INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

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IMPROVE MONITORING UPDATE

Preliminary data collection statistics for the Spring 1993 season (March - May 1993) are:

Data Type	Collection Percentage
Aerosol Data	98%
Optical (transmissometer) Data	88%
Scene (photographic) Data	81%

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

Network changes in the last quarter included the installation of NGN-2 ambient nephelometers at Jarbidge Wilderness, Edwin B. Forsythe Wildlife Refuge, Great Smoky Mountains National Park, Boundary Waters Canoe Area, Dolly Sods Wilderness, and Acadia National Park. Nephelometers are scheduled for installation at Crater Lake National Park and Lye Brook Wilderness by August 31, 1993.

Aerosol data for the Fall 1992 season is complete and seasonal summaries have been submitted to the NPS. Analyses of Winter and Spring 1993 data are underway. The recovery rate of aerosol data for the Spring 1993 season was 98%, the highest to date.

The 1992 annual visibility report (including scene collection statistics for the Spring 1992 through Winter 1993 seasons) was delivered in May 1993. An effort is now underway to reprocess and replot all IMPROVE transmissometer data from December 1987 through May 1993 to incorporate newly-refined lamp drift correction factors. A comprehensive data report will be delivered by July 31, 1993.

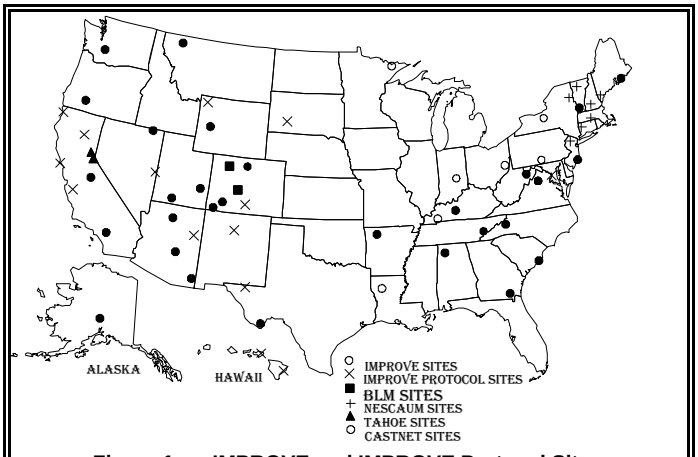

Figure 1. IMPROVE and IMPROVE Protocol Sites

July1993

VISIBILITY NEWS.....

NAS Committee Critiques National Goal For Improving Visibility

The National Academy of Sciences (NAS) Committee on Haze in National Parks and Wilderness Areas has released its findings in its report, Protecting Visibility in National Parks and Wilderness Areas. The report describes the regional nature of visibility impairment, critiques regulatory strategies, evaluates monitoring and modeling methods, and points out how ineffective current and planned emission controls and visibility reduction measures can be. It also calls for the EPA, the Department of Interior, and the Department of Agriculture to carry out their regulatory responsibilities and to consider visibility protection as a high priority.

The following points summarize the committee's major conclusions and recommendations:

- The visibility in the West is naturally greater than in the East. Therefore, policy and control strategies should differ for the West and East regions.
- Efforts to trace the contribution of individual source emissions to visibility impairment are time-consuming and expensive, and they ultimately provide uncertain conclusions.
- The solution to remedying man-made visibility impairment in Class I areas requires limiting emissions of pollutants that cause regional haze and investigating the combined effect on visibility from all regional emission sources, although some situations will require and benefit from individual source assessment.
- Source apportionment models should be used progressively, with the most simple methods used in the early stages of assessment and the more complex applied as necessary.
- In simple cases, photographic and other existing simple identification methods can be used to assess single source contribution to visibility impairment.
- Reducing emissions for visibility improvement will benefit visibility outside Class I areas and will alleviate other air quality problems, and vice-versa.

(VISIBILITY NEWS *continued on page 3*)

Feature Article

INTERNATIONAL IMPACT OF IMPROVE

by Dr. Tom Cahill and Paul Wakabayashi

First came the realization that a unique international resource, the national parks and monuments of the western United States, were threatened by degraded air quality in general and visibility degradation in particular. Next came the realization that urban-based air quality standards could not adequately protect this resource. This led to the Clean Air Act Amendments of 1977 and the focus on visibility as both a resource to be protected and a surrogate for other air quality problems at these remote sites. Finally there came the realization that standard aerosol measurement techniques, based on the Hi-Vol sampler, were incapable of either diagnosing the causes of the problem or tracing them back to their sources, natural and/or man-made. Thus in 1977 the earliest forerunners of the IMPROVE program were founded on the basis of regular measurements of fine aerosols at remote, regionally-representative sites. The programs characterized chemically both those aerosol components that caused the haze and those trace components that provided information useful in tracing ambient aerosols back to their sources. Until then, knowledge of continental aerosols rested on short duration special studies, although extensive international programs existed at remote oceanic sites for climate studies.

The success of IMPROVE and its EPA/NPS forerunners, as well as cooperative programs such as the SCENES programs near the Grand Canyon, has led to growing interest internationally for programs based on IMPROVE protocols and involving, in many cases, IMPROVE scientists. These collaborations fall into two major types:

1. Bilateral exchanges of information and/or equipment and/or analytical expertise, either informal or, as in the case of Canada, extensive.

2. Adoption of many of the IMPROVE protocols by the United Nations program "Global Atmospheric Watch" (GAW) of the World Meteorological Organization, and use of IMPROVE units at several middle eastern sites.

The first program has grown up informally in the course of meetings and informal contacts, greatly aided by the growing IMPROVE-based publications in international journals. In response to many inquiries, UC Davis in 1989 funded the construction of ten IMPROVE Module A units available on indefinite loan to any cooperating international program that adhered (roughly) to the IMPROVE goals. Further, UC Davis agreed to analyze up to 5% of all samples from these units for quality assurance comparisons, guaranteeing that the cooperating network generated data fully compatible with IMPROVE. Of course, all reports, publications, protocols, standard operating procedures, and blueprints were made available free or at nominal cost (for reproduction). These units are now in Australia (2), Canada (1), Denmark (1), Finland (2), Russia/Baikal (1), and Chile (1), while plans have been completed for Ireland and Mexico. One is part of a study in Bermuda this summer with Dr. Joe Prospero of the University of Miami, who has probably the largest oceanic aerosol network in the world.

Further, there have been many inquiries regarding the UC Davis program by laboratories around the world, especially those two or three dozen that possess analytical facilities that could be modified to support the IMPROVE/UC Davis analytical protocols. Surplus stacked filter units (SFUs) from the forerunner networks have been indefinitely loaned to many countries. The data from the fine stacked filter unit filter is identical to, but slightly less sensitive than, that from IMPROVE Channel A. At this time, there are about 15 such units around the world, including Russia (Lake Baikal), Chile, Mexico, and Romania, while a Brazilian aerosol network is being operated in the Amazon basin and other sites by Dr. Paolo Artaxo of Sao Paulo. These older SFUs are a major resource to countries that wish to get started in non-urban aerosol research. These highly portable SFUs also continue to serve at the forefront of aerosol research. The first and most detailed aerosol compositional data from the Kuwaiti fires of 1991 came from SFUs flown on the NCAR Electra in May and June [Cahill et al, 1992]. The sensitivity achieved in these analyses are still unequaled but, beginning in summer 1992, these advances have now been included in every Channel A filter in the IMPROVE network. Through such programs, scientists are beginning to learn of IMPROVE and its capabilities.

Of all the bilateral programs, perhaps the Australian program has exhibited the most dramatic progress of any cooperating program. Under Dr. David Cohen of the Australia Nuclear Science and Technology Organization (ANSTO) of Lucas Heights, New South Wales, the network has grown to 26 sites in NSW, including national parks such as the Blue Mountains west of Sydney. This

network was originally funded by power companies to evaluate their potential impact on aerosol loadings, but also included the Sydney urban area. The first year's data were available in spring 1993, and included in addition to mass, PIXE, PESA, and optical absorption, very light elements via prompt gamma rays, a technique not currently used by IMPROVE but potentially interesting. This is a characteristic of almost all cooperative programs, that IMPROVE benefits from new approaches and ideas from our collaborators. The NSW Environmental Protection Agency has now incorporated this network into its monitoring grid, based upon the dramatic success of the early data, while extension to other areas in Australia is occurring. The global baseline monitoring site at Cape Grimm, Tasmania, now has an operating IMPROVE sampler, thus raising to two sites (the other is the IMPROVE site at Mauna Loa Observatory, MLO, Hawaii) the IMPROVE presence in global climate monitoring.

The second program involves the United Nation's World Meteorological Organization (WMO) and its new program, Global Atmospheric Watch (GAW). The data from the IMPROVE MLO site in Hawaii were noticed by Dr. Rumen Bojkov, WMO, and Dr. John Miller (NOAA), who requested assistance with studies in the Middle East after the Kuwaiti fires of 1991. UC Davis became prime contractor to the WMO and presently supports sites in Egypt and Pakistan, with Iran coming on line this summer. Further, UC Davis was asked to serve on two WMO-GAW committees on aerosols and quality assurance. Many of the IMPROVE protocols were incorporated into the GAW program, especially those associated with the quality assurance aspects of GAW [WMO 1992]. Specifically, the IMPROVE concept of "integral redundancy," in which two fully independent methods are used to measure key parameters, was incorporated into the GAW protocols. Thus, a full GAW aerosol site must include both Channel A and Channel B IMPROVE, allowing comparison of sulfate by ion chromatography with sulfur by PIXE/XRF, along with gravimeter fine mass versus reconstructed mass, the sum of all measured species, in Channel A.

Since there are laboratories around the world capable of duplicating IMPROVE analytical protocols, GAW could draw on this local expertise to support the aerosol analyses. IMPROVE would then become a source for quality assurance comparisons so that data from any country and any laboratory could be compared with IMPROVE and other cooperating networks. This is one way in which IMPROVE could play a vital role in the future of regional and global aerosol monitoring and research. Sharing the IMPROVE protocols with other groups allows them an efficient way to benefit from the 15 years of experience in routine remote area particle sampling and analysis.

On a global scale, emissions such as Kuwaiti fires, Mt. Pinatubo, and climate forcing (i.e. cooling) by anthropogenic sulfate aerosols focused the world's attention on fine aerosols. The successful experience of IMPROVE in continental aerosols, which generally suffer the greatest anthropogenic impact, opens a new avenue to understanding international aerosol concerns and potential modifications of global climate.

REFERENCES

Cahill, Thomas A., Kent Wilkinson and Russ Schnell. Composition analyses of size-resolved aerosol samples taken from aircraft downwind of Kuwait, spring 1991. *Journal of Geophysical Research*, Vol. 97, No. D13, pp. 14,513-14,520. September 1992.

World Meteorological Organization Global Atmosphere Watch. Publication No. 80. Report of the WMO meeting of experts on the quality assurance plan for the global atmosphere watch. Garmisch-Partenkirchen, Germany, March 1992.

VISIBILITY NEWS..... *(continued from page 1)*

- v Taking regulatory action to improve and to protect visibility will require a substantial, long term commitment toward atmospheric research, monitoring, and emissions control research and development.

For an in-depth discussion of the committee's findings, order the report from the National Academy Press:

Protecting Visibility in National Parks and Wilderness Areas. Committee on Haze in National Parks and Wilderness Areas, Board on Environmental Studies and Toxicology, Commission on Geosciences, Environment, and Resources (1993, 316 pp.; ISBN 0-309-04844-3; available from National Academy Press, tel. (800) 624-6242 or (202) 334-3313; $38.00 plus $4.00 for single copy shipment.

IMPROVE Steering Committee Meeting

An IMPROVE Steering committee meeting was held on June 3 and 4, 1993 in Fort Collins, Colorado. The committee received an update of the ongoing monitoring program and of modifications and improvements in monitoring and data analysis methods. Program discussions included program and quality assurance documentation, data dissemination, funding considerations, and interagency cooperation. Several subcommittees were formed to more fully address specific program issues.

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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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PREVIEW OF UPCOMING ISSUE . . .

The next IMPROVE Newsletter will be published in October 1993, and will include:

- Network Status for the Summer 1993 Season.
- **FEATURE ARTICLE:** The USDA Forest Service Enhances Its Visibility Monitoring Program

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