

IMPROVE Steering Committee 12/2/98 to 12/4/98
DRAFT Meeting Summary
Prepared by Marc Pitchford

The meeting was held at the National Forest Service Regional Office in Portland, OR. A list of meeting participants and the agenda is attached. A number of significant issues were considered during the meeting including: increasing the steering committee by adding a representative of the Mid-Atlantic Regional Air Management Association (MARAMA); approval of the national strategy for siting the new monitoring sites; and a possible new category of steering committee representation. These and many other topics of discussion are summarized below in the order that they were discussed during the meeting (see the attached agenda).

Participant Updates

Meeting participants briefly described to the group a variety of visibility-related activities of their organization. BLM is reinitiating their interagency agreement with the NPS to fund some visibility monitoring. The state of Arizona is making a significant commitment to the use of nephelometers at remote area monitoring sites in their state. The National Park Service request for proposals for the aerosol monitoring services contract (all IMPROVE sites) is about close so that a new contract can be put in place when the current contract expires at the end of the year. For obvious reasons there was no discussion of this topic except to identify which organizations would participate in the review of proposals which was limited to federal participants by law.

The FWS indicated that a settlement had been reached to control emissions from the pulp mill that was impacting the Moosehorn Wilderness in Maine. The USFS will be preparing a white paper on the issue of smoke impacts on visibility based upon a workshop on that topic. The joint federal land managers efforts to develop common approaches for reviewing air quality impacts for new source permits (FLAG) is conducting internal reviews of their draft report on recommended approaches. Their final report should be available by the middle of next year. The State of Colorado has conducted its visibility long-term strategy review using IMPROVE data in their analysis. They also reported on Mt Zirkel wilderness area visibility-related news that SO₂ scrubbers are now installed and operating on unit 1 of the Hayden power plant and will be operating on unit 2 by summer.

NESCAUM is organizing a working group to plan a regional PM speciation program in the northeastern U.S. EPA and with assistance from several states are preparing a PM data analysis workbook that is designed to assist those organizations that have little experience with such data. IMPROVE data are being used as examples of the types of information that are being developed at over a thousand monitoring sites nationwide. Cooperation by IMPROVE participants is encouraged. The State of Washington is presently conducting their visibility long-term strategy review. They also reported that the agreed-upon SO₂ emission controls for the Centralia power plant continue to be hung-up in the courts.

State of Arizona Visibility Monitoring Concerns

Representatives of the State of Arizona requested time to discuss with the steering committee a number of observations and concerns they have with respect to the IMPROVE network and how it is managed by the steering committee. Arizona representatives identified both positive and negative features of the current IMPROVE program as well as pointing out some of the difficulties that they have in implementing a state visibility monitoring program that result from the current practices of IMPROVE.

IMPROVE has been and continues to be the dominate player in the collection of remote area visibility and aerosol speciation data across the nation. IMPROVE monitoring protocols have been developed and refined over the years and are in effect de facto standard methods for how to make these measurements. Uniform, routine operations of a moderately large network has worked to reduce the per site/instrument cost of monitoring. This has promoted the collection of comparable data across state boundaries in a cost-effective manner.

In spite of these overall advantages there can be certain problems, especially for any organization that wishes to conduct its own visibility monitoring in remote areas, as is the situation with the State of Arizona. While the IMPROVE approach may be considered adequate from a national perspective, Arizona believes that more monitoring is needed in their state's class I areas. Arizona can either try to have IMPROVE expand the monitoring in their state or have it done independently by some combination of contractor or in-house staff.

Arizona's interests are nominally represented on the steering committee by the WESTAR and STAPPA/ALAPCO representatives. However they also represent many other states that would be unhappy if IMPROVE resources were shifted to do much more for one state's class I areas than for those of the other states. A similar incentive, to equitably share the monitoring resources across the country, exists to some extent for the other steering committee representatives. This makes the first option (having IMPROVE expand the monitoring in AZ) difficult to implement under the present IMPROVE operating structure.

There are difficulties in choosing to independently supplement the IMPROVE monitoring. Arizona would like their data to be as comparable as possible with the IMPROVE data collected in Arizona and surrounding states. However, it is difficult to do that without working with the same contractors or at least by having access to well-documented protocols and the same or very similar monitoring equipment. Access to the IMPROVE contractors is in no way restricted by the IMPROVE steering committee. However the IMPROVE aerosol contractor is a university research organization (Air Quality Group at UCD) which has a research agenda that makes them different from a consulting firm or an analysis laboratory. They have expressed little interest in participating in particle sampling and analysis that does not directly support the IMPROVE program or is not consistent with their research objectives. They have also indicated that until the newly updated samplers are fielded, they can not easily take on any monitoring that involves sampling schedules that are different from the current twice weekly (Wednesday and Saturday). These UCD self-imposed restrictions have caused difficulties for states (including Arizona) that have tried to establish analysis contracts that include the capability to operate on other sampling schedules or include options for special studies with flexible sampling protocols.

Use of a different organization to provide sample analysis services raises concerns for comparability of results and will likely cost more per sample for analysis. Generally the issue of data comparability can be addressed by using the same or very similar analysis protocols and by conducting routine laboratory and field intercomparison studies. However, some aspects of the sample analysis at UCD is not duplicated anywhere else because of the need for specialized and costly equipment, such as the hydrogen analysis. UCD has analytical protocols but they are not readily available, and since they are not nationally recognized standard method (nor are any for filter analysis) there might be resistance or at least extra cost if other laboratories were told they need to adopt them.

Laboratory and perhaps field intercomparison studies should be considered essential if other filter analysis laboratories are used to generate data that should be comparable to IMPROVE particle composition data. However, this too will constitute an extra expense for the laboratories

involved. With the advent of particle sampling and analysis at many locations across the country for the new national PM_{2.5} standard the need already exists for additional filter analysis contractor laboratories. It is in everyone's interest (IMPROVE, states, EPA, etc.) for data from the national speciation network and IMPROVE to be used together to help assess geographic patterns, urban influence in remote areas, regional background concentrations, etc. To do this, the IMPROVE program will have to participate in field and laboratory intercomparison studies. (This has been discussed and approved by the Steering Committee at previous meetings.) Ultimately (6 months to a year) Arizona and other states will be able to use the national speciation contract laboratories for sample analysis with assurance that the degree of comparability to IMPROVE will be assessed. However, in the mean time there is no simple solution for their desire to obtain aerosol analysis data that is comparable to IMPROVE unless they can gain access to the services of the Air Quality Group at UCD.

The presentation of concerns by the Arizona representatives included a number of suggestions to try to alleviate the problems that they identified. These included making the steering committee and contractor more accountable by having a vice-chairperson of the committee whose is tasked to ensure greater access to and services by the contractors. This would include responsibilities for efforts to prepare more formal and readily available documentation of monitoring and laboratory protocols, audits, and schedules; development of a rigorous quality assurance program plan following EPA's guidelines; making data more readily available by direct computer access; coordinating state (and other organizations) access to IMPROVE monitoring resources for special studies. They also suggested that the IMPROVE committee exercise more leadership in integrating Class I area monitoring with the national PM monitoring program.

The steering committee engaged in discussions with the Arizona representatives to clarify and broaden their understanding of these issues during this agenda topic. Some of the participants made suggestions concerning possible approaches to address several of the issues raised by Arizona. However, a more organized response to the many of the issues and suggestions was scheduled in the agenda for later in the meeting (summarized below).

Additional State Representation on the Steering Committee

Months prior to the meeting, STAPPA/ALAPCO representatives in discussions with the steering committee chair expressed their desire to see the steering committee expanded by one additional multi-state organization. This would give the states four representatives, the same number as the land manager organizations. The suggestion was made that as the only multi-state organization that represented all states, STAPPA/ALAPCO was the most appropriate organization to identify which other multi-state organization was the most appropriate to be added to the steering committee. Also that STAPPA/ALAPCO should then make a motion to the steering committee to seek approval for the expansion membership.

The STAPPA/ALAPCO representative made a motion (attached) to expand the steering by adding the Mid-Atlantic Regional Air Management Association (MIRAMA) to the IMPROVE Steering Committee. This motion was discussed and voted upon. The result was unanimous approval of the motion. On behalf of the steering committee I would like to welcome MIRAMA and their designated representative, Charles Pietarinen from the state of New Jersey to the IMPROVE program.

NPS Adopt-a-Site Program

Mark Scruggs of the NPS Air Resources Division briefed the meeting participants on a new NPS program called "Adopt-a-Park." The program calls for each ARD technical staff person to take special interest in (i.e., adopt) two NPS class I areas. They visit each of their adopted park units,

learn about the specific resources and issues, assess available applicable air quality and meteorological monitoring data, and highlight implications for park resource management. This provides the park staff with a specific individual who understands their park's situation as an advocate and point of contact within the ARD. It also provides a change of focus from most of the previous air quality monitoring data assessments that were network-wide or regional to focus on individual class I area assessments. Dr. Scruggs demonstrated some of the site-specific assessment using data from Badlands National Park, one of his pair of adopted class I areas. One of the interesting features that became apparent in the data was an increasing particulate nitrate trend in the winter season. At the time of the presentation he was not able to determine the reason for this trend, though he suspected it might have resulted from recently changed activities near the park.

State Feedback on the National Strategy for IMPROVE Site Selection

On August 31, 1998 the IMPROVE Steering Committee Chair sent a letter (attached) to state and local air quality agency managers through the STAPPA/ALAPCO communications system. In that letter, the IMPROVE Steering Committee solicited the assistance of the air quality managers in finalizing a national strategy for site selection for the expanded IMPROVE network. The letter described a simple method to organize the 156 federal class I areas that have visibility protection into 103 clusters based upon the distance between class I areas and their maximum and minimum elevations. It asked the state air quality agencies to applying their knowledge of emission sources and terrain, and to suggest changes that would allow up to 108 monitoring sites to represent the regional aspects of visibility impairment for the 156 protected areas.

Seventeen states responded to the letter with comments. Several states suggested reorganization of the clusters with no net change in the number of clusters. Six states requested specific changes that resulted in a net increase in the number of clusters needed to represent the 156 class I areas of 4, for a total of 107 monitoring sites. A revised list and map showing the effect of these changes was presented at the meeting.

A motion to use the cluster plan as revised by state comments as the basis for establishing new monitoring sites to expand the IMPROVE network was made and a discussion ensued. As pointed out during this discussion, the IMPROVE network expansion needs to be completed (i.e. 78 new IMPROVE sites) by the end of 1999, so there was not the luxury of much more time prior to identifying specific locations for these monitoring sites. With one notable exception, the state-revised plan was accepted as the basis for proceeding to the next step in the network expansion process.

Representatives of the California Air Resources Board, who were participating in the meeting by telephone were not satisfied with the class I area clusters for their state. Though they had been one of the seventeen states to respond to the August IMPROVE letter and had suggested a number of specific changes that were reflected in the revised plan, they felt that addition thought and coordination were required before they could be satisfied with a final plan. They requested additional time for further assessments by the Air Resources Board and to coordinate with other interested organizations and the public concerning siting options to meet the needs for California class I areas. They also voiced concerns for the use of the IMPROVE particulate sampler as the only instrumentation presently planned for the new sites. Issues were raised concerning the comparability of the IMPROVE sampler with the Federal Reference Method for fine particulate matter and with the speciation samplers that EPA has selected, as well as the lack of optical and meteorological monitoring.

The IMPROVE Steering Committee approved the proposed national strategy as the basis of moving to the next phase of expanding the network. However, they agreed to hold off final decisions on sites in California for several months (i.e. no later than early spring) to give the Air Resources Board time to reconsider their recommendations on class I area monitoring clusters for California. The steering committee chair offered to participate if desired in any process that the state organized to seek input from other organizations and the public concerning siting and monitoring approaches. [Subsequent to the meeting ARB officials have initiated a process to make recommendations to IMPROVE concerning sites in California by the end of April.]

IMPROVE Expansion – Next Steps

With the national strategy approved (except in California), the general locations of new monitoring sites are known. The next steps are to identify appropriate specific monitoring locations and to arrange for all of the logistical support needed to operate the monitors for each site. An overview of the process for doing this was presented, discussed and specific activities were assigned.

The specific location and characteristics of a monitoring site can be influential in the data generated at the site. Since a primary purpose of the expanded network is to address the fundamental monitoring needs of the anticipated regional haze regulation, the sites must be regionally representative. As implied by the screening criteria that were used to develop the national siting strategy, regional scale is generally of the order of 100km. Ideally, a monitoring site should characterize typical remote-area (non-urban) visibility and aerosol condition in an area roughly 100km distant from the site in any direction. Just as important as having representative sites are the practical issues of year-around access, power, security, and a reliable operator for each site.

Recognizing the importance of the site characteristics to the nature of the data, the IMPROVE Steering Committee acknowledges the legitimate siting concerns of the states and federal land managers that will use the data. In addition, the FLM has concerns due to their responsibility for site operations. The IMPROVE Steering Committee and the IMPROVE aerosol contractor, UCD, have concerns related to their overall responsibilities for aerosol monitoring and data quality. The siting process is designed to promote the involvement of all of these organizations in the selection of the specific monitoring locations. This includes making joint site selection trips to view specific candidate sites and/or commenting on candidate site descriptions. While the ultimate choice of sites is the steering committee's responsibility, full participation by interested organizations is encouraged.

A number of activities were identified to implement the specific locations of new IMPROVE monitoring sites. These include preparation of the following documents: a description of the process for selecting new sites, a letter to states to be distributed by STAPPA/ALAPCO asking for their participation, and lists of contact persons for each state and local FLM that are interested in participating in the siting process. UCD offered to prepare the selection process document, Dan Ely offered to draft the letter to the states which would result in state contacts, and the FLM's offered to prepare the local FLM contact lists. [The description and state letter were distributed in February.] Site selection needs to be started in early spring in order for the entire expanded network to be deployed, tested, and fully operational by January 1st 2000 per IMPROVES agreement with EPA upon accepting the resources for expanding the network.

Expectations for IMPROVE Protocol Sites

So called IMPROVE protocol or look-alike sites are sites using the same equipment, protocols, and employing the same contractors as used at IMPROVE network sites that are not managed by

the IMPROVE Steering Committee. Many of them are operated by IMPROVE participant agencies though some are operated by other organizations. For most of these sites, arrangements have been made to share data and various IMPROVE reports have included their data. With the IMPROVE aerosol sampling protocol and equipment changing as part of the expansion, there is a question concerning what if anything the Steering Committee should do for the aerosol monitoring at protocol sites.

Many of the protocol sites (26) are candidates for new sites for the expanded network. They are at locations that meet the national siting criteria (i.e., within 100km and between the minimum and maximum elevations of the class I areas within a cluster.) For those that are considered suitable to represent the cluster, IMPROVE will provide funds to cover all costs including the costs to change equipment and protocols. However, some of the current protocol sites will not be suitable to represent a cluster of class I areas. The revised IMPROVE sampler is needed to change to the every third day sampling schedule, so sites that do not change equipment will no longer be consistent with IMPROVE protocols.

The Steering Committee Chair made the proposal that IMPROVE cover all or part of the expense of upgraded samplers for current remote area protocol sites to encourage the organizations supporting them to continued operations, to share their data with IMPROVE, and to change to the new sampling schedule. This one time cost represents a fairly inexpensive means to provide additional spatial coverage of remote area aerosol data. Action on this proposal will not be taken until the cost of the IMPROVE network expansion is more firmly known (spring or summer of 1999). Lists are attached of all sites presently serviced by the UCD Air Quality Group that use IMPROVE aerosol samplers showing their current and possible future status with respect to the IMPROVE network.

Associate IMPROVE Membership and Sites

The Steering Committee Chair proposed discussion of the development of associate membership on the IMPROVE Steering Committee for states or other government organizations that would be interested in coordinated sponsorship of IMPROVE-like monitoring activities in remote locations to support visibility protection of class I areas. The idea for this was a direct response to the concerns raised prior to this meeting by the State of Arizona, as discussed above.

The concept was that any government organization that was willing to use their discretionary funds to conduct visibility monitoring or related work that supports the goals of visibility protection for class I areas could apply for associate membership on the Steering Committee. Associate members would be able to directly represent their interests at the Steering Committee. They would be aware of and able to voice their opinions on proposed IMPROVE technical protocol changes. They could coordinate the activities that they are funding with IMPROVE with the goal of increasing the information gathering benefits to all while reducing the costs through shared procurement of equipment and services. The only limitation to associate membership on the steering committee would be in casting a vote on the disposition of IMPROVE resources which would remain the sole prerogative of the full members.

An active discussion of this topic ensued. Some of the participants indicated that states already had representation on the Steering Committee and that their needs for coordination and interaction should be met through those representatives. It was also pointed out that since the meetings were open and anyone was permitted to participate in discussions, there was no need for the creation of associate membership to provide access. The IMPROVE protocol sites were indicated as an example of how government organizations are currently coordinating their discretionary funding of visibility resources with IMPROVE for shared mutual benefits. If many

government organizations were to become associate members, the work of the Steering Committee would be much greater to cope with various unique associate monitoring activities and that this would dilute the Steering Committee's ability to manage the IMPROVE network.

Proponents of creating associate membership offered counter arguments for these points as well as additional reasons for supporting the proposal, as briefly stated below. Current state representatives must act in the interest of all of their constituent states that may conflict with the unique interests of any one state. It seems unreasonable for any organization to make funding commitments that are dependent on interactions with another organization without some sort of connection or agreement with that organization beyond just attending their steering committee meetings. Protocol sites are not necessarily very analogous to the situation where a state wishes to operate supplemental visibility monitoring that is coordinated with IMPROVE, since most of the protocol sites are operated by federal land managers with direct representation on the IMPROVE Steering Committee.

Historically, IMPROVE has participated in various short-term studies, including WHITEX, PREVENT, Project MOHAVE, and currently the BRAVO Study that were promoted by one or more to the Steering Committee member organizations. These were done by supplementing the resources to the IMPROVE contractors to expand the measurements at the IMPROVE sites and to add other sites. In effect then these studies did not represent a burden to the IMPROVE network operations and for that reason they were never treated as IMPROVE activities that required Steering Committee prior approval. There is general agreement that such studies have been very beneficial to advancing our understanding of visibility and causes of impairment. The state of Arizona or any other government organization that might like to organize a study along these lines would not have the same access to IMPROVE sites and contractors without going through the Steering Committee. Associate membership for government organizations willing to sponsor additional routine or special study measurements would provide a mechanism for coordination with IMPROVE.

A lengthy discussion of the development of associate membership did not produce consensus among the Steering Committee, so the issue was tabled for future consideration.

Network Operations

Air Resource Specialists reported on the status of the optical monitoring and the University of California at Davis reported on the status of the aerosol monitoring components of the network. The current network configuration and data recovery statistics for all of the IMPROVE monitoring network are routinely reported in the IMPROVE Quarterly Newsletter. ARS has recently changed the optical monitoring data flags to make them consistent for transmissometer and nephelometer data. They have also recently completed reports for 18 additional sites to summarize five or more years of color photography with a spectrum of visual conditions experienced at each of the sites. Finally they reported on assessments that they have done to further explore the relationship between measured and aerosol calculated extinction coefficient for all of the monitoring sites with both types of measurements. Generally, aerosol calculated extinction coefficient over-estimates the optically measured extinction coefficient for the lowest extinction coefficient periods (good visibility periods). For the highest extinction coefficient values, the optically measured values tend to be higher than the aerosol calculated values. There was some speculation concerning an explanation for this behavior but there is insufficient information at this time to resolve the issue.

UCD conducted experiments to determine the sensitivity of filter weights to various relative humidity levels. They found that the masses of blank filters are insensitive to changes in relative

humidity, even very high relative humidity values. However, sampled filters from the western US had moderate sensitivity to relative humidity (i.e. they gained mass by forming solution with water from the air) while those collected from the eastern US tended to have high sensitivity to increased relative humidity. This information will be primarily used to help determine the range of effects of balance room humidity conditions on PM_{2.5} and PM₁₀ mass values for archived IMPROVE data. UCD will be making future gravimetric mass measurements with a balance in a temperature and relative humidity controlled environments per EPA's requirements for the national PM monitoring program.

IMPROVE Aerosol Sampler Specifications

This agenda item has to do with whether we should define the IMPROVE Sampler by listing a set of required specifications. There are a number of variations in the sampler used by IMPROVE and others, often without any distinctions made in referring to these variations in the samplers. These include use of less than all four modules, variable sample tube length, use of different filter diameters or filter masking to adjust aerial density of deposit and pressure drop, and use of samplers in air-conditioned shelters with the inlet through the roof. In approving the changing of the IMPROVE sampler to upgrade certain of its capabilities, the Steering Committee directed that certain of the flow characteristics, materials and dimensions of the sample plumbing in front of the filter be maintained from the earlier design. This was done to minimize the chance of having a difference in the sample that would be collected with the old and new versions of the sampler. These specifications could be used as the definition of the IMPROVE Sampler, but perhaps additional specifications should be added to that list.

A UCD representative presented a summary of the range of variations in the sampler as used in the IMPROVE network over time (evolution of the sampler) and for specific sites (to address differences). Changes over time primarily involved changes to exposed filter area using masks, while changes at specific sites primarily involved longer sample tubes that were used to clear obstructions or sample from inside an existing shelter. Also some of the shelter-housed samplers were in air conditioned shelters.

After some discussion, the steering committee indicated the need to standardize the sample tube length, and to house all samplers in ventilated shelters without air conditioning. UCD should estimate the effect of sample tube length and air conditioned shelters on data already gathered for sites that employed these variations in order to aid in data analysis activities. UCD was also asked to prepare a draft set of IMPROVE sampler specifications for consideration of the steering committee.

IMPROVE and the National PM Monitoring Program

The national PM monitoring program includes the establishment of speciation monitoring which was designed to look very much like the IMPROVE particle monitoring program. Speciation monitoring will be conducted nominally at about 300 locations including about 50 national trend sites. Three newly designed samplers were selected by competitive contract to provide users a choice of possible samplers for use in the speciation monitoring program. These are being field tested at four sites in different regions of the country along with IMPROVE samplers (current design, not the revised version) to determine the degree of comparability and functionality for each. Results are expected by summer 1999.

To perform the compositional analysis of the filter samples for the speciation program, EPA is in the process of selecting up to three contractor laboratories. The selection of these is scheduled for spring/summer of 1999. The speciation program request for proposals specifies that the laboratories be able to perform chemical analysis on filters from the IMPROVE samplers (25mm

diameter). These laboratories will provide an alternative to UCD for organizations who have not found UCD responsive to their IMPROVE sampler analysis needs (see the discussion above on AZ issues).

As part of the quality assurance program for the speciation network, EPA will be sponsoring routine analytical intercomparison studies for the contract laboratories. UCD will participate in these to evaluate analytical comparability between IMPROVE and the speciation program. Though no firm plan now exists, IMPROVE and the national speciation monitoring network intend to have one or more collocated sites, that would permit evaluation of the data comparability to continue in the long-term.

Data Analysis Efforts

Planning for the next IMPROVE Report is underway. The next IMPROVE report in addition to updating the spatial and seasonal trends presentations with current data will utilize the new eastern sites with 3+ years of data. The additional sites will better describe conditions in the eastern states. Long term trends will be examined in depth using those sites that have been in operation since 1988 and will be presented in a format that supports the still pending regional haze regulation. A section that takes an in-depth review of distributions of aerosol concentrations will be presented with the goal of better describing current good "best 20%" aerosol conditions and "natural" background conditions. Comparisons of data between the IMPROVE network and other networks such as the NADP will be presented. A draft outline and schedule for the report is attached. Bill Malm solicited additional ideas for the report. Completion of this report is anticipated in fall of 1999.

Communications Update

The quarterly IMPROVE newsletter continues to be an important method to distribute network and other visibility protection information. It is directly mailed to over 400 people as well as being distributed on the EPA AMTIC web site (www.epa.gov/ttn/amtic/). ARS is soliciting feature articles and visibility related news items from anyone willing to contribute to the newsletter. Authors of contributed articles are now being recognized in the newsletter by having their byline printed with the article.

Based upon the frequent requests for access to data, the IMPROVE measurements continue to be of interest and use to many organizations. All of the IMPROVE data is available electronically, and some of it is available on a web pages operated by third parties. There was some discussion concerning whether IMPROVE should make the data available on a web page of their own. The Western Regional Air Partnership (WRAP) may be developing a web page for such data for the western US. The steering committee chair offered to inquire about the possibility of a joint effort with WRAP to cover visibility and related data for the entire US.

There was some discussion concerning the desirability of having past meeting summaries available on a web site. This can be done but will require some effort for the oldest of the summaries that go back to the first meeting at Grand Canyon in July 1985. The chair offered to assess the amount of effort required to electronically retrieve the older summaries. Suggestions were solicited concerning the most appropriate way to archive and make all of the summaries publicly available.

Organization and Operation of the Steering Committee

Dan Ely made a brief presentation regarding possible future organizational directions for IMPROVE. [All notes regarding this presentation were lost, so this is a short, rough reconstruction.] The presentation identified the success and accomplishments of IMPROVE. It also reinforced points made earlier in the meeting by Arizona representatives, that with the

anticipated regulatory role of IMPROVE monitoring data for the regional haze rule and the resulting monitoring network expansion, there needs to be an evolution of the way in which the steering committee operates. The evolution will build upon the characteristics that have made IMPROVE successful. Dan presented several areas where change would continue to strengthen IMPROVE and the data it collects:

- Need for a Quality Assurance Project Plan (QAPP) for documentation, consistency, and to help with how IMPROVE is perceived as it moves toward its new role as a regulatory network;
- Need for additional organizational support for the chairman, possibly through a vice-chair position (the states will have a specific proposal on this before the next meeting);
- Need for additional accountability and traceability of decisions regarding contractor direction and performance (the states will have a specific proposal on this before the next meeting); and
- Need for additional access to IMPROVE and its contractors through the means of an associate membership (specific proposal by next meeting).

As the meeting was running behind schedule by this agenda item, there was little time to discuss the issues raised by Dan's presentation, nor was there time to discuss the last agenda item [Steering Committee views on sharing operational responsibilities with states]. These topics will be revisited at the next meeting.

12/2/98 to 12/4/98 IMPROVE Steering Committee Participants

Marc Pitchford	NOAA
Scott Archer	USDI - BLM
Tom Moore	AZ – DEQ
Bob Pallarino	EPA Reg. 9
Bob Eldred	UC Davis
Lowell Ashbaugh	UC Davis
William Malm	NPS
Sandra Silva	US FWS
Jack McPartland	NPS
Ed Jones	EPA Reg. 10
Bob Lebens	WESTAR
John Molenaar	ARS
Brian Finneran	OR – DEQ
Bob Bachman	USFS
Neil Frank	EPA - OAQPS
Mark Scruggs	NPS
Dan Ely	STAPPA - ALAPCO
Rich Poirot	VT – NESCAUM
Mike George	AZ – DEQ
Rich Fisher	USFS
Frank Von Hering*	WA – DEQ
Gerry Guay*	AK – DEQ
Ken Stroud*	CA - ARB

* participated via speaker phone

IMPROVE 12/2 to 12/4/98 Meeting Agenda

Location: Room 2 West (second floor)
 Forest Service Regional Office
 333 SW 1st Street
 Portland, OR

Time	Topic	Discussion Leaders
12/2/98		
1:00pm	Welcome, introductions & agenda review	Bob Bachman & Marc Pitchford
1:30pm	Participant updates (e.g. regional haze regulation, WRAP, Visibility Monitoring Guidance, etc.)	Organization representatives
2:30pm	Arizona visibility monitoring concerns	Mike George & Tom Moore
3:30pm	Break	
3:45pm	Request for additional state representation on the steering committee (see attached motion)	Dan Ely
4:00pm	Discussion of motion and vote	Marc Pitchford
4:30pm	NPS adopt-a-site program	Mark Scruggs
5:00pm	Adjourn for the day	
12/3/98		
8:00am	Summary of state feedback on national strategy for IMPROVE site selection	Marc Pitchford
9:00am	Adoption of national strategy – vote	Marc Pitchford
9:15am	IMPROVE expansion next steps, schedule, & problem resolution	Marc Pitchford
10:15am	Break	
10:30am	Expectations for IMPROVE “protocol” sites	Marc Pitchford
11:00am	Proposal for “Associate IMPROVE Sites & Associate Steering Committee participation	Marc Pitchford
11:45am	Lunch	
1:00pm	Network operations technical update Optical Aerosol	John Molenaar Lowell Ashbaugh
3:15pm	Break (view the prototype updated IMPROVE sampler)	
3:45pm	Specifications required for the “IMPROVE Particle Sampler” and its use	Lowell Ashbaugh
4:15pm	Integration of IMPROVE & national speciation network & Other quality assurance related issues	Neil Frank
4:45pm	Recent data analyses efforts & results	Bill Malm
5:15pm	Adjourn for the day	

12/4/98

8:00am	Communications update quarterly newsletter web page meeting summaries future interpretive reports	John Molenaar Mark Scruggs Marc Pitchford Bill Malm
9:00am	Organization & operation of the steering committee (How do we improve?)	Dan Ely
10:00am	Break	
10:15am	Steering Committee's views on sharing operational responsibilities with states	Neil Frank
10:45am	Schedule for next meeting & review of action items	Marc Pitchford
11:00am	Adjourn	

November 23, 1998

Marc Pitchford
Chair, IMPROVE Steering Committee
Las Vegas, NV

Marc:

As I mentioned when we spoke the other day, I am respectfully submitting a motion, on behalf of STAPPA/ALAPCO and other state organizations, to create another “slot” on the IMPROVE Steering Committee.

Whereas, the IMPROVE Steering Committee recognizes the importance of seeking balance in the membership of the Committee between state/local and federal members;

Whereas, the IMPROVE Steering Committee seeks to attain additional “geographic” representatives from parts of the United States not currently represented on the Committee;

Whereas, several states and state organizations have commented to IMPROVE and/or to EPA during the comment period regarding the proposed regional haze rule to the effect that additional state and local representation on the Steering Committee would be appreciated and seen as responsive to the concerns of state and local agencies; and

Whereas, the IMPROVE Steering Committee welcomes the input of additional state and local representatives as IMPROVE expands and grows in response to the regional haze rule;

Now, let it be moved by the IMPROVE Steering Committee that the Mid-Atlantic Regional Air Management Association of Baltimore, Maryland (MARAMA) becomes the newest member of the IMPROVE Steering Committee.

MARAMA has indicated they would like Charles Pietarinen of the New Jersey Department of Environmental Protection to fill this role as MARAMA’s representative. Unfortunately, Mr. Pietarinen will be unable to attend the Portland, OR meeting of the Steering Committee but may be able to participate via speakerphone on December 3rd.

I will be asking for a vote of Steering Committee members in order to affirm this motion at our meeting on December 1st. See you then!!

--Dan Ely, STAPPA/ALAPCO IMPROVE Steering Committee representative

August 31, 1998

Letter to State and Local Air Quality Agencies
c/o STAPPA/ALAPCO

This is a long overdue letter to follow up on my March 11, 1998 communications to you concerning selection of sites for the expansion of the IMPROVE network. In that letter I provided a list of 30 candidate sites nominated by the IMPROVE steering committee out of which we would select 20 for expansion during calendar year 1998 and asked for assistance in determining where new sites should be placed. Remember there are 156 Class I Areas and that the overall plan envisions a network of 108 IMPROVE monitoring sites that would be able to collect data required by the anticipated regional haze rule. The goal of the expansion is to provide *adequate* representative regional haze monitoring for each Class I Area. I received many replies to this request with a variety of suggestions and comments.

One of the comments received from several states had to do with equitable selection of sites on a national/regional basis. I share this concern and in fact have made it the basis for making substantial changes to the plan for site selection that was announced in the March letter. Basically the concern is that by selecting sites in a piecemeal fashion we could end up with some Class I Areas with relatively poor data representation by having the nearest monitoring site rather far from the class I area. Meanwhile there might be other regions where there are several monitoring sites very closely spaced.

In June I communicated my concern to the IMPROVE steering committee with a suggestion that we adopt a simple screening method to determine a national strategy of priorities for selecting new monitoring sites among the Class I Areas. The proposal made at that time was that (1) Class I Areas should be represented by monitoring at sites at least within 100km and (2) the monitoring site should be at an elevation between the maximum and minimum elevations of the Class I Areas it monitors. A third criterion was suggested that major emission sources should be at least twice as far from the monitoring site as the Class I Area(s) its data represents.

The first two criteria were used to evaluate the ability of the existing IMPROVE and IMPROVE protocol sites to represent Class I Areas and to estimate how many additional monitoring sites would be required to represent those not covered by existing sites. The process to do this involved determining clusters or groups of Class I Areas that could meet the first criterion based on their locations (i.e. no Class I Area in a cluster is further than 100km from another in the cluster).

The attached table and map show the clusters of Class I Areas that result from the process that was applied. The map shows 100km circles around the exiting IMPROVE or Protocol monitoring sites (designated by I or P on the map) or the centroid of the Class I Areas in the clusters. Cluster identification numbers cross-reference the table to the map.¹ The 156 visibility-protected Class I Areas are reduced to 92 clusters of which 27 are already covered by the 30 IMPROVE monitoring sites. However, using the elevation criterion, 8 of the clusters require a second monitoring site at a different elevation, leaving 73 clusters to be covered by monitoring at additional sites. There is one cluster (#28) where the amount of overlap in elevations is very small, and another (#3) where the IMPROVE site is only slightly higher in elevation than

¹ Some pairs of adjoining clusters have the same number but are distinguished by the letter "a". These clusters very nearly meet the 100km criterion to be covered by one site.

allowed. Additional sites may also be required to avoid violating the third criterion of being too close to major source areas compared to the distance to the Class I Areas to be represented by the monitoring site. For instance cluster #77 includes Class I Areas that surround the Los Angeles Basin and probably can't be covered by a single site at San Geronio. Some clusters can not be routinely monitored for practical and economic reasons; the most notable example is Bering Sea (# 80). In other words we expect the need for some fine-tuning of the selection process using the knowledge of those who know these areas the best and are asking for your help to identify where this needs to be done.

The table also shows 28 IMPROVE Protocol sites near Class I Areas that are operated by the federal land managers (FLM). Of these, 24 have elevations that make them reasonable candidates to be used to cover some of the 75 sites required. We are aware that there are additional monitoring sites that are not listed here, but they may be appropriate candidates for clusters in need of monitoring and are asking that you help us identify these.

Not all protocol sites have the complete particle monitoring capabilities of an IMPROVE site (e.g. at some only one of the four filter samples are collected), so in many cases a more complete sampler and additional analyses are required for comparability to the IMPROVE sites. The steering committee proposes to evaluate each of the FLM protocol sites, and any other sites brought to our attention, that may be useful in fulfilling the needs of the expanded network. The advantages of using existing sites includes the historic data record as well as the savings associated with already having a site with electric power, security, and an operator. For some existing sites, the FLM or other operator may be willing to guarantee continued operation of the site and data sharing for the foreseeable future with no cost or cost sharing with IMPROVE. In other cases IMPROVE may need to cover all costs to ensure continued data collection at a site. Possible savings by having current protocol site sponsors contributing to the cost of the expanded IMPROVE program could be used to fund additional sites. However, at this stage in the planning process the object is to design a network that provides adequate spatial coverage with the resources presently committed for this purpose.

I am again asking for your comments and suggestions. Specifically I would appreciate knowing your thoughts on the following issues:

1. Do you agree that some method to identify clusters of Class I Areas that can be covered by a single monitoring site with respect to regional haze impacts should be part of the planning process?
2. As a coarse site selection screening method, is the 100km distance and elevation criteria as used here to identify clusters and additional required monitoring sites adequate? If not please suggest another method that we could consider that can be implemented over the next few months and would allow data collection that could be considered representative of the regional haze for all 156 visibility protected areas.
3. For regions that you are familiar with, can you suggest alternative clusters of Class I Areas that would make more sense than those in the table, yet would not substantially increase the total number of monitoring sites required? You may want to include additional criteria (e.g. transport meteorology) that may be important for some Class I Areas. For example you might merely rearrange some of the Class I Areas in clusters to better reflect knowledge of the major air basins or regionally influential sources. Also, in regions with relatively flat terrain a monitoring site further than 100km may provide adequately representative monitoring data. Finally do you know of other existing sites that should be considered for clusters needing monitoring?

Progress on the expansion has been slowed this spring and summer while funds and contracts were put into place. However, these issues are close to being resolved and while it is unlikely we will get all 20 sites installed by the end of 1998, it is still our goal. I would appreciate receiving comments by the end of September, since in order to deploy the first 20 sites this calendar year we need to be directing our aerosol monitoring contractor to begin site selection visits by mid-October.

As indicated in my previous letter to you, we intend to communicate with the responsible state agencies prior to site visits in order to ensure their participation in the site selection process. I encourage state and local agencies to contact local FLMs and discuss this proposal's implications for your area. A number of letters I have received stress the importance of state and local approval of monitoring sites. From a regulatory standpoint, states will be able to indicate in their regional haze SIPs their acceptance or not of monitoring sites for the purpose of the regional haze program. However, the SIP process will not occur for several years and the expansion of IMPROVE is occurring during the next 18 months. The best way to ensure your needs are met is through working collaboratively with IMPROVE and local federal land managers. I am available to work through issues and others on the steering committee have also indicated their willingness to help.

I look forward to seeing your comments and suggestions for the proposed network. If you have questions or want to discuss issues, feel free to email or call me at marcp@dri.edu or 702-895-0432.

Sincerely,

Marc Pitchford, Ph.D
IMPROVE Steering Committee Chair

Table 1. Clusters of all Class I Areas with visibility protection based upon the 100km distance criterion with maximum and minimum Class I Area elevations as well as the elevations of IMPROVE and of federal land manager Protocol sites. For clusters without current IMPROVE monitoring or where that monitoring doesn't meet the elevation criterion, the maximum and minimum elevations for future required sites are shown. Sites within 100' or 10% of the required elevation range were considered to have met the elevation criterion. An asterisk (*) indicates protocol sites with elevations that are within the required site maximum and minimum elevation range. Some pairs of adjoining clusters have the same number but are distinguished by the letter "a". These clusters very nearly meet the 100km criterion to be covered by one site.

Cluster #	Cluster ID	Class I Areas in Each Cluster	Min Elev Class I (ft)	Max Elev Class I (ft)	Elev. of IMPROVE (ft)	Required Minumum (ft)	Required Maximum (ft)	Elev. of Protocol Sites (ft)
1	Acadia	Acadia NP	0	1,530	420			
2	Moosehorn	Moosehorn W Roosevelt Campobello IP	0	480		0	480	130*
3	Lye Brook	Lye Brook W	800	2,941	3,250	800	2,900	
4	Great Gulf	Great Gulf Presidential Range-Dry River W	1,680 880	5,807 5,413		1,680	5,413	1440*
5	Brigantine	Brigantine W	0	15	50			
6	Shenandoah	Shenandoah NP	530	4,050	3,600			
6a	James River	James River Face W	650	3,073		650	3,073	720*
7	Dolly Sods	Dolly Sods W Otter Creek W	2,620 1,830	4,122 3,912	3,800			
8	Mammoth Cave	Mammoth Cave NP	414	919	774			
9	Great Smoky Mtns	Great Smoky Mtns NP	850	6,643	2,700			

		Shining Rock W	3,180	6,030	5,290			
		Joyce Kilmer-Slickrock W	1,100	5,341				
9a	Cohutta	Cohutta W	980	4,149		980	4,149	
10	Linville Gorge	Linville Gorge W	1,650	4,120		1,650	4,120	
11	Swanquarter	Swanquarter W	0	2		0	2	
12	Cape Romain	Cape Romain W	0	25	5			
13	Okefenokee	Okefenokee W	105	125	50			
		Wolf Island W	0	6				
14	St Marks	St Marks W	0	42		0	42	
15	Chassahowitzka	Chassahowitzka W	0	5		0	5	10*
16	Everglades	Everglades NP	0	6		0	6	0*
17	Breton Is	Breton Is W	0	2		0	2	
18	Sipsey	Sipsey W	540	1,070	600			
19	Seney	Seney W	703	801		703	801	
20	Boundary Waters	Boundary Waters Canoe W	1,260	2,301	1,700			
20a	Voyageurs	Voyageurs NP	1,100	1,400		1,100	1,400	
21	Isle Royale NP	Isle Royale NP	601	1,394		601	1,394	
22	Mingo	Mingo W	332	590		332	590	
23	Upper Buffalo	Upper Buffalo W	1,240	2,340	2,300			

		Hercules-Glades W	760	1,360		760	1,360	
24	Canney Creek	Canney Creek W	1,065	2,330		1,065	2,330	
25	Wichita Mtn	Wichita Mtn W	1,465	2,260		1,465	2,260	
26	Big Bend	Big Bend NP	1,720	7,825	3,500			
27	Guadalupe Mtns	Guadalupe Mtns NP	3,630	8,749		3,880	8,749	5400*
		Carlsbad Caverns NP	3,880	8,960				
28	Bandelier	Bandelier NM	6,066	8,182		8,000	8,182	6,500
		San Pedro Parks W	9,400	10,523				
		Pecos W	8,000	13,103				
29	Wheeler Peak W	Wheeler Peak W	7,840	13,161		7,840	13,161	
30	Salt Creek	Salt Creek W	3,525	3,650		3,525	3,650	
31	White Mtn	White Mtn W	6,000	11,580		6,000	11,580	
		Bosque del Apache W	4,597	5,930		4,597	5,930	
32	Chirchahua	Chirchahua NM	5,100	7,800	5,400			
		Chirchahua W	4,680	9,759				
33	Saguaro NP - East	Saguaro NP – East	2,720	8,666		2,720	7,663	
		Galiuro W	3,995	7,663				
34	Petrified Forest	Petrified Forest NP	5,310	6,234		5,310	6,234	5500*
34a	Gila	Gila W	5,700	10,770		5,700	10,770	5840*
35	Mount Baldy W	Mount Baldy W	9,219	11,407		9,219	11,407	
36	Tonto	Superstition W	1,610	6,266	2,600			

		Sierra Ancha W	5,200	8,000		5,200	8,000	
		Mazatzal W	1,600	7,904				
37	Pine Mtn W	Pine Mtn W	4,600	6,814		4,600	6,814	
38	Sycamore Canyon	Sycamore Canyon W	3,580	7,000		3,580	7,000	
39	Grand Canyon	Grand Canyon NP	1,200	9,125	7,100			
40	Bryce Canyon	Bryce Canyon NP	6,600	9,115	8,100			
		Zion NP	3,700	8,726				
41	Canyonlands	Canyonlands NP	3,697	7,211	5,950			
		Arches NP	3,981	5,653				
41a	Capitol Reef	Capitol Reef NP	3,800	8,200		3,800	8,200	
42	Great Sand Dunes	Great Sand Dunes NP	8,200	8,900		8,200	8,900	8200*
43	Meas Verde	Meas Verde NP	6,300	8,400	7,210			
		Weminuche W	8,000	14,083	9,050			
		La Garita W	9,000	14,014				
		West Elk W	7,500	13,035				
		Black Canyon of the Gunnison NM	5,440	9,040				
44	Flat Tops	Maroon Bells W	7,500	14,265		7,850	12,354	11212*
		Flat Tops W	7,600	12,354				
		Eagles Nest W	7,850	13,534				
45	Rocky Mtn	Rocky Mtn NP	7,620	14,255	8,950			
		Rawah W	8,400	12,951				
		Mount Zirkel W	7,400	12,180				10,557
46	Badlands	Badlands NP	2,440	3,140		2,440	3,140	2493*
		Wind Cave NP	3,580	5,013		3,580	5,013	

47	Theodore Roosevelt	Theodore Roosevelt NP		2,855			2,855	
48	Lostwood	Lostwood W	231	2,442		231	2,442	
49	Medicine Lake	Medicine Lake W	1,935	2,045		1,935	2,045	
50	UL Bend	UL Bend W	2,250	2,675		2,250	2,675	
51	Bridger	Bridger W	7,500	13,804	8,000			
		Fitzpatrick W	6,000	13,804				
52	Yellowstone	Yellowstone NP	5,282	11,358		7,200	9,600	7744*
		Grand Teton NP	6,350	13,770				
		Red Rock Lakes W	6,600	9,600				
		North Absoraka W	6,250	12,188				
		Washakie W	6,460	13,100				
		Teton W	7,200	12,156				
53	Jarbidge	Jarbidge W	6,500	10,800	6,200			
54	Craters of the Moon	Craters of the Moon NM	5,340	7,729		5,340	7,729	5900*
55	Sawtooth	Sawtooth W	5,150	10,750		5,150	10,750	6490*
56	Selway	Selway-Bitterroot W (Sula Peak)	1,600	10,131		5,100	10,131	6191*
		Anaconda-Pintler W	5,100	10,793				
57	Glacier	Glacier NP	3,219	10,448	3,200			
58	Marshall	Bob Marshall W	4,000	9,356		5,000	7,980	
		Mission Mtns W	4,500	9,360				
58a	Scapegoat	Scapegoat W	5,000	9,411		3,750	7,980	
		Gates of the Mtns W	3,750	7,980				

59	Cabinet Mtns	Cabinet Mtns W	3,000	8,738		3,000	8,738	
60	Eagle Cap	Eagle Cap W	4,000	9,839		4,000	9,300	
		Hells Canyon W	1,200	9,300				
61	Strawberry Mtn	Strawberry Mtn W	4,196	8,900		4,196	8,900	
62	Mt Rainier	Mt Rainier NP	1,380	14,411	1,380			
		Goat Rocks W	2,240	8,184		2,391	7,972	
		Mt Adams W	2,391	7,972				
		Alpine Lakes W	1,700	9,297				3600*
63	North Cascades	North Cascades NP	330	9,206		2,600	9,066	
		Pasayten W	2,600	9,066				
		Glacier Peak W	1,154	10,587				
64	Olympic	Olympic NP	0	7,969		0	7,969	
65	Mt Washington	Three Sisters W	1,781	10,298		3,074	7,231	2,850
		Mt Jefferson W	2,972	10,358				
		Mt Washington W	3,074	7,231				
65a	Mt Hood	Mt Hood W	1,800	9,200		1,800	9,200	
66	Crater Lake	Crater Lake NP	1,932	8,926	6,500			
		Diamond Peak W	4,383	8,563				
		Mtn Lakes W	4,820	8,196				
67	Lava Beds	Gearhart Mtn	5,984	8,300		5,984	8,300	
		Lava Beds NM	4,000	5,400		4,000	5,400	
67a	South Warner	South Warner W	4,587	9,437		4,587	9,437	
68	Redwood	Redwood NP	0	3,117		741	3,117	760*

		Kalmiopsis W	217	5,092			
		Marble Mtn W	741	7,895			
69	Lassen Volcano	Lassen Volcano NP	na	10,457		6,035	7,678
		Thousand lakes W	5,353	8,090			
		Caribou W	6,035	7,678			
70	Yolla Bolly	Yolla Bolly Middle Eel W	2,284	7,713		2,284	7,713
71	Point Reyes	Point Reyes NP	0	1,409		0	1,409
72	Pinnacles	Pinnacles NP	800	3,304		800	3,304
		Ventana W	540	5,627			
73	San Rafael	San Rafael W	1,109	6,311		1,109	6,311
74	Desolation	Desolation W	5,938	9,415		5,938	9,415
75	Yosemite	Yosemite NP	2,000	13,000	5,300		
		Mokelumne W	3,754	9,720			
		Emigrant W	4,593	10,964			
		Hoover W	7,640	12,446		7,640	9,720
		Ansel Adams W	3,200	12,350			
		Kaiser W	6,660	9,730			
		John Muir W	4,873	13,880			
76	Sequoia	Sequoia NP	1,500	14,494		2,670	9,224
		Kings canyon NP	1,500	14,494			
		Dome Land W	2,670	9,224			2942*
77	San Gorgonio	San Gorgonio W	3,116	10,911	5,618		
		San Gabriel W	1,593	7,675			
		Cucamonga W	4,285	8,583			
		San Jacinto W	1,348	8,922			
		Agua Tibia W	1,615	4,763		1,615	4,763

		Joshua tree NM	1,200	5,814				
78	Denali	Denali NP&P	200	20,320	2,100			
79	Tuxedni	Tuxedni W	0	2,674		0	2,674	
80	Bering Sea	Bering Sea W	0	1,475		0	1,475	
81	Simeonof	Simeonof W	0	1,430		0	1,430	
82	Virgin Islands	Virgin Islands NP	0	1,277		0	1,277	150*
83	Hawaii Volcanoes	Hawaii Volcanoes NP	0	13,677		0	13,677	4100*
84	Haleakala	Haleakala NP	0	10,023		0	10,023	3800*

92 clusters

156 Class I Areas

30 current
IMPROVE

73 required
new sites

28 protocol
sites
24 with *

92 clusters

-27 clusters are covered by the 30 current IMPROVE sites

65 clusters need monitoring

+8 clusters require 2 sites for elevation reason

73 is the minimum number of new sites required by this screening method

+30 current IMPROVE sites

103 is the minimum total number of IMPROVE sites required by this method (doesn't account for locations that are impractical)

CODE	site name	Sponsor	mods
group 1: current IMPROVE			
1 ACAD1	Acadia National Park	IMPROVE	ABCD
2 BIBE1	Big Bend National Park	IMPROVE	ABCD
3 BOWA1	Boundary Waters Canoe Area	IMPROVE	ABCD
4 BRID1	Bridger Wilderness	IMPROVE	ABCD
5 BRIG1	Brigantine National Wildlife Refuge	IMPROVE	ABCD
6 BRCA1	Bryce Canyon National Park	IMPROVE	ABCD
7 CANY1	Canyonlands National Park	IMPROVE	ABCD
8 ROMA1	Cape Romain National Wildlife Refuge	IMPROVE	ABCD
9 CHIR1	Chiricahua National Monument	IMPROVE	ABCD
10 CRLA1	Crater Lake National Park	IMPROVE	ABCD
11 DENA1	Denali National Park and Preserve	IMPROVE	ABCD
12 DOSO1	Dolly Sods Wilderness	IMPROVE	ABCD
13 GLAC1	Glacier National Park	IMPROVE	ABCD
14 GRCA1	Grand Canyon National Park	IMPROVE	ABCD
15 GRSM1	Great Smoky Mountains National Park	IMPROVE	ABCD
16 JARB1	Jarbidge Wilderness	IMPROVE	ABCD
17 LYBR1	Lye Brook Wilderness	IMPROVE	ABCD
18 MACA1	Mammoth Cave National Park	IMPROVE	ABCD
19 MEVE1	Mesa Verde National Park	IMPROVE	ABCD
20 MORA1	Mount Rainier National Park	IMPROVE	ABCD
21 OKEF1	Okefenokee National Wildlife Refuge	IMPROVE	ABCD
22 ROMO2	Rocky Mountain National Park	IMPROVE	ABCD
23 SAGO1	San Geronio Wilderness	IMPROVE	ABCD
24 SHEN1	Shenandoah National Park	IMPROVE	ABCD
25 SHRO1	Shining Rock Wilderness	IMPROVE	ABCD
26 SIPS1	Sipsey Wilderness Area	IMPROVE	ABCD
27 TONT1	Tonto NM / Superstition Wilderness	IMPROVE	ABCD
28 UPBU1	Upper Buffalo Wilderness	IMPROVE	ABCD
29 WEMI1	Weminuche Wilderness	IMPROVE	ABCD
30 YOSE1	Yosemite National Park	IMPROVE	ABCD
Group 2: current Protocol, probably become IMPROVE			
1 CHAS1	Chassahowitzka National Wildlife Refuge	FWS	ABCD
2 MOOS1	Moosehorn National Wildlife Refuge	FWS	ABCD
3 BADL1	Badlands National Park	NPS	ABCD
4 BAND1	Bandelier National Monument	NPS	ABCD
5 EVER1	Everglades National Park	NPS	A
6 GRSA1	Great Sand Dunes National Monument	NPS	ABCD
7 GUMO1	Guadalupe Mountains National Park	NPS	ABCD
8 HALE1	Haleakala National Park	NPS	A
9 LAVO1	Lassen Volcanic National Park	NPS	ABCD
10 PEFO1	Petrified Forest National Park	NPS	ABCD
11 PINN1	Pinnacles National Monument	NPS	ABCD
12 PORE1	Point Reyes National Seashore	NPS	ABCD
13 REDW1	Redwood National Park	NPS	ABCD
14 SAGU1	Saguaro National Park	NPS	A
15 SEQU1	Sequoia National Park	NPS	ABCD
16 VIIS1	Virgin Islands National Park	NPS	ABCD
17 YELL1	Yellowstone National Park	NPS	ABCD

18	GICL1	Gila Wilderness	USFS	ABCD
19	GRGU1	Great Gulf Wilderness	USFS	ABCD
20	JEFF1	Jefferson NF/James River Face Wilderness	USFS	ABCD
21	MOZ11	Mount Zirkel Wilderness	USFS	ABCD
22	SAWT1	Sawtooth Wilderness	USFS	A
23	SNPA1	Snoqualmie Pass / Alpine Lake Wilderness	USFS	ABCD
24	SULA1	Sula / Selway-Bitterroot / Anaconda-Pintler	USFS	A
25	THSI1	Three Sisters Wilderness	USFS	ABCD
26	WHRI1	White River NF/Maroon Bells Wilderness	USFS	A
Group 3: current Protocol, Class I, but probably not IMPROVE				
1	INGA1	Indian Gardens	NPS	ABCD
2	DOLA1	Dome Land Wilderness	USFS	AB
Group 4: current Protocol, remote but not mandatory Class I				
1	SAAN1	San Andres National Wildlife Refuge	FWS	A
2	DEVA1	Death Valley National Monument	NPS	AD
3	GRBA1	Great Basin National Park	NPS	ABCD
4	BRLA1	Brooklyn Lake	USFS	A
5	LOPE1	Lone Peak Wilderness	USFS	ABCD
6	SALM1	Salmon and Challis National Forests	USFS	A
Group 5: current Protocol, urban sites				
1	PUSO1	Puget Sound	PSAPCD	ABC
2	WASH1	Washington D.C.	NPS	ABCD
not on NPS contract, but with IMPROVE samplers				
Group S1: will probably become IMPROVE				
1	CRMO1	Craters of the Moon National Monument	DOE	A
2	BLIS1	Bliss / Desolation Wilderness	TRPA	ABCD
Group S2: remote				
1	MAZA1	Mazatzal Wilderness	AZ DEQ	AB
2	TUMO1	Tucson Mountain Park	AZ DEQ	AB
3	COGO1	Columbia Gorge	WA DOE	ABC
4	CORI1	Columbia River Gorge National Scenic Area	WA DOE	ABCD
5	MOSA1	Mount St.Helens National Monument	WA DOE	ABC
6	NOCA1	North Cascades (Marblemount)	WA DOE	ABC
7	SOMO1	South Mountain / near Olympic	WA DOE	ABC
8	GRVS1	Green River Visibility Study	WY	ABCD
Group S3: not remote				
1	SOLA1	South Lake Tahoe	TRPA	ABCD

DRAFT Outline for the next IMPROVE Report

- 1 INTRODUCTION
 - 1.1 Objectives of Visibility Monitoring
 - 1.2 Overview of the IMPROVE Monitoring Network
 - 1.3 Background Regarding Visibility Impairment and Aerosols
 - 1.3.1 Relationship Between Visibility and Aerosol Concentrations
 - 1.3.2 Effect of Relative Humidity on Light Scattering
 - 1.4 Organization of the Report
 - 1.5 References

- 2 OPTICAL AND AEROSOL DATA
 - 2.1 Transmissometers
 - 2.2 Integrating Nephelometers
 - 2.3 Particle Sampling System
 - 2.4 Determination of Aerosol Types
 - 2.5 References

- 3 AEROSOL MASS BUDGETS AND SPATIAL DISTRIBUTIONS
 - 3.1 Characteristics of the Regions
 - 3.2 Spatial Trends in Aerosol Concentrations in the United States
 - 3.2.1 PM₁₀ Aerosol
 - 3.2.2 Fine Aerosol
 - 3.2.3 Coarse Aerosol
 - 3.2.4 Fine Sulfate Aerosol
 - 3.2.5 Fine Nitrate Aerosol
 - 3.2.6 Fine Organic Aerosol
 - 3.2.7 Fine Light-Absorbing Carbon Aerosol
 - 3.2.8 Fine Soil Aerosol
 - 3.3 Summary
 - 3.4 References

4. SPATIAL PATTERNS OF SELECTED HEAVY METALS
 - 4.1 Spatial patterns
 - 4.1.1 Arsenic
 - 4.1.2 Copper
 - 4.1.3 Zinc
 - 4.1.4 Selenium
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- 5 SPATIAL DISTRIBUTIONS OF RECONSTRUCTED LIGHT EXTINCTION AND LIGHT EXTINCTION BUDGETS
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 - 5.2.1 Characteristics of the Region
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 - 5.3 Summary

- 6 SEASONAL, WEEKLY, AND DIURNAL TRENDS OF MEASURED EXTINCTION, SCATTERING AND RELATIVE HUMIDITY.
 - 6.1 Measured extinction.
 - 6.2 Measured scattering.
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- 7 LONG TERM TRENDS OF AEROSOL CONCENTRATIONS, RECONSTRUCTED AEROSOL EXTINCTION, AND RECONSTRUCTED VISIBILITY
 - 7.1 Trends of 10-50-90 groups for PM2.5
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 - 7.3 Conclusions
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- 8 DISTRIBUTION OF AEROSOL CONCENTRATIONS
 - 8.1 Frequency distributions of the major aerosol species.
 - 8.1.1 PM10
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 - 8.1.3 Ammonium Sulfate
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 - 8.1.5 Organics
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 - 8.2 Approximation of natural background conditions.
 - 8.2.1 Definitions of natural background.
 - 8.2.2 Comparison to best 20% (group 10) aerosol concentrations.
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- 9 INTERNETWORK COMPARISONS
 - 9.1 Description of NADP network.
 - 9.1.1 Ions measured
 - 9.1.2 Averaging time
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 - 9.3 Conclusions
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Estimated completion dates.

- Chapters 1-2 being essentially “boilerplate” should be done by the end of May.
- Chapters 3,4, and 5 will require reprocessing of some of the data and new graphics should be completed by mid July.
- Chapters 6, 7, and 8, the core of the report, will attract the most attention and reprocessing of RH, optical, and aerosol data will be ready by September.
- Chapter 9 should be ready by September.
- The preliminary draft should be ready to distribute for review by October.
- Assuming a 30 turn around for the review revisions should be completed by mid November
- Publication - Mid November to December.