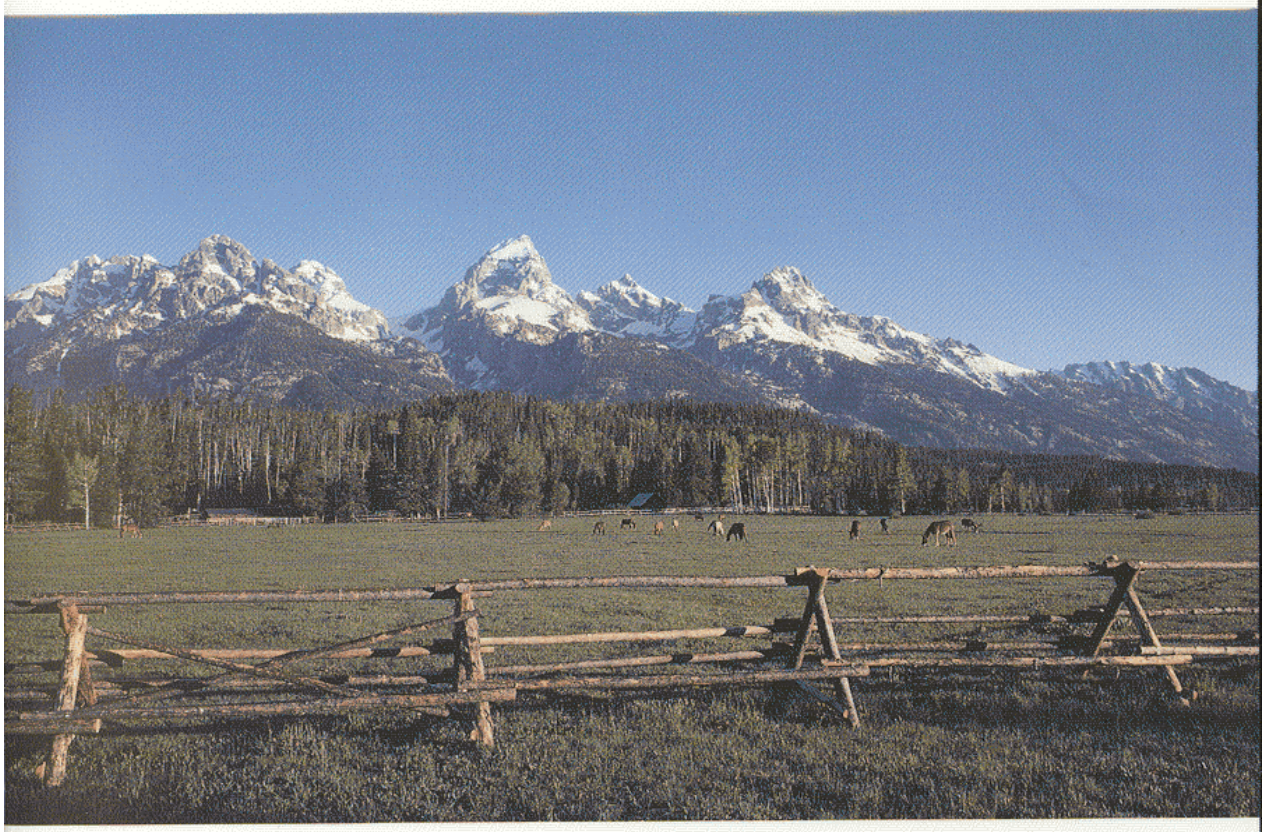
TRANSACTIONS

VISIBILITY PROTECTION



Research And Policy Aspects

Prem S. Bhardwaja, Editor

An APCA International Specialty Conference

TRANSACTIONS

Visibility Protection: Research and Policy Aspects

Prem S. Bhardwaja, Editor

An APCA Specialty Conference

Sponsored By

APCA's TE-5 Visibility &
TT-1 Particulate Committees

Hosted by

APCA's Rocky Mountain States Section
Grand Teton National Park, Wyoming

September 8-10, 1986

TR-10

VISIBILITY PROTECTION: RESEARCH AND POLICY ASPECTS

A Peer-Reviewed Publication

Cover Photo: Scene near Grand Teton National Park, Wyoming.
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APCA The Association Dedicated to Air Pollution Control and Hazardous Waste Management
FOUNDED IN 1907

P.O. Box 2861
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FOREWORD

Toward the end of 1980 a symposium was organized to discuss ways to address the objectives of the U.S. legislation which calls for preserving and remedying man-made visibility impairment in national parks and wilderness areas (Class I areas). This symposium was held at Grand Canyon, Arizona. People with varied backgrounds attended the symposium; they included researchers conducting fundamental research on the fate of pollutants in the atmosphere and exploring the role that atmospheric pollutants play in affecting human perception of distant vistas, the public who would be affected by the regulations established as a result of this legislation, and the representatives of local, state, or federal governments who were entrusted with the prevention of deterioration of visibility in the Class I areas.

[NOTE: APCA sponsored an earlier Visibility Speciality Conference "View on Visibility – Regulatory and Scientific" in Denver, Colorado, on November 26-27, 1979]

Since the Grand Canyon symposium, a number of events have taken place. The Environmental Protection Agency has promulgated regulations to control plume blight in the national parks and wilderness areas, and many fundamental studies have been conducted to understand the nature of pollutants that cause plume blight. Additionally, several studies have been planned to investigate the roles that near and distant sources, natural and anthropogenic pollutants, and/or meteorological factors play in causing visibility impairment. However, researchers have not yet succeeded in establishing source-receptor type of relationships to predict improvement in visibility impairment if polluting sources are controlled.

A second conference was organized in Grand Teton, Wyoming in September 1986, for updating our understanding of visibility. It was the first time since the Grand Canyon conference that those interested in visibility got together to exchange their views and review the latest findings on the subject.

At this conference, discussions were held on the following topics: the results of major field studies conducted in the national parks and wilderness areas scattered throughout the western United States; progress on our understanding of human perception of visibility; improvement in modeling techniques; and progress in the field of source attribution determinations. In all, fourteen sessions were organized to discuss technical findings, regulatory issues and demonstrate new monitoring techniques. The technical papers were peer-reviewed and are included in these transactions. Personal views and policy options were not peer-reviewed and have not been included in this volume.

Great advancements have been made to better understand the subject of visibility impairment. Observations made in recent years show that existing monitoring or analytical techniques are not accurate enough to link visibility impairment to a specific pollutant. New discoveries are enabling us to understand the role of air pollutants in human perception of distant vistas. Modeling techniques have been updated but these are still unable to accurately predict the contribution of a source to visibility impairment in complex terrain or in describing the transport of pollutants from distant sources. Furthermore, it is still hard to predict the economic benefits to be achieved if additional pollution controls are installed based solely upon the results of these models. New measurement techniques are being developed and tested to determine the particulate constituents that go undetected with existing methods.

The Grand Teton conference was sponsored by APCA's TE-5 Visibility and TT-1 Particulate Committees and co-sponsored by the American Association for Aerosol Research, American Mining Congress, Colorado Department of Health, Motor Vehicle Manufacturers Association, Salt River Project, Southern California Edison, U.S. Departments of Agriculture and the Interior, U.S. Environmental Protection Agency and Wyoming Department of Environmental Quality. The Rocky Mountain States Section of APCA was the host of this conference.

The participants enjoyed the physical setting of the meeting place. Here they were encouraged to hold frank and enlightening discussions, amid good company and the enjoyment of the expansive vistas offered by the Grand Tetons.

ACKNOWLEDGMENT

I greatly appreciate the support made available to me by the management of Salt River Project during all phases of this conference.

Completion of this volume is the culmination of dedicated efforts of the technical session chairpersons and the reviewers who provided timely and valuable assistance. I convey my sincerest thanks to all of them.

Ms. Sara J. Head and the entire General Conference Committee members did an excellent job in planning, organizing, and successfully running the conference. For their excellent work I congratulate Sara and her co-workers for the job well done.

Messrs. Hal Englund and John McGovern of APCA headquarters provided valuable guidance and suggestions to complete this volume. On behalf of the Technical Committee and the General Conference Committee, I extend sincerest thanks to Hal, John and the APCA headquarters staff.

Finally, I want to convey my special thanks to those who made many sacrifices during the preparation of this volume. They are my wife Kailash, son Nand Kishore and daughter Sunita. They were always a ready source of inspiration and encouragement.

P.S. Bhardwaja
Phoenix, AZ

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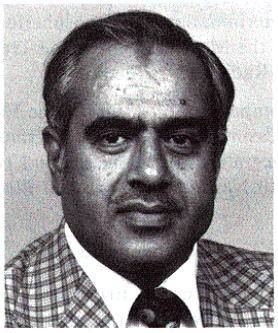

Prem S. Bhardwaja is a senior staff scientist at the Salt River Project, Phoenix, Arizona. He has been involved in several aspects of air pollution research including visibility, acid deposition, transport and transformation of pollutants in the atmosphere, and studying the characteristics of ambient and stationary source particulate matter.

Dr. Bhardwaja received his Ph.D. in Geophysics and M.S. in Physics from the University of Washington, Seattle, and earned an M.Sc. in Physics from the Agra University (Bareilly College) India.

Dr. Bhardwaja is a member of APCA, the American Association for the Advancement of Science, and Sigma Xi. He actively participates in the electric utility industry's technical committees and he is a Co-chairman of the Utility Air Regulatory Group's Visibility Protection Committee.

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Remarks Prepared for Scott M. Matheson
To the Air Pollution Control Association
International Specialty Conference
Visibility Protection -- Research and Policy Aspects

Jackson Lake Lodge
September 8, 1986

[Introductory Remarks]

As I was preparing my remarks for this morning, I was surprised to realize how quickly and completely the issue of visibility protection has disappeared from public view. Even though the regulatory wheels have kept slowly grinding and many states are amending their implementation plans to include visibility monitoring and new source requirements, discussion of visibility questions in legislative settings, in the popular press and even the environmental press, has become quite rare. I suppose this is the result of a combination of factors: a general reduction in emphasis on environmental regulation at the federal level; the reluctance of Congress to pursue a general reauthorization of the Clean Air Act; the emergence of acid rain as the major clean air issue of the 1980's; and the dramatic recession in the western energy economy. The final factor may be the most important. As energy prices have forced plans for new energy projects – power plants, synthetic fuel facilities and mines – to the shelf, major conflicts between energy development and visibility protection have simply evaporated. [end of page 909]

As you know, this was not always the case. In the early 1980's, visibility protection of mandatory class I areas under the Clean Air Act generated considerable controversy and commanded significant attention, particularly in the West. My experience with the issue comes from those times, when, as Utah's governor, I expressed concern over the potential impacts of visibility regulation and the process by which decisions would be made.

Those of you who are familiar with Utah geology and geography will immediately understand my interest in Clean Air Act issues, particularly visibility. Utah is home to five of the nation's most beautiful and spectacular National Parks – all mandatory class I areas under the 1977 Clean Air Act Amendments. Utah is also the site of significant energy resources – coal, oil shale, oil and gas and uranium. And those resources and the Parks often coexist in the same areas. For example, the views from Bryce Canyon National Park are truly unique; under proper conditions, the Park visitor can see for over 100 miles. But within that view lie billions of tons of low sulfur coal. Similarly, visitors to Arches National Park are surrounded by oil and gas and uranium and those few who venture to the northern reaches of Capitol Reef National Park can look northward to the productive Central Utah coal fields. [end of page 910]

In the late 1970's and early 1980's, we expected frequent conflicts between proposals for development of energy resources and the protection of visibility in the Parks. As the energy industry in Utah and the West has declined, those conflicts have disappeared. Consequently, the pressures to refine the regulatory scheme have faded, providing time to expand our base of scientific knowledge. This conference and the body of research that will be presented demonstrates continued progress toward that goal. I am impressed by the topics you will be discussing. Our understanding of visibility has obviously made great progress.

But while we continue to make progress on research and technical issues – within the constraints of declining budgets and shifting priorities – I fear that in other ways we have not made good use of the time which the unfortunate recession in the energy industries offers. Key issues in the scope and management of the visibility program remain unresolved. This respite offers an opportunity to

address and resolve those issues by a complete Congressional revision and reauthorization of the PSD program. Instead, Congressional efforts have been sidetracked and chances for any action on clean air legislation appear slim.

Action is important because I do not believe that the conditions we face today are permanent. Energy supplies and [end of page 911] prices have been riding a roller coaster for nearly two decades. The products of the last crisis – recession, oversupply and then reduced prices – discourage investment in energy development and conservation and may sow the seeds for the next shortage. Without a national energy policy which fosters long term solutions to our energy needs – and at this time I can discern no national energy policy – we are doomed to a series of alternating gluts and crises.

Some indications of change in energy markets are already apparent. The Department of Energy projects that domestic crude oil production will decrease by about 200,000 barrels per day between 1985 and 1986 and by another 170,000 barrels per day by 1987. In the meantime, demand is expected to increase, including additional oil use for electricity generation, reversing a long trend toward coal conversion of utility boilers. To balance that increase in demand and decrease in domestic production, net oil imports are expected to average nearly 5.1 million barrels per day in 1986 and 5.3 million barrels per day in 1987, up nearly 25% from the 1985 level.

I do not mean to suggest that we're on the brink of an immediate energy crisis. Structural changes in energy use and permanent conservation measures and practices allow us to produce much more with less energy, and our economy – particularly the energy intensive manufacturing sectors – does [end of page 912] not appear strong enough to generate significant new energy demand. My point is simply that our long term energy problems remain, and it would be imprudent to write off vast deposits of energy fuels in Utah and the West. At some point, and it may be a decade or more from now, those resources will be needed.

The implication for clean air and visibility policy is equally simple: we should use this opportunity, this period of quiescence in energy and environmental battles, to review the structure of the visibility program, to make decisions about the extent of protection which is appropriate and to develop a workable process for making trade-off decisions between development and visibility protection.

Specifically, I believe that action is necessary in three areas: the level of visibility protection, the scope of protection – that is, the question of integral vistas – and procedures for resolving conflicts over new sources of air pollutants. All three were addressed by Clean Air Act amendments approved by the Senate Environment and Public Works Committee in 1982. Unfortunately, that was the last major effort to adopt a comprehensive reauthorization of the Clean Air Act, but I'll refer to those amendments as at least one approach to revising the visibility program. [end of page 913]

First, as you know, the current language of the Clean Air Act establishes as a national goal the prevention of <u>any</u> future impairment of visibility and the remedying of <u>any</u> existing impairment. The goal is laudable and I don't necessarily disagree with it <u>as a goal</u>. Unfortunately, however, casting the key statutory language in such absolute terms ignores all other national goals, whether they are complementary or in conflict, and leaves regulatory agencies and states without flexibility to implement programs or to balance visibility needs with other goals.

The amendments proposed in 1982 dealt with this particular problem by adding one vague and imprecise word – "significant" – to the national goal. That is, we were to be concerned only with "significant" impairments of visibility. I'm not usually comfortable advocating deliberate vagueness in the law, but in this case, I think it's necessary. First, visibility modeling and protection is not an exact science, and despite the progress which has been made, I suspect that it won't be for many years.

We need some "wiggle room" in the law to address technical uncertainties and to prioritize our visibility protection efforts. More importantly, states charged with implementing visibility goals can not be expected to successfully protect against any impairment of visibility and must be free to focus their efforts and limited resources on "significant" visibility problems. [end of page 914]

Second, Congress has yet to address the most difficult visibility issue: what exactly are we going to protect? That is, does visibility protection stop at the Park borders or at the horizon? Should our program include protection for certain "integral vistas?" Frankly, I have mixed feelings about this issue. In some instances – and I would point once again to the spectacular overlooks at Bryce Canyon – visibility protection which stops at the Park boundaries seems meaningless; the important visible features lie almost totally outside the Park. On the other hand, I believe that the current language of the Clean Air Act simply does not support the extension of visibility protection outside class I boundaries. More importantly, protection of unlimited views effectively extends class I boundaries hundreds of miles without state or Congressional action and may limit necessary energy or industrial development.

Again, I return to Utah as an example. A 1982 study by the Office of Technology Assessment reviewed the impacts of integral vistas in Utah as proposed by the National Park Service. The 19 proposed vistas covered an area totalling nearly 16,000 square miles, roughly twenty percent of the state's land area. OTA estimated that over one-third of the state would be within the area directly or indirectly affected by integral vista protection. OTA also identified significant conflicts with coal production, synthetic fuel development, [end of page 915] especially tar sands, uranium mining and power plant construction.

The OTA study reached no conclusion, however, because assessing the ultimate impact of integral vista protection was complicated by the fact that no clear standards existed for the required level of protection. OTA noted two specific problems: first, "there are no generally accepted objective standards for determining the significance of a potential impact on visibility in an integral vista" and second, "available modeling techniques are not sufficiently developed and validated to support a general regulatory approach."

My review of the developments in visibility since that study leads me to believe that those two problems remain essentially unsolved. The question of integral vistas has not been resolved but only deferred by inaction – federal land managers have simply chosen not to designate them.

From a practical standpoint, this is an adequate temporary solution; it effectively leaves the protection of integral vistas up to the states. However, as a permanent solution it is unsatisfying. When proposals for energy or industrial development are revived, or in a different administration with different priorities, today's solution will unravel. [end of page 916]

Furthermore, if we are to have protection outside of class I boundaries, I believe it should be by explicit Congressional action. And while no scheme provides an ideal solution or eliminates the possibility of controversy, a combination of the current regulatory program and the proposed 1982 amendments would be workable, providing protection for critical vistas and the flexibility to meet energy and economic needs.

Specifically, the statute should allow federal land managers the opportunity to nominate integral vistas but should leave designation and protection of those areas up to the states. In addition, an integral vista designation should not provide absolute protection from visibility impairment, but should trigger a review of new sources and consultation with the federal land manager. Finally, the law should provide that, after the review is completed, the permit for a new source should be granted unless the Governor, based on the technical review by the state and the recommendations of the federal land manager, believes that the visibility values outweigh the importance of the new source.

My recommendations for dealing with integral vistas also suggest a response to the third policy area which I mentioned earlier – resolving conflicts between visibility protection and development.

Permits for new sources which would create an adverse impact on visibility within the class I area should be denied. However, if the impacts are limited to the designated [end of page 917] vista, the decision is left open to a case-by-case determination. Factors which should be considered include: the importance of the vista, the significance and scope of the air quality impact, and the relative economic importance of the vista and the source.

Permitting agencies – whether EPA or the state – are not the proper body for evaluating and weighing these intangibles. Based on my experience and natural bias, I believe that such a decision is best made by the governor. A governor's daily fare includes resolving difficult and controversial issues, and he or she must be capable of balancing many disparate interests.

Leaving the decision in the hands of the governor will likely generate two criticisms. First, protection of visibility in National Parks and other class I areas reflects not only a state interest, but a strong national interest as well. But the national interest will not be ignored. The very existence of the visibility program and the additional review for new sources reflects a recognition of that national interest in visibility protection. In addition, this procedure allows the federal land manager to be a strong advocate for national concerns. Finally, I can assure you that governors are not immune to concerns raised outside state boundaries, particularly when federal lands are concerned. [end of page 918]

Second, I suppose that some will suggest that the governor will always side with the "economic" interest, directing that all permits be granted despite visibility consequences. That perception is inaccurate. In fact, in a dispute between the visual integrity of a National Park and energy or industrial development, the primary economic interest is not always clear. In Utah, our five National Parks are the heart of one of the most important sectors of the economy. No governor could risk the loss of thousands of national and international visitors.

Finally, if these arguments are not convincing, I would suggest one more. The system simply won't work unless the ultimate responsibility for a decision rests somewhere. Out of all the possibilities -- EPA, the state air quality agency, the federal land manager and the governor -- only the governor is directly accountable to the public for his decision. my experience indicates that, if tough decisions have to be made, that public scrutiny will assure that those decisions are made thoughtfully and carefully. [end of page 919]

Conclusion

This conference is scheduled to cover both research and policy aspects of visibility protection. I've given you a full dose of policy – my recommendations for legislative action on the visibility provisions of the Clean Air Act. I hope that my remarks provide a useful background for the discussions and technical reports which will follow.

Remarks by
J. Craig Potter
Assistant Administrator for Air and Radiation
U.S. Environmental Protection Agency
Before the
APCA International Specialty Conference
Visibility Protection - Research and Policy Aspects

Jackson Hole, Wyoming
September 8, 1986

It gives me special pleasure to address this conference on visibility, because this is one of those issues where my past and present jobs overlap. When I was at the Department of the Interior, I looked at visibility protection from the perspective of the Federal Land Manager. To those of youwho know the visibility issue, that says a lot, because Federal Land Managers include not only the National Park Service and the Fish and Wildlife Service, but the Bureau of Land Management and the Office of Surface Mining as well. Now I see the problem from the perspective of the Federal regulatory structureand the EPA. Those viewpoints are different, to be sure, but they both areessential to the development of good national policy to protect visibility.

Most of you look at visibility from yet another perspective. You're technical experts and scientists. You tend to think of visibility in terms of extinction coefficients, dispersion models, colorization and other technical terms that defy normal english usage. I tend to think of it in terms of Federal Register notices and State Implementation Plans. But despite the different vantage points, you and I must work together toward the same goal: the protection of visibility in the United States.

Thus, the value of a conference like this. It provides an opportunity for researchers and policymakers to get together and talk about our common goals. I hope to learn more about the technical issues germane to visibility. I hope to find at least partial answers to some of the technical questions that have [end of page 921] slowed the regulatory process. At the same time, I want to give you a solid feeling for where your work fits within the policy development process. Your job is crucially important to mine, and I want to make sure that you understand why

The Congress gave us relatively straight forward marching orders. They said that visibility was a value to be protected in all parts of the country through the enforcement of welfare-based ambient air quality standards. They also said that visibility in our national parks and wilderness areas was of special value, and was therefore to be protected with special care.

When we wrote our final visibility regulations in 1980, we were a little naive. We thought that visibility impairment was a relatively simple problem: you saw a plume, you traced it to its source, you controlled the source. Back then, we didn't realize that our ability to measure plume blight was very limited. We had barely begun to think about regional haze. We had no visibility specifications. Our modelling tools were primitive. And we hadn't defined what terms like "reasonably attributable" really meant.

Now, six years later, we think we know better. We know that Congress' very understandable desire to protect a cherished national resource requires us to answer technical questions of mind-numbing complexity. Answering such questions takes time, and time seems to be shared disproportionately among bureaucrats and scientists. We always take too much time for what we do, and you never get enough for what you do. I'd like to talk this morning about some of the difficulties that face policymakers like me when we try to craft visibility policy. My objectives are twofold: I want to drum up some sympathy for the amount of time it takes us to write regulations, and I want to make clear with practical examples how important your work is to mine. [end of page 922]

Protecting visibility is an especially difficult job because the goal is so hard to quantify. If I want to judge whether the air is healthy to breathe, I can measure the concentrations of particulates and then compare them with health data. That's relatively easy, and I can be relatively certain that my judgment is reasonable. But visibility – like beauty – is in the eye of the beholder. And human perceptions are difficult to quantify. So we've got an initial problem just defining what it is we're trying to protect and trying to quantify what impairment means.

Besides defining visibility in a way that allows quantitative measurement, I've also got to determine what pollutants impair it, and how. Then I've got to answer a whole series of questions:

- What are the sources of the pollutants in question?
- How can those sources be controlled?
- What is the effect of controlling the sources, or adding new ones?
- What are the costs and benefits of control?
- How do we distribute the costs equitably?

These are the same questions I have been asking with regard to acid rain, indoor air pollution, and stratospheric ozone depletion. But the answers are much different in the case of visibility, and that's where you come in. You are carrying out the research that will find specific technical answers to generic policy questions.

For example, your economic studies will provide data on the economic impact of visibility impairment, and the benefits of different remedies. Your studies of perception and aerosols will help develop meaningful quantitative measures of visibility impairment. Your modelling and meteorological studies [end of page 923] will clarify the relationship between sources and receptors, and thus help us predict the effects of new sources, or new regulations. In short, what you're learning now will shape visibility regulations as they evolve in the future.

To a large extent, today's visibility program is a direct result of the research conducted over the past five or six years. Many of you may remember the last time we held a visibility conference like this. Think back to what you knew about visibility monitoring then. Think back to the modelling techniques you used then. Think back to what you thought were the causes of visibility impairment. Some people may think the visibility program should have moved farther than it has, but compared to what we knew in 1980, we've come a long way.

And despite rumors to the contrary, we've also made substantial regulatory progress. We've taken a number of actions under the visibility protection program we announced in 1980. For example, we've established new source review provisions aimed at protecting visibility. We've developed a strategy to monitor Class I visibility that uses state-of-the-art visibility monitoring techniques. We're developing long-term control strategies to address specific problems in certain Class I areas. Considering the kinds and complexity of the technical questions we've worked to answer over the past six years, the program that exists today is no small accomplishment.

Yet, from both a policy and a research perspective, we've still got a long way to go. We've worked hard to understand plume blight -- what it is, what causes it, and how to control it. But that problem was easy compared to regional haze. The sources of regional haze are far more difficult to identify. It's far more difficult to determine the kinds and levels of control needed to alleviate it. Developing federal regulations for regional haze is going to be [end of page 924] doubly difficult, because it's a different kind of problem in different parts of the country.

In April 1985, the Interagency Visibility Task Force issued its report on regional haze. The report recognized both the extent of the regional haze problem and our current inability to define effective solutions. In fact, we may have to design different visibility protection strategies for different parts of the country. The composition and sources of the fine particulates that degrade visibility are very different in different parts of the country.

The Visibility Task Force also recommended an expanded research program to clear up some of these uncertainties. This conference will give us all a good idea of where that visibility research is going.

In the meantime, the task force recommended that policymakers pay a lot of attention to the linkage between visibility and other regulatory policy. That recommendation is more important than it sounds. For it points out – once again – that we make a great mistake if we try to protect the environment piecemeal. We can't protect visibility in a vacuum. The causes of visibility impairment, and the kinds of controls needed to protect visibility, are closely linked to other serious air quality problems. We have to understand visibility in this broader context if we hope to develop sensible environmental policy.

The close ties between visibility and a number of other air quality issues also helps explain EPA's apparent lack of progress regulating visibility. Some people think EPA hasn't done much about visibility over the past six years. We haven't put out a lot of regulations. But we have spent a lot of time and money studying several air quality issues linked closely to visibility. Any actions we take in those areas will affect visibility. And any actions we take in those areas will have to be coordinated with our visibility policy. [end of page 925]

Acid rain is a case in point. I have often been struck by the similarities between acid rain and regional haze. Both are caused by the same kinds of sources emitting the same kinds of pollutants. Both are affected by the long range transport of those pollutants. Source-receptor relationships in both cases are equally difficult to define. And in both cases it's very difficult to estimate the effect of any particular level of control. Thus it's hard to separate policy decisions related to regional haze from policy decisions related to acid rain.

The 1985 Visibility Task Force also recommended that EPA consider setting a secondary national standard for fine particulates. The Clean Air Act authorizes us to set secondary national standards to protect welfare values like visibility. Fine particulates clearly are a major cause of visibility impairment. Setting a standard like that could go a long way toward remedying existing impairment in Class I areas.

However, a fine particulate standard might not be appropriate in all parts of the country. A standard that protected visibility in the East would probably be ineffective in the West. And a standard that protected visibility in the West might well be totally inappropriate in the East. Regardless, these kinds of visibility issues have been important parts of our review of the particulate matter standard.

My staff tells me that working on the visibility issue is a lonely life. People just don't seem to get wound up about visibility impairment. When visibility degrades, people usually don't know what they're missing, and they frequently don't seem to care what causes it. Given its lack of action, some might say that even EPA doesn't seem to care very much. [end of page 926]

But we do care, and indeed we care very much. At EPA Headquarters, we worry about visibility a great deal. If for no other reason than its linkage with acid rain, the fine particle standard, and other serious air quality concerns, we know the issue isn't going away. We also know that your research is needed to clarify the linkage between visibility and those other issues. I need your research so I can propose a regional haze control program that supports and is consistent with a much larger body of EPA policy. The visibility program has to make sense on its own terms and in conjunction with other air quality programs. Your research will help it make sense, and indeed will be the foundation for the whole future of national visibility policy. Finally, I cannot leave this podium today without telling you how much I respect and rely on what you do here. I have been in the field for the last two days and I am awed by the level of effort and dedication that I have seen there. There is no more that I can say except keep up the good work. [end of page 927]

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