert with UCD scientists, have strived to enhance aerosol monitoring and analyses techniques by increasing the sensitivity, accuracy, and precision of aerosol measurements.

Measuring the type and concentration of elements collected on aerosol filters is the cornerstone of the analytical program. The Particle Induced X-ray Emission (PIXE) technique has long been used to measure lighter elements such as sulfur, but it is not sufficient to accurately quantify trace elements heavier than iron. Identifying these trace elements can be a particularly important factor in determining emission source types. To improve the measurement of these heavier trace elements, UCD now employs a high sensitivity X-ray Fluorescence system to analyze aerosol samples on Teflon filters. One of the most important heavy trace elements for determining emission source types is selenium, which is emitted from coal-fired facilities including power plants. UCD's minimum detectable limit for selenium is 0.02 ng/m^3. Since beginning the high sensitivity analyses in June 1992, selenium has been above this limit on approximately 85% of all analyzed samples.

The maps below show the mean seasonal concentrations of selenium (Figure 2) and particulate sulfur (Figure 3) for Summer 1993 (June to August) for all the remote sites using IMPROVE samplers. The measured levels of selenium range from 0.02 ng/m^3 (at the minimum detection limit) at both Crater Lake National Park and Jarbidge Wilderness in the west to 1.88 ng/m^3 at Dolly Sods Wilderness in the east. The highest concentrations in the west occur along coastal California and in Badlands National Park. The highest concentrations in the eastern U.S. are east of the Ohio River Valley in West Virginia and Virginia. As shown in Figure 3, sulfur measurements are also lowest in the western U.S. and highest in the east ranging from 141 ng/m^3 at Jarbidge Wilderness to 2870 ng/m^3 at Shenandoah National Park. The sulfur measured on aerosol filters is primarily from sulfate particles which are a major cause of visibility degradation. Several interesting patterns are evident on these two maps. First, the mean concentrations for selenium show definite regional patterns. This indicates that there are no individual sites where selenium is elevated above regional levels due to a nearby local source. Second, the contours for selenium generally follow those of sulfur, indicating a fairly constant ratio of sulfur to selenium. Sulfur in conjunction with selenium indicates reduced visibility (high sulfates) due in part to coal-fired facilities (a source of selenium)

The sulfur/selenium ratio is a convenient way to express the relationship between the two elements. Figure 4 shows a comparison plot between selenium and particulate sulfur at the 10 sites in the northeast for samples collected between June and August 1993. The high

PARTICULATE continued on page 3

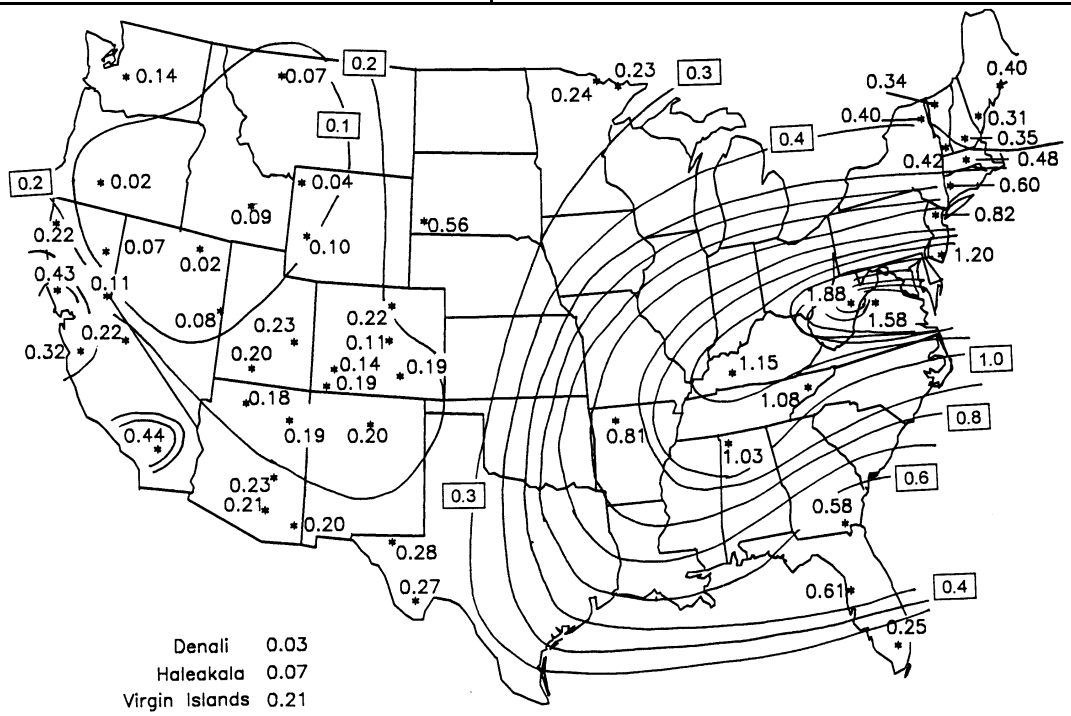

Figure 2. Contour map of mean selenium concentrations from June to August 1993 at remote IMPROVE sites. The units are ng/m^3. The contours are based only on the data shown and do not reflect concentrations at less remote sites.

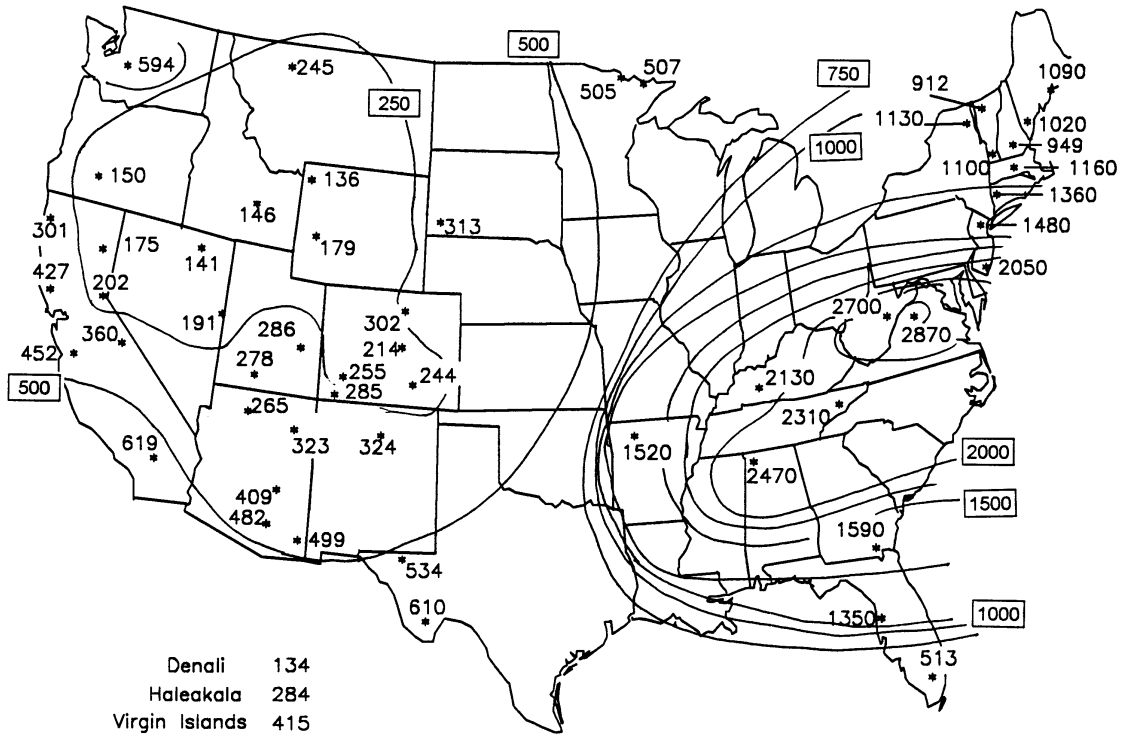

Figure 3. Contour map of mean sulfur concentrations from June to August 1993 at remote IMPROVE sites. The units are ng/m³. The contours are based only on the data shown and do not reflect concentrations at less remote sites.

PARTICULATE (continued from page 2)

correlation between selenium and sulfur concentrations exhibited in Figure 4 is not present at all IMPROVE sites. Site-specific variations in the sulfur/selenium ratio do exist and may reflect the fact that selenium is emitted directly as particles, while sulfur must convert from sulfur dioxide gas to sulfate particles. The fraction converted depends on several factors such as transport time, temperature, and relative humidity.

In the eastern half of the United States and in the southwest, the concentration of both sulfur and selenium are relatively high and the ratios of sulfur to selenium are between 1500 and 3000. In the Four Corners region and much of California, the ratios are slightly smaller, between 1100 and 1400. The largest variations occur in the northwest.

The mapping of other trace elements such as arsenic (an indicator of copper smelting) and potassium (an indicator of forest fires and agricultural burning) can yield other interesting regional and local patterns that are indicative of interesting source receptor relationships of visibility reducing aerosols. The geographical and seasonal patterns for selenium and other trace elements (based on IMPROVE data) will be presented by UCD scientists in a paper at the international conference on Aerosols and Atmospheric Optics in Snowbird, Utah, September 1994.

For more information on IMPROVE aerosol samplers and analysis techniques, contact Dr. Bob Eldred at UC Davis, (916) 752-1124.

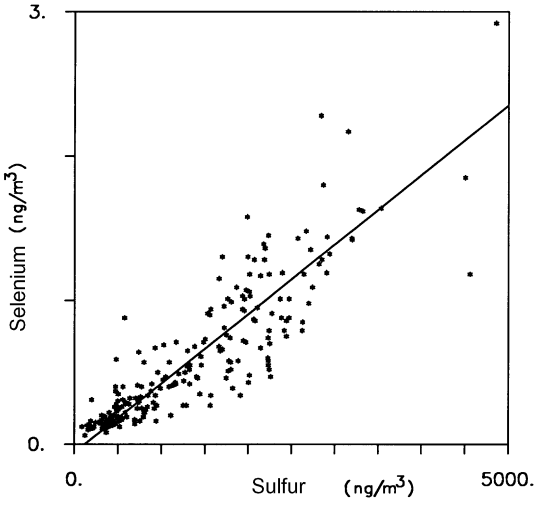

Figure 4. Comparison plot of selenium and sulfur concentrations from June to August 1993 at 10 sites in the northeast, from New Jersey to Maine. The correlation coefficient (r^2) is 0.77.

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PREVIEW OF UPCOMING ISSUE . . .

The next IMPROVE Newsletter will be published in October 1994 and will include:

- Network Status for the Summer 1994 Season.
- **FEATURE ARTICLE:** Interagency Work Group for Air Quality Modeling (IWAQM)

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